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ENCYCLOPÆDIA.

ANGERMANIA, a province of the kingdom of Sweden, bounded on the N. by Lapland and Bothnia, on the E. by the gulph of Bothnia and Medelpadia, and on the W. by Jemti and Herndel. It is full of rocks, mountains, and foreſts; and there is one very high mountain called *Scull*. It has excellent iron-works, and lakes abounding with fiſh.

ANGERMOND, a town of the duchy of Berg, in Germany, on the E. ſide of the Rhine, ſubject to the elector Palatine. E. Long. 6. 20. N. Lat. 51. 10.

ANGERONA, in mythology, the name of a pagan deity whom the Romans prayed to for the cure of the *quinzy*: In Latin, *angina*. Pliny calls her the *goddeſs of ſilence* and *calmneſs of mind*, who baniſhes all uneaſineſs and melancholy. She is repreſented with her mouth covered, to denote patience and refraining from complaints. Her ſtatue was ſet up, and ſacrificed to, in the temple of the goddeſs Volupia, to ſhow that a patient enduring of affliction leads to pleaſure.

ANGERONALIA, in antiquity, ſolemn feaſts held by the Romans the 21ſt of December, in honour of Angerona, or Angeronia, the goddeſs of patience and ſilence. Feſtus and Julius Modeſtus, quoted by Macrobius, Saturn. lib. i. cap. 10. derive the name from *angina*, "quinzy;" and ſuppoſe the goddeſs to have been thus denominated, becauſe ſhe preſided over that diſeaſe.—Others ſuppoſe it formed from *angor*, "grief, pain;" to intimate that ſhe gave relief to thoſe afflicted therewith. Others deduce it from *angeo*, "I preſs, I cloſe," as being reputed the goddeſs of ſilence, &c.

ANGERS, a great city of France, and capital of the duchy of Anjou, with a biſhop's ſee. It is ſeated a little above the place where the Sarte and the Loire loſe themſelves in the Maine. This laſt river divides the city into two equal parts, called the high and the Low Town. There are twelve pariſhes in the city and four in the ſuburbs, which contain upwards of 36,000 inhabitants. Beſides theſe, there are eight chapters, and a great number of convents for both ſexes. Its greateſt extent is along the declivity of a hill, which reaches quite down to the river ſide. The caſtle was built by St Louis, about the middle of the 13th century. The walls, foſſes, and numerous towers which yet ſubſiſt, evince its former magnificence; and its ſituation in the centre of the city, on a rock overhanging the river, conduces to give it an air of grandeur, though at preſent in decay. It was the principal reſidence of the kings of Sicily, as dukes of Anjou, but is now in a ſtate of total ruin. The cathedral of Angers is a venerable ſtructure; and although it has undergone many alterations in the courſe of ages ſince its conſtruction, yet the architecture is ſingular and deſerves attention. Here lies interred with her anceſtors the renowned Margaret, daughter of René king of Sicily, and queen of Henry VI. of England. She expired, after her many intrepid, but ineffectual, efforts to replace her huſband on the throne, in the year 1482, at the caſtle of Dampierre in Anjou. Near the church of St Michael is the handſomeſt ſquare in the city, from whence runs a ſtreet which has the name of the church. On one ſide of this ſtreet is the town-houſe; which has a fine tower, with a clock, raiſed upon an arch, which ſerves for a paſſage into the great ſquare. There are two large bridges, which keep up a communication between the two parts of the city; and in the leſſer of theſe there is another ſquare, which ſerves for a market. The univerſity of Angers was founded in 1398, and the academy of belles lettres in 1685. This laſt conſiſts of thirty academicians. At the end of the ſuburbs of Breſigny are the quarries of Angiers, ſo famous for the fine ſlate which is got from thence. The pieces are of the thickneſs of a crown piece, and a foot ſquare. All the houſes in Angers are covered with this ſlate, which has gained it the appellation of the *Black City*. The walls with which king John of England ſurrounded it in 1214 remain nearly entire, and are of very great circumference. W. Long. 0. 30. N. Lat. 47. 28.

ANGHIERA, a town of Italy, in the duchy of Milan, and capital of a country of the ſame name. It is ſeated on the eaſtern ſide of the lake Maggiore, in E. Long. 9. 5. N. Lat. 45. 42.

ANGINA, in medicine, a violent inflammation of the throat, otherwiſe called *quinzy*. See *MEDICINE-Index*.

ANGINA Pectoris. See *MEDICINE-INDEX*.

ANGIOSPERMIA, in the Linnæan ſyſtem of botany, the ſecond order in the claſs Didynamia. It conſiſts of thoſe plants, of that claſs, whoſe ſeeds are incloſed in the pericarpium. In this order the ſtigma is generally obtuſe. Theſe are the *perſonati* of Tournefort.

ANGITIÆ LUCUS or NEMUS (Virg.), ſituated on the weſt ſide of the Lacus Fucinus. The inhabitants are called *Lucenſes*, by Pliny. Angitia was ſiſter of Medea, who taught antidotes againſt poiſon and ſerpents, according to Sil. Italicus. But Servius on Virgil ſays, that the inhabitants called Medea by this name for the ſame reaſon. The town is now called *Luco*.

ANGLE, the inclination of two lines meeting one another in a point. See GEOMETRY.

ANGLE *of Incidence*, in optics, the angle which a ray of light makes with a perpendicular to that point of the ſurface of any medium on which it falls: tho' it is ſometimes underſtood of the angle which it makes with the ſurface itſelf.

ANGLE *of Refraction*, now generally means the angle which a ray of light, refracted by any medium, makes with a perpendicular to that point of the ſurface on which it was incident; but has ſometimes been underſtood of the angle which it makes with the ſurface of the refracting medium itſelf.

ANGLER, a perſon who practiſes the art of angling, whether as a diverſion, or otherwiſe. See the article ANGLING.

ANGLER, in ichthyology, the Engliſh name of a ſpecies of lophus. See LOPHUS.

ANGLES, an ancient German nation, originally a branch of the Suevi; who, after various migrations, ſettled in that part of Denmark, and duchy of Sleſwick, which to this day is called *Angel*, and of which the city of Flenſburgh is the capital. Here they were known, even in the time of Tacitus, by the name of *Angli*. The origin of this name is variouſly accounted for. According to Saxo-Grammaticus, they were called *Angli* from one Angulus, ſon to Humblus king of Denmark. Windiſchind, a Saxon writer, will have them to be called *Angli*, from an iſland in the corner or angle of the ſea, which they conquered. Goropius derives their name from the Saxon word *Angel* or *Engel*, ſignifying a fiſh-hook; the Angles, like the other Saxon nations, being greatly addicted to piracy, and on that account being ſo named by the neighbouring nations; as if, like hooks, they caught all that was in the ſea. To this nation the Britiſh ambaſſadors are ſaid to have applied when ſoliciting ſuccours againſt the Scots and Picts. The Angles therefore went over in greater numbers than any other Saxon nation; and accordingly had the honour of giving the name of *Anglia* to England. See ENGLAND.

ANGLESEY (Iſle of,) is the moſt weſtern country of North Wales. It is 24 miles in length, 18 in breadth, and ſends one member to parliament. It is ſeparated from Caernarvonſhire by a ſtrait called *Menai*, and on every other ſide is ſurrounded by the ſea. It is a fertile ſpot, and abounds in corn, cattle, fleſh, fiſh, and fowls.

At port Aethwy, the moſt general ferry into the iſland, there is a great paſſage of cattle. It is computed that the iſland ſends forth annually from 12,000 to 15,000 heads, and multitudes of ſheep and hogs. It is alſo computed that the remaining ſtock of cattle is 30,000. In 1770 upwards of 90,000 buſhels of corn were exported, excluſive of wheat. The improvement in huſbandry has greatly increaſed ſince the ſuppreſſion of ſmuggling from the Iſle of Man: before that time every farmer was mounted on ſome high promontory, expecting the veſſel with illicit trade; but ſince that period, he has ſet in earneſt to induſtry and cultivation. Not but that the iſland was in moſt remote time famous for its fertility: Mon, Mam Gymry, the Nurſing-mother of Wales, was a title it aſſumed even in the 12th century.

This iſland is divided into 74 pariſhes, of which moſt of the churches are ſituated near the ſhores. By an account given on the 13th of Auguſt 1563, there were 2010 houſholds, or families, in Angleſey; allowing five to a family, the whole number of inhabitants in that period was 10,050. It 1776, the number of houſes in Angleſey was about 3,956: allowing five perſons to a family, the whole number of inhabitants was at that time 19,780; which wants only 340 of doubling the number of inhabitants in the intervening ſpace. The chief town is BEAUMARIS.

In ancient times this iſland was called *Mon*, *Mona*, or *Moneg*. It was the great nurſery of the religion of the Druids; being the reſidence of the Grand Druid, or chief pontiff, and conſequently of all the learned doctors in that religion.

Many ancient monuments of Druidiſm ſtill remain in the iſland.—At Tre'r Dryw, or the habitation of the arch-druid, are ſeveral mutilated remains, which have been deſcribed by Mr Rowland. His *Bryn Gwyn*, or *Brein Gwyn*, or royal tribunal, is a circular hollow of 180 feet in diameter, ſurrounded by an immenſe agger of earth and ſtones, evidently brought from ſome other place, there not being any mark of their being taken from the ſpot. It has only a ſingle entrance. This is ſuppoſed to have been the grand conſiſtory of the druidical adminiſtration.—Not far from it was one of the *Corſeddau*, now in a manner diſperſed, but which once conſiſted of a great copped heap of ſtones, on which ſat aloft a druid, inſtructing the ſurrounding people *multa de Deorum immortalium vi et poteſtate diſputare, et juventuti tradunt*; Cæſ. lib. 6.—Here were alſo the relics of a circle of ſtones, with the *cromlech* in the midſt; but all extremely imperfect. Two of the ſtones are very large; one, which ſerves at preſent as part of the end of a houſe, is 12 feet 7 inches high and 8 feet broad; and another 11 feet high and 23 feet in girth. Some leſſer ſtones yet remain. The circle, when complete, was one of the temples of the druids, in which their religious rites were performed. It is the conjecture of Mr Rowland, that the whole of theſe remains were ſurrounded with a circle of oaks, and formed a deep and ſacred grove: *Jam per ſe roborum elegunt lucos, neque ulla ſacra ſine ea fronde conficiunt*; (Plin. Hiſt. Nat. xv. 44.)—Near this is *Caer Leb*, or the moated entrenchment; of a ſquare form, with a double rampart, and broad ditch intervening, and a leſſer on the outſide. Within are foundations of circular and of ſquare buildings. This Mr Rowland ſuppoſes to have been the reſidence of the arch druid, and to have given the name, *Tre'r Dryw*, to the townſhip in which it ſtands. At Trev-Wry are ſeveral faint traces of circles of ſtones, and other veſtiges of buildings; but all ſo dilapidated, or hid in weeds, as to become almoſt formleſs. *Bod-drudan*, or the habitation of the druids, *Tre'r-Beirdd*, or that of the bard, and *Bodowyr*, or that of the prieſts, are all of them hamlets, nearly ſurrounding the ſeat of the chief druid, compoſing the eſſential part of his ſuite. At the laſt is a thick cromlech, reſting on three ſtones.

The ſhore near Porthamel, not far from hence, is famed for being the place where Suetonius landed, and put an end in this iſland to the druid reign. His infantry paſſed over in flat-bottom boats, perhaps at the ſpot ſtill called *Pant yr Yſcraphie*, or the valley of *Skiffs*. His cavalry croſſed partly by fording, partly by ſwimming. Of the conflict on this occaſion we have the following animated deſcription by Tacitus*:

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* *Annal.* xiv. 30.

“ Stat pro littore diverſa acies, denſa armis viriſque, intercurſantibus fæminis in modum furiarum, veſte ferali, crinibus dejectis, faces preferebant; *druidæque* circum, preces diras ſublatis ad coelum manibus fundentes. Novitate aſpectus percutere militem, ut quaſi hærentibus membris, immobile corpus vulneribus præberent. Dein cohortionibus ducis, et ſe ipſe ſtimulantes, ne muliebre et fanaticum agmen paveſcerent, inferunt ſigna, ſternuntque obvios et igni ſuo involvunt. Præſidium poſthac impoſitum vicis, exciſque luci, ſævis ſuperſtitionibus ſacri. Nam cruore captivo adolere aras, et hominum fibris conſulere deos fas habebant.”—Thus Engliſhed: “ On the ſhore ſtood a motley army in cloſe array; and well armed; with women running wildly about in black attire with diſhevelled hair, and like the furies brandiſhing their torches; ſurrounded by the druids, lifting up their hands to heaven, and pouring forth the moſt dreadful imprecations. The ſoldier ſtood aſtoniſhed with the novelty of the ſight. His limbs grew torpid, and his body remaining motionleſs reſigned to every wound. At length, animated by their leader, and rouſing one another not to be intimidated with a womanly and fanatic band, they diſplayed their enſigns, overthrew all who oppoſed them, and flung them into their own fires. After the battle, they placed garriſons in the towns, and cut down the groves conſecrated to the moſt horrible ſuperſtitions: for the Britons held it right to ſacrifice on their altars with the blood of their captives, and to conſult the gods by the inſpection of human entrails.”—There are no traces of any Roman works left in this country. Their ſtay was ſo ſhort, that they had not time to form any thing permanent.

Near the ferry of Moel y Don appear the fine woods of Sir Nicholas Bayley, ſkirting the Menni for a conſiderable way. The wooded part of the iſland is on this ſide. It commences at Llanidan, and recals the ancient Britiſh name of Angleſey, *Ynys Dywyll*, or the *Dark Iſland*, on account of the deep ſhade of its groves: but at preſent it is (except in this part) entirely diveſted of trees; and the climate ſo averſe to their growth, that in moſt parts it is with great difficulty the gentry can raiſe a plantation round their houſes. Plas Newydd, the ſeat of Sir Nicholas Bayley, lies cloſe upon the water, protected on three ſides by venerable oaks, and aſhes. The view up and down this magnificent river-like ſtrait is extremely fine. The ſhores are rocky; thoſe on the oppoſite ſide covered with woods; and beyond ſoar a long range of Snowdonian alps. Here ſtood a houſe built by Gwenllian, a deſcendent of Cadrod Hardd. The manſion has been improved, and altered to a caſtellated form by the preſent owner.

In the woods are ſome very remarkable druidical antiquities. Behind the houſe are to be ſeen two vaſt cromlechs. The upper ſtone of one is 12 feet 7 inches long, 12 broad, and four thick, ſupported by five tall ſtones. The other is but barely ſeparated from the firſt: is almoſt a ſquare of five feet and a half, and ſupported by four ſtones. The number of ſupporters to cromlechs are merely accidental, and depend on the ſize or form of the incumbent ſtone. Theſe are the moſt magnificent in the iſland, and the higheſt from the ground; for a middle-ſized horſe may eaſily paſs under the largeſt. In the lands of Llugwy, indeed, there is a moſt ſtupendous one of a rhomboidal form. The greateſt diagonal is 17½ feet, the leſſer 15, and the thickneſs three feet nine inches; but its height from the ground is only two feet: it is ſupported by ſeveral ſtones. The Welſh, who aſcribe every thing ſtupendous to the famous king Arthur, call it *Arthur's Quoit*. In the woods at this place are ſome druidical circles nearly contiguous to each other.

At a ſmall diſtance from Beaumaris, on the ſhore, ſtand the remains of Llanvaes, or the Friars. It was founded by Prince Llewelyn ap Jerwerth, and, according to the general tradition of the country, over the grave of his wife Joan, daughter of king John, who died in 1237, and was interred on the ſpot. Here alſo were interred a ſon of a Daniſh king, Lord Clifford, and many barons and knights who fell in the Welſh wars. It was dedicated to St Francis, and conſecrated by Howel biſhop of Bangor, a prelate who died in 1240. The religious were Franciſcans, or minor friars. Their church and houſe were deſtroyed, and their lands waſted, in the inſurrection made ſoon after the death of Llewelyn, laſt Welſh prince, by his relation Madoc. Edward II. in conſideration of their miſfortunes, remitted to them the payment of the taxes due to him, which before the war were levied at the rate of L.12, 10s. Theſe friars were ſtrong favourers of Glendwr. Henry, in his firſt march againſt Owen, plundered the convent, put ſeveral of the friars to the ſword, and carried away the reſt; but afterwards ſet them at liberty, made reſtitution to the place, but peopled it with Engliſh recluſes. It poſſibly was again reduced to ruin; for Henry V. by patent, eſtabliſhed here eight friars, but directed, that two only ſhould be Welſh. At the diſſolution, Henry VIII. ſold the convent and its poſſeſſions to one of his courtiers. They became in later days the property of a family of the name of *White* (now extinct), who built here a good manſion. It of late became, by purchaſe, the property of Lord Bulkely. The church is turned into a barn, and the coffin of the princeſs Joan now ſerves for a watering-trough. A little farther is Caſtell Aber Llienawg, a ſmall ſquare fort, with the remains of a little round tower at each corner. In the middle one ſtood a ſquare tower. A foſs ſurrounds the whole. A hollow way is carried quite to the ſhore, and at its extremity is a large mound of earth, deſigned to cover the landing. This caſtle was founded by Hugh Lupus Earl of Cheſter, and Hugh the Red Earl of Shrewſbury, in 1098, when they made an invaſion, and committed more ſavage barbarities on the poor natives, eſpecially on one Kenred a prieſt, than ever ſtained the annals of any country. Providence ſent Magnus king of Norway to revenge the cruelties. His coming was to all appearance caſual. He offered to land, but was oppoſed by the earls. Magnus ſtood in the prow of his ſhip, and calling to him a moſt expert bowman, they at once directed their arrows at the Earl of Shrewſbury, who ſtood all armed on the ſhore. An arrow pierced his brain through one of his eyes, the only defenceleſs part. The victor, ſeeing him ſpring up in the agonies of death, inſultingly cried out, in his own language, *Leit loupe*, “ Let him dance.” This fort was garriſoned ſo lately as the time of Charles I. when it was kept for the parliament by Sir Thomas Cheadle; but was taken by Colonel Robinſon in 1645.

Above Llanddona is a high hill, called *Bwrdd Ar-*

thur, or Arthur's round table: the true name was probably *Din*, or *Dinas Sulwy;* for a church immediately beneath bears that of *Llanvihangle Din-Sulwy.* On the top of it is a great Britiſh poſt, ſurrounded by a double row of rude ſtones with their ſharp points uppermoſt; and in ſome parts the ramparts are formed of ſmall ſtones. In the area are veſtiges of oval buildings: the largeſt is formed with two rows of flat ſtones ſet on end. Theſe had been the temporary habitations of the poſſeſſors. It had been a place of vaſt ſtrength; for, beſides the artificial defence, the hill ſlopes ſteeply on all ſides, and the brink next to the ramparts is moſtly precipitous. It is worth while to aſcend this hill for the ſake of the vaſt proſpect; an intermixture of ſea, rock, and alps, moſt ſavagely great.

About two miles ſouth of Plas-Gwyn, the ſeat of Paul Panton, Eſq; was ſituated Penmynnydd, once the reſidence of the anceſtors of Owen Tudor, ſecond huſband to Catherine of France, queen dowager of Henry V.; "who beyng (as honeſt Halle informs us) young and luſtye, folowyng more her owne appetyte than frendely conſaill, and regardyng more her private affecton than her open honour, toke to huſband privily (in 1428) a goodly gentylman, and a beautiful perſon, garniged with manye godly gyftes both of nature and of grace, called *Owen Teuther*, a man brought furth and come of the noble lignage and auncient lyne of Cadwalader, the laſt kynge of the Britonnes." The match, important in its conſequences, reſtored the Britiſh races of princes to the kingdom: Theſe reigned long, under the title of the Houſe of Tudor; the mixed race having ceaſed on the acceſſion of Henry VII. grandſon to our illuſtrious countryman. The remains of the reſidence of the Tudors are, the door of the gateway: part of the houſe, and the great chimney-piece of the hall, are to be ſeen in the preſent farm-houſe. Some coats of arms, and dates of the building or time of repairs, are to be ſeen, with the initial letters of the names of the owners. The Tudors, for a conſiderable ſpace before the extinction of their race, aſſumed the name of *Owen.* Richard was the laſt male of the family, and was ſheriff of the county in 1657. Margaret, heireſs of the houſe, married Coningſby Williams, Eſq; of Glan y gors, in this iſland, who poſſeſſed it during his life. It was afterwards ſold to Lord Bulkley, in whoſe deſcendant it ſtill continues. In the church of Penmynnydd is a moſt magnificent monument of white alabaſter, removed at the diſſolution from the abbey of Llanvaes to this place; probably erected in memory of one of the houſe of Tudor; who had been interred there. On it is the figure of a man in complete armour, a conic helm, and mail-guard down to his breaſt; his lady is in a thick angular hood; their feet reſt on lions, and their heads are ſupported by angels.

On the weſtern point of the bay is a ſmall cape, flat at top, called *Caſtell-mawr*, joined to the land by a low iſthmus. It is compoſed of lime-ſtone, which is carried to diſtant parts in ſmall veſſels, which lie in a ſmall channel near the rock, and by their numbers frequently enliven the view. Roman coins have been found in this neighbourhood; but there are no veſtiges of their having been any ſtation. Beyond Caſtell-mawr, on the ſhore, are vaſt blocks of black marble filled with ſhells, corolloids, and fungitæ.

At Treſclwyn mountain is the moſt conſiderable body of copper ore perhaps ever known. The part of Tryſclwyn which contains it is called *Parys mountain.* Of this mountain, and the works there carried on, we have the following very curious and particular account by Mr Pennant*:—"The external aſpect of the hill is extremely rude, and riſes into enormous rocks of coarſe white quartz. The ore is lodged in a baſon or hollow, and has on one ſide a ſmall lake, on whoſe waters, diſtaſteful as thoſe of Avernus, no bird is known to a light. The whole aſpect of this tract has, by the mineral operations, aſſumed a moſt ſavage appearance. Suffocating fumes of the burning heaps of copper ariſe in all parts, and extend their baneful influence for miles around. In the adjacent parts vegetation is nearly deſtroyed; even the moſſes and lichens of the rocks have periſhed; and nothing ſeems capable of reſiſting the fumes but the purple melic graſs, which flouriſhes in abundance. It is thought that the ore had been worked in a very diſtant period. Veſtiges of the ancient operations appear in ſeveral parts, carried on by trenching, and by heating the rocks intenſely, then ſuddenly pouring on water, ſo as to cauſe them to crack or ſcale; thus aukwardly ſupplying the uſe of gunpowder. Pieces of charcoal were alſo found, which proves that wood was made uſe of for that purpoſe. As the Britons imported all works in braſs, it is certain that the Romans were the undertakers of theſe mines; and it is very probable that they ſent the ore to Caerhên to be ſmelted, the place where the famous cake of copper was diſcovered. They might likewiſe have had a ſmelting-hearth in this iſland; for a round cake of copper was diſcovered at Llanvaethlle, a few miles from this place. Its weight was fifty pounds, and it had on it a mark reſembling an *L.*

"In the year 1762, one Alexander Frazier came into Angleſey in ſearch of mines. He viſited Parys mountain; called on Sir Nicholas Bayley, and gave him ſo flattering an account of the proſpect, as induced him to make a trial, and ſink ſhafts. Ore was diſcovered; but before any quantity could be gotten, the mines were overpowered with water. In about two years after, Meſſrs Roe and Co. of Macclesfield, applied to Sir Nicholas for a leaſe of Penrhyn ddu mine in Caernarvonſhire; with which they were, much againſt their wills, compelled to take a leaſe of part of this mountain, and to carry on a level, and make a fair trial. The trial was accordingly made; ore was diſcovered; but the expences overbalanced the profits. They continued working to great loſs; and at length determined to give the affair up. They gave their agent orders for that purpoſe; but he, as a final attempt, divided his men into ten ſeveral companies, of three or four in a partnerſhip, and let them ſink ſhafts in various places, about eight hundred yards eaſtward of a place called the *Golden Venture*, on a preſumption that a ſpring, which iſſued from near the place, muſt come from a body of mineral. His conjecture was right; for in leſs than two days they met with, at the depth of ſeven feet from the ſurface, the ſolid mineral, which proved to be that vaſt body which has ſince been worked to ſuch advantage. The day that this diſcovery was made was March 2d, 1768; which has ever ſince been obſerved as a feſtival by the miners. Soon after this diſcovery, another adventure was begun by the reverend Mr Edward Hughes, owner of part of the mountain, in right of his wife Mary Lewis of Llys Dulas; ſo that the whole of the treaſure is the property of Sir Nicholas Bayley and himſelf. The body of copper ore is of unknown extent. The thickneſs has been aſcertained in ſome places by the driving of a level under it, ſeveral years ago, and it was found to be in ſome places twenty-four yards. The ore is moſtly of the kind called by Cronſted *Pyrites cupri flavo virideſcens*, and contains vaſt quantities of ſulphur. It varies in degrees of goodneſs; ſome of it is rich, but the greater part poor in quality.

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* *Tour in Wales*, ii. 263.

“ There are other ſpecies of copper ore found here. Of late a vein of the *Pyrites cupri griſeus* of Cronſted, about ſeven yards wide, has been diſcovered near the weſt end of the mountain: ſome is of an iron grey, ſome quite black; the firſt contains ſixteen ℔ of copper per c℔. the laſt forty. An ore has been lately found, in form of looſe earth, of a dark purpliſh colour; and the beſt of it has produced better than eight in twenty. Some years ago, above thirty pounds of native copper was found in driving a level through a turbery; ſome was in form of moſs, ſome in very thin leaves.

“ It is quarried out of the bed in vaſt maſſes; is broken into ſmall pieces; and the moſt pure part is ſold raw, at the rate of about 3*l.* to 6*l.* per ton, or ſent to the ſmelting-houſes of the reſpective companies to be melted into metal. Mr Hughes has great furnaces of his own at Ravenhead, near Liverpool, and at Swanſey, in South Wales. An idea of the wealth of theſe mines may be formed, by conſidering that the Macclesfield company have had at once fourteen thouſand tons of ore upon bank, and Mr Hughes thirty thouſand.

“ The more impure ore is alſo broken to the ſize of about hen's eggs; but in order to clear it from the quantity of ſulphur with which it abounds, as well as other adventitious matter, it muſt undergo the operation of burning. For that purpoſe, it is placed between two parallel walls of vaſt length: ſome kilns are 20, others 40, and 50 yards in length; ſome 10, others 20 feet wide, and above 4 feet in height. The ſpace between is not only filled, but the ore is piled many feet higher, in a convex form, from end to end. The whole is then covered with flat ſtones cloſely luted with clay, and above is placed a general integument of clay, and ſmall rubbiſh of the work, in order to prevent any of the fumes from evaporating. Of late, ſome kilns have been conſtructed with brick arches over the ore, which is found to be the beſt method of burning. Within theſe few years, attempts are made to preſerve the ſulphur from flying away; and that is done by flues made of brick, whoſe tops are in form of a Gothic arch, many ſcores of feet in length. One end of theſe opens into the beds of copper which are to be burnt. Thoſe beds are ſet on fire by a very ſmall quantity of coal, for all the reſt is effected by its own phlogiſton. The volatile part is confined, and directed to the flues; in its courſe the ſulphureous particles ſtrike againſt their roofs, and fall to the bottom in form of the fineſt brimſtone; which is collected and carried to adjacent houſes, where it is melted into what is called in the ſhops *ſtone brimſtone*.

“ The beds of copper, thus piled for burning, are of vaſt extent. Some contain 400 tons of ore, others 2000. The firſt require four months to be completely burnt, the laſt near ten. Thus burnt, it is carried to proper places to be dreſſed, or waſhed, and made merchantable. By this proceſs the ore is reduced to a fourth part in quantity, but conſiderably improved in quality: and by this means the water is ſtrongly or richly impregnated with copper, which is diſſolved by the acid quality of the ſulphur; and is collected or precipitated again by iron in the above-deſcribed pits. The iron is all diſſolved.

“ But a far richer produce of copper is diſcovered from the water lodged in the bottom of the bed of ore, which is highly ſaturated with the precious metal. This is drawn up, either by means of whimſies or windmills, to the ſurface, and then diſtributed into numbers of rectangular pits 36 feet long, ſome pits more, ſome leſs, 12 or 15 feet broad and 20 inches deep. To ſpeak in the language of the adept, Venus muſt make an aſſignation with Mars, or this ſolution will have no effect. In plain Engliſh, a quantity of iron muſt be immerſed in the water. The kind of iron is of no moment; old pots, hoops, anchors, or any refuſe will ſuffice: but of late, for the convenience of management, the adventurers procure new plates, four feet long, one and a half broad, and three quarters of an inch thick. Theſe they immerſe into the pits. The particles of copper inſtantly are precipitated by the iron, and the iron is gradually diſſolved into a yellow ocher. Great part of it floats off by the water, and ſinks to the bottom. The plates, or the old iron (as it happens), are frequently taken out, and the copper ſcraped off; and this is repeated till the whole of the iron is conſumed. The copper thus procured differs little from native copper, and is prized accordingly, and ſold for prices of £. 25 to £. 45 a ton.

“ This diſcovery is far from new: it has been practiſed long in the Wicklow mines in Ireland; and above a century in thoſe of Hern-grundt in Hungary, where it is called *ziment copper*. The waters of the Hungarian mines are much more ſtrongly impregnated with copper than thoſe of Parys mountain. The firſt effects its operation in 12 or about 20 days, the laſt requires two months. Horſe-ſhoes, iron made in the ſhape of hearts, and other forms, are put into the foreign waters; and when perfectly tranſmuted, are given as preſents to curious ſtrangers.

“ The ore is not got in the common manner of mining, but is cut out of the bed in the ſame manner as ſtone is out of a quarry. A hollow is now formed in the ſolid ore open to the day, and extends about 100 yards in length, about 40 yards in breadth, and 24 yards in depth. The ends are at preſent undermined, but ſupported by vaſt pillars and magnificent arches, all metallic; and theſe caverns meander far under ground. Theſe will ſoon diſappear, and thouſands of tons of ore be gotten from both the columns and roofs. The ſides of this vaſt hollow are moſtly perpendicular, and acceſs to the bottom is only to be had by ſmall ſteps cut in the ore; and the curious viſitor muſt truſt to them and a rope, till he reaches ſome ladders, which will conduct him the reſt of the deſcent. On the edges of the chaſms are wooden platforms, which project far; on them are windlaſſes, by which the workmen are lowered to tranſact their buſineſs on the face of the precipice. There ſuſpended, they work in mid air, pick a ſmall ſpace for a footing, cut out the ore in vaſt maſſes, and tumble it to the bottom with great noiſe. In ſuch ſituations they form caverns, and there appear ſafely lodged till the rope is lowered to convey them up again. Much of the ore is blaſted with gunpowder, eight tons of which are ſaid to be annually uſed for the purpoſe.

“ Nature hath been profuſe in beſtowing her mineral favours on this ſpot: for above the copper ore, and not more than three quarters of a yard beneath the common ſoil, is a bed of yellowiſh greaſy clay, from one to four yards thick, containing lead ore, and yielding from 600 to 1000 pounds weight of lead from one ton; and one ton of the metal yields not leſs than 57 ounces of ſilver. Mixed with the earth are frequently certain parts of the colour of cinnabar. Whether theſe are ſymptomatic of the ſulphureous arſenical ſilver ores or of quickſilver, I will not pretend to decide. Something interferes with the ſucceſsful ſmelting of this earth in the grate; inſomuch that it has not yet been of that profit to the adventurers which might reaſonably be expected from the crucible-aſſays of it, and they have at this time about 8000 tons on bank undiſpoſed of. This place has been worked for lead ore in very diſtant times. In the bottom of the pool was found an ancient ſmelting-hearth of grit-ſtone, and ſeveral bits of ſmelted lead, of about four inches in length, two in breadth, and half an inch thick.

“ Theſe works have added greatly to the population of the iſland; for about 1500 perſons are employed; who, with their families, are ſuppoſed to make near 8000 perſons, getting their bread from theſe mines. The little village of Amlwch, the port of the place, is increaſing faſt, and the market grows conſiderable. At the ſeaſon of the greateſt work, Mr Hughes's men alone receive for many weeks £. 200 in one week, and £. 150 in another, merely for ſubſiſtence. The port is no more than a great chaſm between two rocks, running far into land, and dry at low-water; into which ſloops run, and lie ſecure to receive their lading.”

Near Kemlyn Bay is a quarry of marble, common to this place, ſome parts of Italy, and to Corſica, and known in the ſhops by the name of *Verde di Corſica.* Its colours are green, black, white, and dull purple, irregularly diſpoſed. In different blocks one or other of the colours are frequently wanting; but among the green parts are often found narrow veins of a moſt elegant and ſilky white aſbeſtos. It is a compound ſpecies of marble: part is calcareous and may be acted on by aquafortis. The green parts partake of the nature of jaſper. It is apt to be interſected by ſmall cracks, or by aſbeſtine veins, therefore incapable of taking a high poliſh. This quarry lies on the lands of Monachty, in the pariſh of Llan-Fair-Ynghornwy; and it is found again in the iſle of Skerries, off this pariſh. Neither the quarry not the aſbeſtos are at preſent in uſe. In Rhoſcolyn pariſh, a green amianthus, or brittle aſbeſtos, is met with in great plenty in a green marble ſimilar to the above; but by reaſon of the inflexible quality of its fibres not applicable to the ſame uſe.

ANGLING, among ſportſmen, the art of fiſhing with a rod, to which are fitted a line, hook, and bait. See FISHING-*Rod*, FISHING-*Hook*, FISHING-*Fly*.

The angler's firſt buſineſs is to attract the fiſh to the place intended for angling. The method of doing this, in ſtanding waters, by throwing in grain, chopped worms, and the like, is well known: but the chief difficulty is in running rivers and brooks. The method, in this caſe, is to prepare a tin box capable of holding ſome hundreds of worms, bored on all ſides, and full of holes of ſuch a ſize as they may be juſt able to crawl out at; there muſt be a plummet faſtened to this box to ſink it, and a line to draw it back at pleaſure; in this caſe it is to be thrown into the water in a proper place, above which the angler may ſtand under cover. The worms will ſlowly and gradually crawl out of this box, and the fiſh will be gathered about to feed on them; the baited hook is to be thrown in higher up and carried down by the ſtream. If this method do not bring the fiſh about the place in a little time, there is reaſon to ſuſpect that ſome pike lies lurking thereabout, and deters them: in this caſe, it is proper to throw out a baited hook, and he will generally be taken; after this the attempt will ſucceed.

When the angler takes his ſtand, he is to ſhelter himſelf under ſome tree or buſh, or ſtand ſo far from the brink of the water that he can only diſcern his float; as the fiſh are timorous and eaſily frighted away. The angling rod muſt be kept in a moderate ſtate, neither too dry nor too moiſt: in the firſt caſe it will be brittle; in the other rotten. When paſtes are uſed, it is proper to mix a little tow with them, and rub them over with honey; finally, a ſmall anointing with butter is of great uſe to keep them from waſhing off the hook. The eyes of any fiſh that is taken are an excellent bait for almoſt any other kind of fiſh. The beſt way of angling with the fly is down the river, and not up; neither need the angler ever make above half a dozen of trials in one place, either with fly or ground bait, when he angles for trout: by that time the fiſh will either offer to take, or refuſe the bait and not ſtir at all.

In a pond, the beſt place for the angler to take his ſtand is uſually that where the cattle go up to water: in rivers, if breams are fiſhed for, it ſhould be in the deepeſt and moſt quiet places; if eels, under the banks of rivers that hang over; perch are to be expected in clean places, where the ſtream is ſwift; and chub in deep ſhaded holes: roach are moſtly found where the perch are, and trout only in ſwift and clear ſtreams. Places where there are many weeds, or old ſtumps of trees, harbour fiſh in great numbers, and they uſually bite freely there; but there is danger of entangling the line, or faſtening the hook to the weeds. In caſe of this accident, recourſe is to be had to a ring of lead, of about ſix inches round, faſtened to a ſmall pack-thread: this ring is to be thruſt over the rod, and let fall into the water. It will deſcend to the place where the hook is entangled; and then, by pulling the pack-thread gently, the hook will be ſoon diſengaged, or at the worſt it can only be broke off near the end of the line; whereas, when this is not employed, the rod itſelf is ſometimes broken, or the line nearer its upper end.

Deep waters are beſt for angling in, for the fiſh do not love to be diſturbed by wind and weather.

The openings of ſluices and mill-dams always bring fiſh up the current to ſeek for the food which is brought with the ſtream; and angling in theſe places is uſually ſucceſsful.

The beſt ſeaſon is from April to October; for, in very cold ſtormy weather, the fiſh will not bite: the beſt times of the day are from three till nine in the morning, and from three in the afternoon till ſun-ſet. In an eaſterly wind, there is never much ſport for the angler; the ſoutherly winds are the beſt for his purpoſe, and a warm but lowering day is moſt of all to be choſen; a gentle wind, after a ſudden ſhower, to diſturb the water, makes a very good opportunity for the angler: the cooler the weather in the hotteſt months, the better; but in winter, on the contrary, the warmer the day the better. A cloudy day, after a bright moonlight night, is always a good day for ſport; for the fiſh do not care for going after prey in the bright moonſhine, and are therefore hungry the next morning.

Thoſe who are fond of angling might ſave themſelves ſome fruitleſs trouble, by obſerving when ſmall fiſh in a jar take or refuſe food. See Fish.

The ſeveral methods of angling for ſalmon, trout, carp, tench, pearch, pike, dace, gudgeons, roach, flounder, &c. may be ſeen under the article Fishing.

ANGLO-Calvinists, a name given by ſome writers to the members of the church of England, as agreeing with the other Calviniſts in moſt points except church-government.

Anglo-Saxon, an appellation given to the language ſpoken by the Engliſh Saxons: in contradiſtinction from the true Saxon, as well as from the modern Engliſh.

ANGLUS (Thomas), an Engliſh prieſt, well known for the ſingularity of his opinions, and ſeveral little tracts which he wrote in the 17th century. He went by ſeveral names. Mr Baillet ſays his true name was *White;* but that he uſed to diſguiſe it under that of *Candidus*, *Albus*, *Bianchi*, and *Richworth:* but he was moſt known in France by the name of *Thomas Anglus*. Des Cartes generally called him Mr *Vitus*. He paſſed ſome time in moſt countries of Europe; but his longeſt ſtay was at Rome and Paris. When he was in England, he lived a conſiderable time in the family of Sir Kenelm Digby; and ſeems to have had a great eſteem for the opinions of this gentleman, as may be ſeen in his writings, particularly in the Preface to his Latin work concerning the Inſtitutions of the Peripatetic Philoſophy, according to the hypotheſis of Sir Kenelm. He was a great advocate for the peripatetic philoſophy. He attempted even to make the principles of Ariſtotle ſubſervient to the explaining the moſt impenetrable myſteries of religion; and with this view, he engaged in the diſcuſſion of predeſtination, free-will, and grace. Mr Baillet ſays, "What he wrote upon this ſubject reſembles the ancient oracles for obſcurity." In ſuch abſtruſe points as we have mentioned, he was much embarraſſed; and, by giving too great ſcope to his own thoughts, he pleaſed neither the Moliniſts nor Janſeniſts. He is allowed, however, to have been a man of an extenſive and penetrating genius. On the 10th of June 1658, the congregation of the Index Expurgatorius at Rome condemned ſome treatiſes of Thomas Anglus. The doctors of Douay cenſured alſo 22 propoſitions extracted from his Sacred Inſtitutions. He publiſhed his *Supplicatio poſtulativa juſtitiæ*, in oppoſition to their cenſure; wherein he complains that they had given him a vague undetermined cenſure, without taxing any particular propoſition. He died ſome time after the reſtoration of Charles II. but in what year is uncertain.

ANGOL, a city of Chili in South America, ſituated in W. Long. 78°. and S. Lat. 38°.

ANGOLA, a kingdom on the weſtern coaſt of Africa, lying, according to the moſt probable accounts, between Lat. 8. 30. and 16. 21. South, forming a coaſt of upwards of 480 miles; but how far it extends from weſt to eaſt, has never been exactly determined. Angola Proper is bounded on the north by the river Danda, which ſeparates it from Congo; and on the ſouth by the Coanza, by which it is ſeparated from Benguela. This laſt, however, is now included in the kingdom of Angola, having been conquered by its monarchs, tho' it ſtill retains the name of kingdom, and is included in the dimenſions we have juſt now given. The air here is very hot and unwholeſome, and the country mountainous; there being but few plains to be met with in it, except on the ſea-coaſt, and between the huge ridges of mountains.

1
Originally a province of Congo.

That part of the kingdom which we have diſtinguiſhed by the name of *Angola Proper*, was ſubject to the kings of Congo in the year 1484, when the Portugueſe firſt diſcovered the country: but how long it had been ſo before that time, is not known; the inhabitants being utterly deſtitute of chronology, and have no other way of diſtinguiſhing paſt events but by ſaying they happened in ſuch a king's reign. Neither, though Angola became a diſtinct kingdom ſince its diſcovery by the Portugueſe, is it known with more certainty at what time that revolution happened; or whether the Portugueſe were not concerned in aſſiſting the viceroy of the king of Congo, who governed the province of Angola, to ſet up for himſelf.

2
Tradition concerning its becoming a diſtinct kingdom.

All accounts agree, that this kingdom was founded by one *Ngola*, or *Angola*, from whom it took its name. According to the tradition of the country, this Ngola was a ſmith, and the inventor of that trade, in which he had been inſtructed by the dæmons of the country. In conſequence of this, he became exceeding rich, not in gold, ſilver, or ſhell-money, which were not at that time in uſe; but in corn, cattle, and fruits, which were then exchanged in traffic. The country being not long after viſited by a grievous famine, Ngola generouſly relieved his diſtreſſed countrymen, and ſaved the lives of ſome thouſands. In gratitude for this generoſity, he was unanimouſly choſen king; and hence the ſmith's trade is reckoned among the royal arts of Angola.

3
More authentic account.

According to other accounts which can be more depended upon, Ngola was the king of Congo's viceroy; who, having become powerful by the reduction of ſeveral of the neighbouring ſtates, was induced to ſet up for himſelf. Dreading, nevertheleſs, the power of his old maſter, he choſe to ſend him the uſual tribute and preſents annually, till he reckoned himſelf firmly ſeated on the throne, and had ſecured it to his deſcendents. His meaſures were greatly facilitated by the wars which the king of Congo was then engaged in with the *Giagas*, a barbarous nation in the neighbourhood. Theſe made ſuch a powerful inroad into his dominions, that he was glad to aſk aſſiſtance from Ngola; not as a ſubject, but as a friend and ally. This was readily granted; and the two monarchs continued ever after ſending preſents and aſſiſtance to each other, and encouraging a mutual commerce between their ſubjects.

4 Ngola the firſt king.

Ngola lived to a great age, highly reſpected by his ſubjects, and in alliance with the king of Congo and the Portugueſe, whoſe numerous ſettlements on the coaſt had made them become very powerful. According to the cuſtom of the country, he had many wives and concubines. By his chief favourite he had three daughters, *Zunda Riangola*, *Tumba Riangola*, and another whoſe name is unknown. Towards the latter part of his life, the king's chief care was to ſecure the crown to the eldeſt of theſe; for which purpoſe he conſulted his beloved queen, who encouraged him in the deſign with all the eloquence in her power. By her advice, he ſent for his lieutenant-general; a favourite ſlave, whom he had created viceroy over the whole kingdom, to acquaint him with his reſolution. The artful miniſter did not fail to applaud his deſign, though his intention was to defraud the princeſs, and ſeize the throne for himſelf. He accordingly took the opportunity, one day, when that princeſs and the whole court were employed in ſowing their lands, to ſpread a report that the Angolic enemies had entered the kingdom, and were deſtroying every thing with fire and ſword. In this confuſion, the treacherous viceroy conducted the three princeſſes to the royal palace; and acquainting Ngola with the pretended danger, urged him to betake himſelf to a ſpeedy flight.

5 Murdered by his prime miniſter, who ſeizes the throne.

The frighted monarch, unable to ſtir with age, deſired his miniſter to take the moſt proper means for his ſafety: whereupon, being a ſtout young fellow, he takes his majeſty on his back, and carries him into a neighbouring wood; where he no ſooner had him in a convenient place, than he ſtabbed him with a dagger. This ſtratagem was too ſhallow to remain long concealed; the murderer was quickly diſcovered, and many of the nobles roſe in arms againſt him; but finding his party too ſtrong to be oppoſed, they were at laſt obliged to ſubmit, and ſuffer him quietly to aſcend the throne, upon his publicly declaring that he had not ſeized it but with a view of ſecuring it to the princeſs Zunda Riangola.

To this princeſs, the uſurper palliated his conduct in the beſt manner he could; and ſhe had art enough to diſguiſe her reſentment ſo effectually, that he never diſcovered the ſmalleſt occaſion for jealouſy.

6 Death of the uſurper, who is ſucceeded by Zunda Riangola.

At laſt, his ſudden death gave Zunda an opportunity of aſcending the throne peaceably; when ſhe behaved with ſuch moderation and juſtice, as to gain the love and affection of all her ſubjects. Her jealous temper prevented her from marrying; and, by giving too much way to it, ſhe came at laſt to dread as rivals the two ſons of her younger ſiſter Tumba, and to form deſigns againſt their life. To accompliſh her purpoſes, ſhe ordered them to be brought to court, pretending to have them educated under her own eye. This was declined for ſome time; but at length the queen prevailed ſo far as to have the eldeſt ſent to her; whom ſhe no ſooner got into her power, than ſhe cauſed him to be maſſacred, with all his attendants; only one eſcaping, all covered with wounds, to carry the dreadful news to the princeſs and her huſband.

7 Murders her nephew.

On hearing of this bloody act, the afflicted parents immediately ſallied forth at the head of all their vaſſals. They were waited for by Queen Zunda at the head of a numerous army; but, no ſooner did her ſoldiers perceive the parents of the deceaſed prince, than they immediately abandoned the queen to their reſentment.

8 Is herſelf murdered by her ſiſter.

Tumba immediately ruſhed upon her ſiſter, and ſtabbed her to the heart; after which, ſhe commanded her entrails to be taken out, and thrown into the hole in which her ſon's body had been caſt. Upon this Tumba was crowned queen of Angola, and invited her huſband to participate with her in the management of public affairs. This offer he was too wiſe to accept; and Tumba, upon his refuſal, reſigned the crown into the hands of her ſurviving ſon, named *Angola Chilvagni*. He proved a great and wiſe prince, extending his dominions by conqueſt, and gaining the love of his ſubjects by the moderation and equity of his government. He was ſucceeded by one of his younger ſons, named *Dambi Angola*;

9 Dambi Angola a cruel tyrant.

who no ſooner aſcended the throne, than he put all his brethren to death, leſt they ſhould unite in favour of the eldeſt. The reſt of his reign proved conformable to ſuch a beginning. He was a monſter of cruelty, avarice, lewdneſs, and perfidy. Death, however, in a ſhort time, happily delivered his ſubjects from this tyrant; who, notwithſtanding his infamous life, was buried with the greateſt magnificence; and a mount was erected over his grave, conſiſting, according to the cuſtom of the country, of a prodigious nnmber of human victims which had been ſacrificed to his ghoſt.

10 Ngola Chilivagni; his conqueſts.

Dambi Angola was ſucceeded by Ngola Chilivagni, a warlike and cruel prince. He conquered many nations, and made the moſt dreadful inroads into the kingdom of Congo, along the rivers of Danda, Lucalla, Zanda, and Coanza; whoſe waters were often tinged with the blood of thouſands whom he maſſacred in his excurſions. Notwithſtanding theſe butcheries, Ngola Chilivagni ſhowed ſuch generoſity to thoſe who readily ſubmitted to him, that he was ſure to conquer, not only wherever he came, but wherever he ſeemed to direct his forces. At laſt, as if weary of conqueſt, he planted a tree on the banks of the Coanza, about eight leagues from Loanda San Paulo, as a boundary to his ravages. This tree the Portugueſe called *Iſanda*, or *Iſandaura*; and afterwards erected a fortreſs near it.

11 Fancies himſelf a god.

The ſame folly and inſolence which took place in the breaſt of Alexander the Great, on account of his rapid conqueſts, ſoon puffed up the mind of this petty African tyrant. Becauſe he had conquered and ravaged ſome of the neighbouring countries, and brought under his ſubjection a few cowardly barbarians; he firſt fancied himſelf invincible, and then that he was a god. He demanded the ſame reſpect and adoration that was paid to their other deities; and with this demand his ſubjects were ſervile enough to comply. This pretended deity, however, was forced to ſubmit to the fate of other mortals, and died without leaving a ſucceſſor behind him.

On the deceaſe of Ngola Chilivagni, the ſtates elected Ngingha-Angola-Chilombo-Kickaſanda, great-nephew to queen Tumba's huſband, as his ſucceſſor. He proved ſuch a rapacious and cruel tyrant, that his ſubjects univerſally wiſhed for his death; which, luckily for them, ſoon happened. He was interred with the uſual pomp and ſolemnities, particularly that of having a whole hecatomb of human victims ſacrificed upon his grave.

12 Revolt againſt Bandi Angola.

13 Quelled by the aſſiſtance of the king of Congo and the Portugueſe.

grave. His ſoe Bandi Angola, who ſucceeded him, proved yet a greater tyrant than his father; ſo that he ſoon became intolerable to his ſubjects. A general revolt enſued, in which his ſubjects called in the cannibal Giagas to their aſſiſtance. They immediately poured in like a band of hungry dogs haſtening to feed upon a carcaſe; and having defeated and devoured the forces of the tyrant, beſieged him in an inacceſſible mountain; where not being able to come at him, they reſolved to reduce him by famine. Bandi Angola applied to the king of Congo for aſſiſtance. As it was the intereſt of that prince to hinder the ravenous Giagas from entering into the Angolic dominions, whence they could ſo eaſily paſs into his own, he did not heſitate at granting his requeſt; and ordered a ſtrong reinforcement of the Portugueſe, of whoſe valour he had a high opinion, and of whom he entertained a great number at his court, to march to the aſſiſtance of the king of Angola. The command of the army was given to one of the moſt experienced Portugueſe officers; who, depending more on the handful of Europeans he had under his command than on the Congoeſe, attacked the rebels, though greatly ſuperior in number; and, having utterly defeated them, reſtored the king of Angola to his throne.

14 The king's daughter falls in love with the Portugueſe general;

15 Who retires to Congo.

This eſſential piece of ſervice ſo endeared the Portugueſe to Bandi Angola, that he took them into his ſervice, and even into his council. Their general became a great favourite of the king, but much more ſo of his daughter, who conceived a violent paſſion for him Unfortunately for them both, the amour was carried on with ſo little precaution on her part, that the king quickly diſcovered it; and immediately formed a reſolution of exterminating the Portugueſe all at once. Such violent meaſures, however, could not be concerted ſo privately but the princeſs got ſome intelligence of it; and having appriſed her lover of the danger, he immediately withdrew into Congo, taking with him as many of his countrymen as he conveniently could. The king of Congo expreſſed ſuch ſtrong reſentment againſt Bandi Angola for his ingratitude, that the Portugueſe general would have probably prevailed upon him to declare war againſt Angola, had he not been obliged to defend his own dominions againſt a neighbouring prince who then made an invaſion. This afforded that general a fair pretence of aſking leave to return home; promiſing to come with ſuch reinforcements as would enable the king of Congo to revenge himſelf for the affront put upon him by the Angolic monarch. His real intention, however, was, to give the king of Portugal an opportunity of ſeizing upon the kingdom of Angola.

16 Lays a plan for the conqueſt of Angola before the king of Portugal.

On his return to Liſbon, the Portugueſe general having laid his plan before the king, it was ſo well reliſhed, that an armament was ordered to be fitted out, well furniſhed with every neceſſary for building fortreſſes, &c. and a ſufficent number of men. The wind proving favourable all the way back, the Portugueſe ſoon arrived ſafe at Loando San Paulo; whence the general diſpatched a meſſenger to acquaint the king of Congo with his arrival, and to make him ſome rich preſents. Theſe were no ſooner gone than the admiral ſailed up the Coanza; and, landing without oppoſition in the kingdom of Angola, ſet about erecting a fortreſs in a convenient ſituation, which was completed in a few days.

17 Defeats the Angolans.

The king being informed of the return of the Portugueſe, and of their fortifying themſelves on advantageous ground, gathered together a numerous army: but his forces though upwards of 100,000 in number, were utterly defeated by the Portugueſe; vaſt numbers killed, and many more carried into ſlavery. The admiral now ravaged the whole country, putting all to fire and ſword, and making himſelf maſter of every advantageous ſpot of ground. The king, however, had ſtill the good luck to eſcape all the ſtratagems that were laid for him; and once more got ſafe to his inacceſſible fortreſs.

18 Bandi Angola murdered.

All this time Bandi Angola had himſelf tyrannized, and allowed his favourites to tyrannize, in ſuch a manner, that his ſubjects were become no leſs weary of his government than when they formerly revolted. Being now exaſperated beyond meaſure at the calamitous war of which he had been the occaſion, they formed a deſign of putting an end to his life; and in order to draw him out of his retreat, where he wallowed in all manner of debauchery, they had recourſe to the following ſtratagem: A deputation was ſent, acquainting him with the revolt of one Cuculo Cabazzo; who, at the head of a numerous band, committed the moſt cruel ravages. They beſought his majeſty either to levy a ſufficient number of troops, and march in perſon againſt him, or to allow them to arm themſelves againſt him. The credulous king complied with this laſt propoſal; and granted them leave to raiſe what forces might be thought neceſſary. Four days after, notice was ſent to the king, that his ſubjects had attacked the rebels, and had been repulſed with loſs; but that, if his majeſty would but condeſcend to animate them with his preſence, the ſight of him would inſpire them with ſuch courage, that they would aſſuredly prove victorious. This had the deſired effect; and the king ſet out a few days after, without any other precaution than his own guards, to head his army which was encamped on the banks of the Lucalla. He no ſooner appeared in view, than all the chief officers came out to meet him; and having under pretence of paying their reſpects, gradually ſeparated him from his guards, they fell upon him and diſpatched him at once.

19 Cruelty of the new king.

Bandi Angola was ſucceeded by his ſon Ngola Bandi, whoſe mother had been a ſlave; and whoſe title to the crown was conſequently diſputable, according to the laws of the country. Of this the new king being well appriſed, thought proper to begin his reign by murdering every perſon who had oppoſed his election. He began with the *Tendula*, or commander of the king's rear-guard; who, by his office, is the chief of the electors, and the perſon who governs the kingdom during the interregnum. Him he ordered to be put to death, with all his family. Theſe were followed by the principal officers of his father's court; all his concubines, together with their parents and near relations, whom he cauſed to be butchered; together with his half-brother. his father's ſon by a favourite concubine, and then but an infant. He did not ſpare even the ſon of his ſiſter Zingha Bandi, whom ſhe had by one of her paramours. The intereſt of his ſiſter had contributed greatly to raiſe this tyrant to the throne; and his ingratitude, with the murder of her ſon, ſo exaſperated her, that ſhe ſwore to be revenged on him in the ſame way.

20 Makes war on the Portugueſe and is reduced to great diſtreſs.

The Portugueſe were the next objects of his reſentment. Theſe he ſo much dreaded on account of their valour and policy, that he immediately declared war, reſolving not to lay down his arms till he had exterminated them to the laſt man, or driven them totally out of his dominions. His raſhneſs, however, coſt him dear. Myriads of the Angolic poltroons were overthrown by an handful of Portugueſe; and the king himſelf was forced to fly, firſt into the iſland of Chiconda in the river Coanza, and then into the deſarts of Oacco. Here his conquerors, out of great clemency, allowed him to live among the wild beaſts, without any other ſuſtenance than what the deſarts afforded. He had the misfortune alſo to loſe his queen and two ſiſters Cambi and Fungi, who were taken priſoners by the Portugueſe, but honourably treated.

21 His treachery.

22 Sends his ſiſter Zingha on an embaſſy.

The king being informed of this, ſent an embaſſy to treat of their ranſom and an exchange of priſoners. The propoſal was readily agreed to; and the princeſſes were ſent back, laden with preſents. The king, however, refuſed to perform his part of the agreement, and thereby plunged himſelf into ſtill greater difficulties. A new Portugueſe viceroy being arrived about this time, Ngola was quite at a loſs how to excuſe the non-performance of his part of the treaty. At laſt he had recourſe to his exaſperated ſiſter Zingha; and having excuſed, as well as he could, the murder of her ſon, propoſed to ſend her on a ſplendid embaſſy to the viceroy. Having conſented, but without forgetting her reſentment, ſhe ſet out, as plenipotentiary for the king of Angola, with a magnificent retinue, was received with all the honour due to her rank, and lodged in a ſplendid palace prepared for her.

23 Her haughty behaviour.

At the firſt audience Zingha had of Don John (the Portugueſe viceroy), ſhe was greatly ſurprized to find a ſtately elbow-chair prepared for him to ſit upon, and for herſelf only a rich tapeſtry ſpread on the floor, with a velvet cuſhion embroidered with gold, and placed over againſt the chair of ſtate. Diſſembling her diſpleaſure however, ſhe beckoned to one of the ladies of her retinue, commanded her to lay herſelf down on her elbows and knees upon the carpet, and ſat herſelf upon her back during the whole time of the audience. She behaved with ſuch addreſs and dignity, as to gain the admiration of the whole council. A propoſal was made of entering into an alliance offenſive and defenſive with the king of Angola, provided he acknowledged himſelf the vaſſal of the king of Portugal, and ſubmitted to pay a yearly tribute. To this Zingha replied, that ſuch conditions were indeed fit to be impoſed upon thoſe who had been conquered by the ſword; but not upon a great and powerful monarch, who only ſought their friendſhip and alliance: upon which the treaty was concluded on both ſides, without any other conditions than the exchange of priſoners. The audience being over, Don John took notice to Zingha, as he conducted her out of the hall, that the lady who had ſerved her as a ſeat, continued ſtill in the ſame poſture; upon which ſhe replied, That it did not become the ambaſſadreſs of a great monarch to make uſe of the ſame chair twice, ſo ſhe looked upon her as a piece of caſt-off goods not worthy of further notice.

24 Embraces the Chriſtian religion.

Zingha was ſo taken with the honours done her by the Portugueſe, and ſo intent upon obſerving the order, dreſs, arms, &c. of their troops, that ſhe ſtaid at Loando a conſiderable time; during which ſhe was inſtructed in the Chriſtian religion, and conſented to be baptized. Don John and his ſpouſe were her ſponſors; who diſmiſſed her ſoon after, with all poſſible honours, and highly ſatisfied with her reception and ſucceſs. At her return ſhe took care to have the articles ratified by her brother; who expreſſed his approbation of them, and the higheſt obligations to her. He even went ſo far as to deſire the viceroy to ſend him ſome proper perſons to inſtruct him in the Chriſtian religion, which he ſaid he was very deſirous of embracing. This requeſt was immediately granted; and Don Denis de Faria, a negro prieſt, a native of Angola, was diſpatched, along with an officer of diſtinction, to ſtand godfather to the king. Theſe met at firſt with a gracious reception; but when they come to talk of baptiſm, Ngola altered his tone, and told him it was too much below his dignity to receive it from the ſon of one of his ſlaves, and ſent them both back. This was cried up by the courtiers as a princely act: but Zingha repreſented that it could not fail to exaſperate the viceroy; and tried all poſſible means to diſſuade him from it, but in vain. He ſuffered, however, his other two ſiſters, Cambi and Fungi, to be baptized; which was performed in 1625, with a ſplendor ſuited to their dignity.

25 War again declared againſt the Portugueſe.

26 The king poiſoned.

As no experience ſeems to have been a ſufficient antidote againſt the innate folly of Ngola Bandi, he ſoon after took it into his head to make war on the Portugueſe and invaded ſome of their territories. This laſt action proved his ruin: his troops were all cut off, and himſelf forced to ſwim for his life to a ſmall iſland in the Coanza, about a mile long, and two bow-ſhots in breadth; whither the Portugueſe purſued and ſurrounded him, ſo that he had no other chance, but either to fall into their hands, or be devoured by the wild beaſts with which the place ſwarmed. From both theſe dangers he was relieved by a doſe of poiſon, given him, as was ſuppoſed by his ſiſter Zingha. Before this time, however, he had taken care to ſend his eldeſt ſon to the country of the Giagas, and put him under the care of one of their chiefs called *Giaga Caza*, whom he beſought to take care of him and protect him from his aunt Zingha, as he rightly imagined ſhe would not fail of attempting his life, in order to ſecure herſelf on the throne.

27 Zingha Bandi crowned queen.

Zingha Bandi was crowned queen of Angola, without oppoſition, in 1627.—She was a very artful woman, endowed with great preſence of mind, firm in her reſolutions, of an intrepid courage, and a great miſtreſs in the art of diſſimulation. She inherited a large ſhare of her brother's jealous and cruel temper, to which ſhe would not heſitate to ſacrifice her neareſt relations, if they gave her the leaſt umbrage.—To this jealouſy therefore ſhe reſolved to ſacrifice her nephew, as well knowing he had a better title to the crown than herſelf. She made uſe of the moſt ſolemn oaths to draw him out of the hands of his guardian, proteſting that ſhe had accepted of the throne with no other view than to preſerve it for him. But Giaga, being well acquainted with her temper, was proof againſt all her oaths and fair ſpeeches.—Zingha, finding this method ineffectual, pretended a deſire of reſigning the crown to her nephew; to which ſhe ſaid ſhe had no other objection, than that ſhe was afraid he was yet incapable of aſſuming the reins of government. She therefore deſired an interview with him, though ever ſo ſhort that ſhe might ſatisfy herſelf in this particular, and promiſed to detain him no longer than Giaga ſhould think neceſſary. Giaga thought there could be no danger in conſenting to a ſhort interview; and therefore ſent the unfortunate 28 She murders her nephew. prince to her, attended by a magnificent retinue. The cruel queen no ſooner got him in her power, than ſhe murdered him with her own hand, and cauſed his body to be thrown into the Coanza, ridding herſelf, by that inhuman act, of a formidable rival, as well as revenging herſelf on her brother, as ſhe had ſworn to do, for the murder of her ſon.

Zingha's next ſcheme was to rid herſelf of the Portugueſe, who had eſtabliſhed themſelves in ſuch a manner as to be almoſt entire maſters of the country. They had built fortreſſes on every convenient ſpot that ſuited them, eſpecially near her principal towns, which they could level with the ground with the greateſt eaſe. They had engroſſed all her commerce, were become very wealthy, and their numbers increaſed daily; ſo that they were dreaded not only by her ſubjects, but by all the neighbouring nations. As Zingha was of a 29 Declares war againſt the Portugueſe. martial temper, ſhe did not long heſitate. She quickly made all neceſſary proviſions, ſtrengthened herſelf by alliances with the Giagas, and other idolatrous nations, and even with the Dutch and the king of Congo. With this combined force ſhe attacked the Portugueſe ſo ſuddenly and unexpectedly, that ſhe gained ſome advantages over them; and the Dutch made themſelves maſters of San Paulo de Loando, and ſoon after of ſome of the beſt provinces in the kingdom. This happened in the year 1641; and the Portugueſe did not recover theſe places till the year 1648, when the Dutch were entirely driven out of Angola.

30 Her bad ſucceſs. Zingha's ſucceſſes proved ſtill more ſhort-lived. Her allies the Congoeſe were ſo completely overthrown, that they were forced to ſue for peace; which the Portugueſe did not grant till they had obtained a ſufficient number of hoſtages, and obliged the Congoeſe to deliver up to them ſome conſiderable poſts, upon which they immediately erected fortreſſes. Zingha's troops were now defeated in every battle; and theſe defeats followed one another ſo cloſe, that ſhe was ſoon abandoned, not only by her allies, but by her own troops. She was now conſtrained to abandon her dominions, and retire to ſome of the eaſtern deſerts, whether the Portugueſe did not think it worth while to follow her.

Zingha being reduced to ſuch diſtreſs, the Portugueſe, after giving her ſome time to ruminate on her ſituation, ſent her propoſals of peace, upon condition that ſhe ſhould become tributary to the crown of 31 Refuſes to become tributary to them. Portugal. This propoſal was rejected with ſcorn; and ſhe let them know, that, however her daſtardly ſubjects might ſubmiſſively and ſhamefully behave towards them, their queen diſdained ſubjection to any foreign power. On this haughty anſwer, the Portugueſe, to mortify her ſtill more, ſet up a king in her place. 32 They ſet up a king. The perſon they pitched upon was named *Angola Oarij*, or *Aaru*, who was of the royal family. Before he was crowned, the Portugueſe obliged him to turn Chriſtian; and he was accordingly baptized by the name of John. The new king, however, ſoon died of grief, at ſeeing himſelf ſo hardly treated by his new maſters the Portugueſe, they quickly ſet up another, named *Philip*; who bore the yoke with more patience, and lived to the year 1660.

33 Zingha's apoſtacy and horrid barbarity. In the mean time Zingha, exaſperated at ſeeing herſelf deprived of eleven of the beſt provinces in her dominions, and her authority in the remaining ſix greatly weakened, renounced the Chriſtian religion, and embraced all the horrid and bloody cuſtoms of the Giagas, whom ſhe outdid even in their own barbarity.—We have already hinted the barbarity of this nation in eating human fleſh. In this Zingha not only joined them, but took pleaſure in devouring the raw fleſh of human victims, and drinking their blood while warm, both at her ſacrifices and at her public meals.—She affected a martial and heroic ſpirit, together with an utter averſion to the male ſex; but, according to the Portugueſe, maintained a number of the ſtrongeſt and luſtieſt youths, in whoſe embraces ſhe gave a full ſcope to her inclinations, and managed matters with ſuch ſecrecy that her intrigues could never be diſcovered. At the ſame time ſhe ordered many of her own ſex to be ripped up, when their incontinency was manifeſted by their pregnancy; and their bodies, with thoſe of the infants, to be caſt to wild beaſts.

But what made her moſt admired, as well as dreaded, by her ſubjects, was a notion that ſhe had by various ſtratagems inculcated upon them, of her being able to penetrate into the moſt ſecret thoughts. To keep up this apprehenſion, ſhe ordered the bones of her deceaſed brother to be brought from the iſland where he was poiſoned, locked up in a cheſt covered with coarſe plates of ſilver, and laid on a fine carpet upon a pedeſtal. A number of ſinghillos or prieſts were ordered to offer ſacrifices to theſe bones, and to keep lamps continually burning before them. To this place ſhe herſelf frequently repaired, to aſſiſt at thoſe rites, which, as ſhe gave out, and every body believed, engaged the ſpirit of the deceaſed to inform her of every thing that was done, ſaid, or even deſigned, either in the kingdom or out of it.—To procure, however, as much real intelligence as poſſible, ſhe kept vaſt numbers of ſpies all over the kingdom, who conſtantly gave her notice of what happened in their reſpective circles; and this ſhe ſo cunningly improved to her own ends, that her ſubjects looked upon her as a kind of deity from whom nothing could be concealed.

34 Her influence over the Giagas. By ſuch means as theſe, Zingha gained ſuch authority over the Giagas, that they were ready, at the very firſt indication of her will, to follow her through the moſt dreadful dangers, and to engage in the moſt deſperate enterprizes. She now made many ſtrenuous and daring efforts to drive out the Portugueſe; but though ſhe had, in all probability, more valour and ſkill than her enemies, the fire-arms gave them ſuch an advantage, that ſhe was always defeated with great loſs. Perceiving therefore the folly of attempts of this kind, ſhe contented herſelf with making continual inroads into their country, carrying off or deſtroying every thing that fell in her way. Though ſhe ſpared neither Europeans, nor blacks who were ſubjects of the 35 Her terrible ravages. mock-monarchs ſet up by the Portugueſe, yet the caſe of the former were peculiarly dreadful when they happened to be taken priſoners. They were either roaſted

by a ſlow fire, or had their fleſh cut off in pieces, and devoured before their faces, in the manner related by Mr Bruce of the Abyſſinian oxen *. In this manner ſhe infeſted the Portugueſe territories for 28 years, ſcarce ever allowing them a moment's ceſſation of arms. Their mock-kings were often obliged to ſhelter themſelves from her fury in an inacceſſible rock called *Maopongo;* and they themſelves could never hope to enjoy their dominions with any kind of peace ſo long as this furious queen continued alive. They in vain exhauſted all their politics either to reduce her by force, or to mollify her by preſents and fair offers. The one ſhe rejected with diſdain, and always found means to baffle the other. Nor would ſhe hearken to any terms, unleſs they conſented to reſign all their conqueſts. The refuſal of this demand was ſo commonly followed by ſome marks of her reſentment, that it was with the utmoſt difficulty the Portugueſe could prevail on any body to carry their propoſals to her; and as for Zingha ſhe diſdained to make any to them, except thoſe of the hoſtile kind. The terror of her arms procured her a free paſſage wherever ſhe directed her courſe; all the inhabitants of the province making no leſs haſte to abandon, than ſhe to invade it. Thus ſhe continued to advance, till at length ſhe was got ſo far as the ſmall iſland of Dangii in the river Coanza. The Portugueſe now found themſelves under a neceſſity of raiſing an army of negroes, in order to drive her out of it. Accordingly they ſurrounded the iſland, and intrenched themſelves along the banks on both ſides of the river; but while they were buſy at their work, Zingha attacked them with ſuch advantage, that ſhe killed and wounded ſeveral hundreds of the blacks, and ſome of the white men. Elated with this advantage, ſhe was preparing for another attack; when ſhe perceived, to her ſurpriſe, that the Portugueſe had drawn their lines ſo cloſe, and raiſed them to ſuch a height, that they overlooked her whole camp, and could fire upon her naked ſoldiers as if they ſhot at a mark.—Thus great numbers of her men were cut off, particularly her chief officers. 36 Outwits the Portugueſe. The queen, now perceiving the danger of her ſituation, amuſed the Portugueſe with propoſals of an accommodation; and having obtained a truce for three days, croſſed the river in the dead of the night, and led her forces to the province of Oacco. The next morning, the Portugueſe, ſeeing no human creature upon the iſland, began to apprehend ſome new ſtratagem; but, upon landing ſome of their troops, they perceived themſelves over-reached, and deprived of the faireſt opportunity they ever had of forcing her to ſurrender at diſcretion.

Zingha ſtaid no longer in the province whither ſhe had retired, than till ſhe was aſſured that the Portugueſe were retired from the Coanza; and then, croſſing that river once more marched directly towards the kingdom of Metamba, which had been invaded by ſome of the neighbouring princes. The ſpeed with which ſhe led her forces thither, and recruited her army with multitudes of Giagas, who were all emulous of fighting under her banners, quickly enabled her to recover ſome of her territories in that kingdom. 37 Her complicated misfortunes. Beginning now to think herſelf ſucceſsful, ſhe again attacked the Portugueſe; but was defeated with great loſs, ſo as to be obliged to ſend for freſh troops. To complete her misfortune, ſhe received news that the Giaga Caſſangi had taken the advantage of her abſence, to enter the kingdom of Metamba with a numerous army, had carried off the greateſt part of the inhabitants, deſtroyed all the fruits of the earth, plundered the towns of all that was valuable, and ſet fire to the reſt, leaving that kingdom in a manner deſolate. To add to all this, her troops, exaſperated at the loſs of their wives, children, and goods, which were carried to the fartheſt corner of Benguela, were all on the point of revolting.

38 The Portugueſe ſend an embaſſy to her

Notwithſtanding theſe diſaſters, Zingha behaved with ſuch reſolution and addreſs, that the Portugueſe, who, according to character, had probably inſtigated the Giaga againſt her, were ſo much afraid of her joing with him in alliance againſt them, that they diſpatched one Anthony Coglio, a learned prieſt, and an excellent negociator, with Don Gaſpar Borgia, an eminent officer, under pretence of negociating a peace between them, firſt to the Giaga, and afterwards to the queen. They met with a very civil reception from the firſt, who told them he was very willing to live at peace with that princeſs, and even to let her enjoy the kingdom of Metamba, though he was the rightful heir to it, provided ſhe would lay down her arms. This anſwer encouraged the prieſt to try whether he could prevail on him to embrace the Chriſtian religion; but this was declined by the Giaga in ſuch ſtrong terms, that the prieſt thought proper to deſiſt, and ſet out for Zingha's camp.

39 Their propoſals rejected.

The ambaſſadors, at their firſt arrival, met with ſuch a polite reception, as made them hope for ſucceſs: but after ſhe had heard their propoſals, ſhe aſſumed a haughty threatening tone; and told them, in the concluſion of her ſpeech, "That it did not become her dignity ty to lay down her arms, till ſhe had brought the war ſhe had begun, to an honourable concluſion: that as to the Giagas, whoſe ſect ſhe had embraced ſome years before, and who had furniſhed her with ſuch a prodigious number of forces to fight in her defence, her honour and intereſt required that ſhe ſhould ſtill keep them in her ſervice, and under her protection: and laſtly, that as to herſelf, ſhe remembered, indeed, that ſhe had formerly embraced Chriſtianity; but that it was not now a proper ſeaſon to propoſe her returning to it, and they ought to remember that they themſelves were the cauſe of her abandoning it."

Borgia, perceiving that ſhe was not to be wrought upon by religious motives, ſhifted the topic; and told her, that ſhe had gained honour enough in war, and that it was now high time to think of granting peace and tranquillity to the ſubjects of two ſuch powerful kingdoms, and accept of the favour and friendſhip of the king of Portugal. which was offered her by his viceroy. To this the queen made anſwer, that ſhe was perfectly well acquainted with the valour and ſtrength of the Portugueſe, and ſhould eſteem it an honour to be allied to that monarch; but that ſhe thought it juſt that their reſpective claims to the dominions which ſhe juſtly inherited from her anceſtors, and of which he had unjuſtly deprived her, ſhould firſt of all be decided, either by the ſword or by ſome equitable judges.

Borgia, vainly imagining that he had now obtained enough, ſet off immediately for Loanda San Paulo; but left the prieſt, on ſome pretence or other, to ſee whether, in the time of ſickneſs, he could make any im-

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* See *Abyſſinia.*

impreſſion on the inflexible mind of Zingha, who now laboured under a lingering diſeaſe. Coglio, however, found all his arts to no purpoſe; and, upon the queen's recovery, ſhe recommenced the war with more fury than ever.

40 Zingha's narrow eſcape.

For ſome time hoſtilities were carried on with various ſucceſs; Zingha being ſometimes victorious and ſometimes defeated. In one attempt of the latter kind, before the fortreſs of Maſſangana, ſhe not only loſt a great number of men, but had her two ſiſters Cambi and Fungi taken priſoners, ſhe herſelf eſcaping with the utmoſt difficulty. Exaſperated by this loſs, ſhe led her troops into ſome of the beſt provinces of the Portugueſe, and reduced them to a mere wilderneſs. Still, however, ſhe had the mortification to find her loſſes vaſtly greater than what ſhe gained; and had now the additional misfortune of loſing her ſiſter Fungi, who was put to death by the Portugueſe for treachery, and ſeeing her allies the Dutch totally expelled out of Angola.

41 Begins to relent;

Zingha being thus oppreſſed with a complication of misfortunes, and conſcious of the crimes ſhe had committed, began ſeriouſly to conſider whether ſuch a continued ſeries of diſaſters was not owing to the diſpleaſure of the God of the Chriſtians. To this opinion ſhe ſeemed to have inclined; and therefore began to treat with more lenity ſuch Chriſtians as fell into her hands, eſpecially if they happened to be prieſts or monks. To theſe ſhe now began to liſten with ſome attention; and ordered them, under ſevere penalties, to be treated with all poſſible reſpect; yet without loſing in the leaſt that invincible hatred ſhe had conceived againſt thoſe who had ſtripped her of her dominions, or dropping her reſolution never to make peace till ſhe had recovered them.

The viceroy, Don Salvador Correa, who had driven out the Dutch, being appriſed of the regard ſhown to the clergy by Queen Zingha, thought proper to ſend ſome capuchins to her, in hopes that they might now find her more tractable. But Zingha was ſtill proof againſt their utmoſt art; obſerving, however, that if they would conſent to reſtore what they had unjuſtly taken from her, ſhe would not only return to the Chriſtian religion, but encourage it to the utmoſt of her power.

42 But ſtill reſiſts the artifices of the Portugueſe

The viceroy, being now afraid that Zingha might make an alliance againſt him with the king of Congo, firſt raiſed a powerful army, and then acquainted that monarch, that, if he deſigned to prevent the total ruin of his dominions, he muſt immediately make reparation for all the damage he had cauſed to the Portugueſe by his alliance with the Dutch. The fame of the Portugueſe valour ſo intimidated the king, that he ſubmitted to a treaty almoſt on the viceroy's own terms; and as ſoon as this treaty was concluded, Don Ruy Pegado, an old experienced officer, was diſpatched to Zingha, offering a firm and laſting alliance with her, provided ſhe renounced the Giagan ſect, and returned to the boſom of the church. To this embaſſy ſhe returned the old anſwer, namely, that the Portugueſe themſelves had been the occaſion of all that had happened; as they had not only ſtripped her of her hereditary dominions, but dared to proclaim one of her vaſſals king of Angola; but, provided theſe dominions were reſtored, ſhe would immediately embrace Chriſtianity.

43 Their infamous conduct.

All this time the furious Queen Zingha went on with her ravages, notwithſtanding the viceroy kept plying her with letters for near three years. At laſt he had recourſe to the artifice of taking advantage of the remorſe for her crimes with which Zingha was ſometimes affected, in order to procure the peaceable enjoyment of his own ill-gotten conqueſts.

It is eaſy to ſee, that had this viceroy, or the prieſts he employed, really intended to convert Zingha to Chriſtianity, they ought to have ſo far ſet her an example as at leaſt to abandon part of the countries of which they had robbed her: But, inſtead of this, they impiouſly made uſe of the ſacred name of our Saviour, in order to deter a poor ſavage African from recovering what juſtly belonged to her.

44 She returns to Chriſtianity.

Queen Zingha, at laſt, came to incline ſo much to return to the Chriſtian religion, that a general murmur ran through her army. But having, by various artifices reconciled the minds of her ſubjects to this event, ſhe explained her deſign in a ſet ſpeech; offering at the ſame time liberty to thoſe who choſe to abandon her on this account to go where they would; and ſuch was their attachment to her, that even in ſuch a ſudden and important change in her reſolutions they expreſſed no uneaſineſs, but on the contrary applauded her to the higheſt degree.

45 Treaty with the Portugueſe propoſed.

The Portugueſe, after having been harraſſed in a terrible manner for 28 years, and at laſt obliged to profane the name of their Saviour to procure a peace, began now freely to enjoy the fruits of their villany. A treaty was ſet on foot between the viceroy and Zingha; which, however, was not eaſily concluded. She demanded the releaſe of her ſiſter Cambi, whoſe Chriſtian name was Donna Barbara; and the Portugueſe demanded a ranſom of 200 ſlaves, or an equivalent in money. This Zingha did not well reliſh; and, being preſſed to a compliance, threatened them with a more furious war than any they had yet experienced. Upon this the viceroy was obliged to have recourſe to the uſual method of ſending prieſts to perſuade her to comply through motives of religion. Theſe hypocrites effected their purpoſe; and the ſlaves were ſent, as if Chriſtianity required the delivering up innocent people to thoſe who had no lawful authority over them: but not being able to conclude a laſting peace about the ceſſion of the Angolic provinces, they were forced to conclude a ſhort truce, and ſent back her ſiſter.

This princeſs was received by Zingha in a very affectionate manner: and ſome time after, the queen, her mind being probably weakened through the infirmity of old age, not only was thoroughly reconciled to the Portugueſe, but looking upon them as her beſt friends. She encouraged the Chriſtian religion; had a church built in her capital; made ſeveral laws againſt Paganiſm; and, *to encourage marriage*, ſhe herſelf wedded a handſome young fellow in the 75th year of her age.

46 The Portugueſe terms.

The Portugueſe now imagining they would at laſt gain their point, propoſed to her the following terms, as the baſis of a laſting treaty between the two nations. 1. "That they ſhould yield to her, *as a preſent*, ſome of the countries of which they had already robbed her. 2. That, in conſideration of the ſaid preſent, which ſhould in noways be interpreted as an inveſtiture, the queen ſhould pay yearly a certain acknowledgment to the king of Portugal, who ſhould be at liberty to withdraw the ſaid preſent whenever ſhe failed of making the ſaid acknowledgment. 3. That a free commerce ſhould be opened between thoſe two ſtates, as well for ſlaves as for other merchandizes. 4. That the queen ſhould moleſt none of the lords that were feudatory to the Portugueſe, whatever damages and ravages they might have committed during the late wars between them. 5. That ſhe ſhould reſtore all the Portugueſe ſlaves that had taken refuge in her dominions. 6. That ſhe ſhould deliver up the Giaga Colanda, who had revolted from the Portugueſe, upon condition that his crime ſhould go unpuniſhed."

47
The Queens noble anſwer.

The queen, having now a thorough view of the deep-rooted villany of thoſe with whom ſhe had to do, conceived ſuch diſpleaſure againſt the Portugueſe, that ſhe fell ſick. During this ſickneſs, father Anthony, her chief confident, and a creature of the viceroy, never left off ſoliciting her to make her peace with God, and to accept of the terms offered her by the Portugueſe: but Zingha, though worn out with age and ſickneſs, had ſtill the good ſenſe to perceive, that there was no connection between making her peace with God and complying with ſuch infamous terms; and therefore gave the following anſwer, which, under ſuch circumſtances, ſhows a magnanimity ſcarce equalled in any age or in any country. 1. "That as to her converſion, as it was neither owing to any deſire of obtaining a peace, or other worldly motives, but the Divine Grace by which ſhe was recalled, ſhe was reſolved to perſevere in it to her laſt breath. 2. That as to her going over to the Giagan ſect, ſhe had in a great meaſure been forced to it by the Portugueſe viceroy. 3. That the king of Portugal would do a generous act in reſtoring ſome of her Angolic dominions; but it would be more ſo, were he to reſtore them all. 4. That as to her paying homage to him, neither her mind nor heart were baſe enough to conſent to it; and that as ſhe had refuſed the propoſal while ſhe lived among the Giagas, much more did ſhe think herſelf above it now ſhe was a Chriſtian queen, and owed neither tribute nor homage to any but to the Supreme Power, from whom ſhe had received both her being and her kingdom: That, nevertheleſs, if ſhe could be convinced that there was any thing in her dominions that would be acceptable to his Portugueſe majeſty, ſhe would voluntarily make him a preſent of it; and as to the reſt of the articles, ſuch was her deſire of making a firm and laſting peace with them, that ſhe ſhould make no difficulty of conſenting to them."

48
Articles of the treaty.

This anſwer was not altogether ſatisfactory to the viceroy; but the prieſt, finding it impoſſible to make any impreſſion upon her mind, eaſily prevailed upon him to conſent to the following terms. 1. "That the river Lucalla ſhould be the boundary between the dominions of the Portugueſe and of Queen Zingha. 2. That neither ſide ſhould thenceforth give any reception to the fugitive ſlaves of the other, but ſend them back without any delay, together with the priſoners which had been taken during the laſt war. 3. That the queen ſhould remain wholly free and exempt from all tribute and homage whatever, provided ſhe agreed to the other articles."

49
The peace ſigned.

Theſe terms were at laſt ſigned by the queen and viceroy in the month of April 1657, and ratified by the king of Portugal in the month of November the ſame year.—The only difficulty the queen had concerning this treaty was with regard to the Giaga Colanda: and the manner in which ſhe extricated herſelf from it, with her ſubſequent behaviour, cannot fail to give us an high idea of the mental abilities of this African heroine.

50
Zingha's honourable behaviour.

This Giagan chief, weary of the Portugueſe yoke, had retired from them, at the head of 1000 ſtout ſoldiers, and a much greater number of ſlaves, ſome leagues beyond the river Lucalla, and put himſelf under the queen's protection. This ſhe readily granted, as he was very able to be ſerviceable to her in caſe the perfidious conduct of the Portugueſe ſhould oblige her to renew the war. She could not therefore but look upon it as unjuſt and diſhonourable, to deliver up a brave chief who had devoted himſelf to her ſervice, and whom ſhe had taken under her ſpecial protection, to a nation with whoſe perfidy ſhe was ſo well acquainted. To ſave her honour, therefore, ſome time before the ratification of the treaty, ſhe ſent privately for the Giaga, and acquainted him with the demand of the Portugueſe; telling him, at the ſame time, that though ſhe doubted not of the viceroy's keeping his word, and forgiving his offence, yet ſhe adviſed him to go out of her dominions, and ſettle himſelf and his men in ſome diſtant country from the Portugueſe frontiers; but forbad him, on pain of her higheſt diſpleaſure, to commit the leaſt outrage or hoſtility within their dominions.

51
Defeats and kills the Giaga Colanda.

The Giaga thanked her majeſty, and ſeemed to acquieſce with her advice, but did not follow it. On the contrary, he had no ſooner reached his fortreſs, than he ſet himſelf about fortifying it in ſuch a manner as looked rather like defiance than defence; and, having gathered a conſiderable army, ſoon ſpread a general terror around him. Of this the Portugueſe failed not to complain to the queen; who immediately marched againſt him, ſurpriſed and defeated his army; and he himſelf being killed in the action, his head was cut off and ſent to the Portugueſe.

52
Encourages Chriſtianity.

This was among the laſt memorable actions performed by this famous queen; who, now finding herſelf unfit for the fatigues of war, contented herſelf (in 1658) with diſpatching an old experienced general againſt a neighbouring prince who had invaded her territories. He proved no leſs ſucceſsful than herſelf, and quickly forced the aggreſſor to ſubmit to her terms. She now gave herſelf up to ſtudy the beſt method of propagating Chriſtianity among her ſubjects; and for this purpoſe ſent a ſolemn embaſſy to Rome, to pay homage to the Pope in her name, and to requeſt a freſh ſupply of miſſionaries. To this letter ſhe received an anſwer from his Holineſs in 1662; and it was read in the church, that ſame year, in the moſt public and ſolemn manner. The day appointed was the 15th of July; on which ſhe repaired to the church at the head of a numerous retinue, and having the letter hanging about her neck in a purſe made of cloth of gold. The concourſe was ſo great, that the church could not contain one half of the people, ſo that none were admitted but perſons of rank. The father having finiſhed the maſs, read the letter at the altar in the Portugueſe language; and the ſecretary interpreted it in that of the country. The queen, who had ſtood all the while it was reading, went towards the

53 Ceremonies at receiving a letter from the Pope.

the altar, and on her knees received it from the father: and having kiſſed it, and ſworn afreſh upon the goſpel to continue in obedience to the church of Rome, kiſſed the letter again, put it into the purſe, and returned to the palace amidſt the ſhouts and acclamations of many thouſands of her ſubjects. On that day ſhe gave a magnificent treat to the Portugueſe reſident, and to all her court, in two great porticos, and ſhe herſelf vouchſafed to eat after the European manner; that is, ſitting on a ſtately elbow chair, with a high table before her, covered with the fineſt linen, and with diſhes, plates, knives, and forks, all of ſilver gilt. She beſtowed ſome largeſſes upon her chief officers, releaſed a good number of ſlaves, and at night appeared at the head of her ladies of honour, both ſhe and they dreſſed in the Amazonian manner. They performed a kind of combat, in which the queen, though upwards of eighty years of age, behaved with the great vigour and activity of a woman of thirty.

54 Zingha dies.

Her life, however, was not lengthened in proportion to her vigour and activity: for in the month of September ſhe was ſeized with an inflammation in her throat; which, in December, having ſeized her breaſt and lungs, ſhe expired on the 7th of that month, and was ſucceeded by her ſiſter Barbara.

55 Succeeded by her ſiſter Barbara.

56 Cruelty of her huſband Mona Zingha to her.

57 He accuſes Father Anthony.

The deceaſed queen was buried with extraordinary pomp; and, out of regard to her, Barbara was inaugurated a ſecond and third time, with the greateſt pomp, and the moſt joyful acclamations.—She was a very zealous chriſtian, but wanted her ſiſter's abilities, and had the misfortune to be in the decline of life, lame, and almoſt blind. Beſides this, ſhe had been married to a proud ill-natured huſband, named Mona Zingha; who, though to her he owed all his fortune and advancement, being himſelf no more than the ſon of a ſlave, uſed her with ſuch cruelty, even in the late queen's life, that ſhe was obliged to take refuge in the palace, from whence he had the inſolence immediately to fetch her. This ſo exaſperated queen Zingha, that ſhe had well nigh ordered him to be cut in pieces before her face; but pardoned him at the requeſt of father Anthony, who probably knew he was privy to ſome religious ſecrets, which he might, in a caſe of ſuch emergency, have diſcloſed. On Barbara's acceſſion to the throne, however, he not only redoubled his cruelty to her, in hopes of getting the management of affairs entirely into his own hands, but invented accuſations againſt Anthony himſelf, with a deſign to extirpate both him and his religion. He gave out that the late queen had been poiſoned by ſome favourite European diſhes, with which brother Ignatio uſed to regale her during her laſt illneſs; and attributed his wife's lameneſs and blindneſs to ſome ſorceries or charms uſed by the convent againſt her. He had even perſuaded, or rather forced, his queen to conſent that ſome of the ſinghillos or prieſts ſhould be brought to countercharm her diſtemper.

58 Who reprimands the Queen.

Father Anthony, far from being intimidated at the accuſations brought againſt him, repaired immediately to the palace; where he boldly reprimanded the queen for giving ear to theſe jugglers, threatening at the ſame time to leave her dominions, and carry off with him all the croſſes and other religious utenſils, from which alone they could have any benefit. The queen returned a very ſubmiſſive anſwer; and promiſed to deliver up the counter-charms which ſhe at that time had upon her, before ſunſet; which ſhe accordingly did, and ſent them to the convent by the hands of her ſecretary. This ſo exaſperated her huſband, and all the Giaga ſect, that they reſolved upon the deſtruction of all the prieſts and Europeans, and even the queen herſelf. This, however, was found improper to be attempted; and Mona Zingha was ſo much chagrined at his diſappointment, that he retired to his own eſtate; giving out, that he deſigned no more to meddle with ſtate-affairs; but, in reality, to concert meaſures for engroſſing the ſovereignty to himſelf, and to deprive his wife of her life and crown.

59 Mona Zingha revives the Gigan rites;

60 And poiſons Father Anthony,

To accompliſh his purpoſe, he ſent a meſſenger to her, deſiring her to repair to his houſe, where he had ſomething of importance to communicate; but ſhe declining the invitation by the advice of father Anthony, he found himſelf diſappointed, and begged leave to retire to a neighbouring province, which was under his government. He was again diſappointed, and forbid to ſtir out of the province of Metamba. The queen was, however, guilty of an error not long after, in ſending Mona Zingha at the head of an army to quell a revolt on the frontiers. On his returning victorious, he thought himſelf ſtrong enough to revive the ancient Giagan rites, and therefore ordered 100 ſlaves to be ſacrificed to the manes of the deceaſed queen. Though the queen was immediately appriſed of his intention, and diſpatched a meſſenger expreſsly commanding him to deſiſt; yet Mona, by diſtributing ſome preſents, particularly ſome European wines among the counſellors, effected his purpoſe with impunity. He did not forget to ſend ſome of his wine to father Anthony: but to prevent ſuſpicion, preſented him only with a ſmall quantity, to be uſed, as he ſaid, at the maſs; adding, that if it proved agreeable, he would ſupply him with a larger quantity. The unſuſpecting prieſt drank about two glaſſes of it; and in about a quarter of an hour was ſeized with violent convulſions in his bowels, and other ſymptoms of being poiſoned. By proper aſſiſtance, however he recovered; yet ſo far was he diſabled by this doſe, that he was obliged to abandon his miſſion.

61 The Queen dies.

62 Cruelties of Mona Zingha.

The queen's infirmities in the mean time daily increaſing, Mona Zingha was ſoon delivered from all further oppoſition on her part, by her death, which happened on the 24th of March 1666. Upon this, Mona Zingha made all poſſible haſte to get himſelf elected king; and immediately renounced the Chriſtian religion, raiſing a perſecution at the ſame time againſt its profeſſors. He even wrote to the Portugueſe viceroy, acquainting him with his having renounced Chriſtianity, which he had only embraced out of complaiſance to his queen, and with his deſign to revive the Giagan rites. To ſhow that he meant to be as good as his word, he ordered all the children under ſix years of age, that could be found, to be ſacrificed in honour of their infernal deities. He alſo recalled the ſinghillos, and heaped many favours upon them; ſo that they became entirely devoted to his purpoſes. He likewiſe cauſed many of his ſubjects to be privately poiſoned; and then gave out, that their unaccountable deaths were owing to their having abandoned the religion of their anceſtors, and embraced Chriſtianity; which he ſtyled the religion of a parcel of famiſhed ſtrangers, who through their extreme miſery, had been forced to leave their native country,

try and ſeek for a livelihood in the richeſt provinces of Africa.

By theſe and ſuch like ſtratagems he almoſt entirely extirpated Chriſtianity, and any appearances of civilization which had been introduced among his ſubjects. His career, however, was ſtopped by Don John the princeſs Barbara's firſt huſband, from whom ſhe had been divorced on account of his having another wife. He ſoon compelled the uſurper to fly into an iſland in the Coanza; but not having the precaution to reduce him entirely, Mona Zingha found means to retrieve his affairs, and at laſt found means to kill Don John himſelf, by which he became maſter of the throne without any further oppoſition. He was no ſooner re-eſtabliſhed, than he began to purſue his butcheries with more fury than ever: when, on a ſudden, Don Franciſco, the ſon of Don John, appeared at the head of an army in oppoſition to the uſurper; and in the firſt engagement Mona Zingha being defeated and killed, Don Franciſco became ſole maſter of the empire.

63 He is defeated and killed.

64 Low ſtate of the kings ſet up by the Portugueſe

It is not known whether this prince kept to the terms of the alliance made by Queen Zingha with the Portugueſe or not.—Theſe, however, have preſerved their conqueſts, and for ſome time they allowed the natives to chooſe a king for themſelves, or rather they choſe him for them, as we have already noticed. Theſe kings enjoyed only a mere ſhadow of royalty; their whole grandeur conſiſting in being allowed to breed peacocks, and adorn themſelves with their feathers, which was forbidden to their ſubjects under pain of perpetual ſlavery. The laſt of theſe kings was named Ngola Sedeſio, who, diſliking an empty name of royalty, revolted from the Portugueſe, and carried on a long war with them; but being at laſt defeated and killed, his head was cut off, ſalted, and ſent to Liſbon in pickle. After this the Portugueſe ſeem not to have thought it ſafe to truſt their Angolic ſubjects even with the name of a king of their own, but have veſted the power entirely in their viceroy; but as to the extent of his dominions, and how matters ſtand between him and that race of Angolic princes who have preſerved their liberty, we are entirely in the dark.

Diviſion into provinces.

When in its greateſt ſplendor, the kingdom of Angola contained the 17 following provinces: Cheſſama, Sumbi, Benguela, Rimba, Sietta, High and Low Bembea, Temba, Oacco, Cabezzo, Lubolo, Loanda, Bengo, Danda, Moſiche, Higher and Lower Ilamba, Oraij, and Embacca. The provinces conquered by the Portugueſe during the wars abovementioned were, Danda, Moſiche, Bengo, the Higher and Lower Ilamba, Oraij, Embacca, Benguela, Sietta, Cabezzo, Lubolo, and Oacco.

Rivers.

The principal rivers are thoſe already mentioned, viz. The Danda and Coanza. The Coanza is large, deep, and rapid. It empties itſelf into the Atlantic ocean about Latitude 9° 20 S. twelve leagues ſouth of Loando the capital of the kingdom. It is navigable for 150 miles, and abounds with variety of fiſh. It forms ſeveral iſlands, has ſome cataracts, and one in particular which bears its name. As for its ſource, and the length of ground it croſſes from eaſt to weſt before it comes to the Portugueſe ſettlement, it is abſolutely unknown, as well as the countries through which it runs. Its mouth, which runs between the capes Palmerino and Lego, is above a league wide; the northern ſhore is the deepeſt, and along which the veſſels ſail. The fall of this river into the ocean is ſo rapid, that the ſea appears quite muddy for two or three leagues below it. Its mouth is not eaſily perceived from the open ſea, by reaſon of an iſland quite covered with high trees which lies juſt before it. The two principal iſlands formed by this river are called *Maſſander* and *Motchiamia*. The one is ſix leagues long, and about two miles broad: it is very fertile in maize, millet, and ſome other grains, which are reaped at three different ſeaſons of the year. It produces likewiſe vaſt quantities of Manhioc, a root, of which they make a coarſe kind of meal, which ſerves inſtead of bread. Here alſo grow great numbers of palm and other fruit trees of various kinds. The iſland of Motchiamia is four or five miles long, and one in breadth, moſtly plain, and producing variety of roots and herbs. It likewiſe abounds in cattle; and there were formerly five or ſix Portugueſe families ſettled upon it, who drove a conſiderable trade in theſe commodities, and likewiſe in ſlaves.

Concerning the river Danda we know little or nothing: only, that though its mouth is not above 70 or 80 miles diſtant from that of the Coanza, yet their diſtance grows ſo conſiderably wider as you penetrate further into the inlands, as to be much above twice if not thrice that ſpace; though how much, is not exactly known.

The manners, religion, and dreſs, &c. of the inhabitants, are much the ſame with the Congoeſe. See CONGO.

ANGOLA Pea, or *Pigeon-Pea*. See CYTISUS.

ANGON, in the ancient military art, a kind of javelin uſed by the French. They darted it at a conſiderable diſtance. The iron head of this weapon reſembled a flower-de-luce. It is the opinion of ſome writers, that the arms of France are not flowers-de-luce, but the iron point of the angon or javelin of the ancient French.

ANGOR, among ancient phyſicians, a concentration of the natural heat; the conſequence of which is a pain of the head, palpitation, and ſadneſs.

ANGOT, a province or kingdom of Abyſſinia, formerly rich and fertile, but almoſt ruined by the Gallas, a wandering nation in the internal parts of Africa, who diſpoſſeſſed the Abyſſinian monarchs of all that was worth poſſeſſing.

ANGOULESME, a city of France, the capital of the duchy of Angoumois, and ſee of a biſhop. It is ſeated on the top of a hill, ſurrounded with rocks, at the foot of which runs the river Charante. The inhabitants are ſaid to be about 8000, and to drive a conſiderable trade in paper, which is their manufacture. E. L. 0. 10. N. Lat. 45. 39.

ANGOUMOIS, a province of France, bounded on the north by Poitou, on the eaſt by Limouſin, and March, on the ſouth by Perigord, and on the weſt by Saintonge. Through this province run the rivers Touvre and Charante. This laſt is full of excellent fiſh; and though it often overflows its banks, it is ſo far from doing any damage, that it greatly enriches the ſoil. The Touvre is full of trouts. The air is generally warmer than at Paris, though the country is hilly. The ſoil produces plenty of wheat, rye, oats, Spaniſh corn, ſaffron, grapes, and all ſorts of fruit. Here are ſeveral iron mines, which yield a very good ſort of iron.

ANGOURA, ANGRA, or ANGORI, a city of Aſia, in Anatolia, formerly called *Ancyra,* and ſtill full of remarkable antiquities, which are ſo many marks of its ancient magnificence. It is at preſent one of the beſt cities in Anatolia; its ſtreets are full of pillars and old marbles, among which are ſome of porphyry and jaſper. The greater part of the pillars are ſmooth and cylindrical; ſome are channelled ſpirally; but the moſt ſingular are oval, with plate bands before and behind from the top to the bottom of the pedeſtal. The houſes are now made of clay, which is ſometimes intermixed with fine pieces of marble. The walls of the city are low, with very mean battlements. The maſonry of the walls is intermixed with pillars, architraves, capitals, and other ancient fragments, eſpecially that of the towers and gates. The caſtle of Angora has a triple incloſure; and the walls are of large pieces of white marble, and a ſtone much like porphyry.

The baſha of Angora has about 30 purſes income; and there are here about 300 janiſaries, under the command of a ſardar. The Turks are ſaid to be 40,000, the Armenians 4000 or 5000, and the Greeks 600. The Armenians have ſeven churches, beſides a monaſtery; and the Greeks two. They breed the fineſt goats in the world; and their hair which is of a dazzling white, is almoſt as fine as ſilk, and nine inches in length: it is worked into very fine ſtuffs, particularly camblet. All the inhabitants are employed in this manufacture. Several large caravans paſs through this city to different places. E. Long. 32. 5. N. Lat. 39. 30. See ANCYRA.

ANGOY, a kingdom of Loango in Africa, bounded on the north by Cacongo, and on the ſouth by Congo; from the former of which it is ſeparated by the river Cabinda, and from the latter by the river Zaire. It is but of ſmall extent; being only a vaſſal province of Cacongo, till the mani or prince, who had married a Portugueſe's daughter, was perſuaded by his father-in-law to make himſelf independent. This he effected at a favourable juncture, the king of Loango having but juſt before revolted from the king of Congo, and the king of Cacongo from the new king of Loango. The country is full of woods and thickets; and has no towns of any note, except one called Bomangoy, ſituated on the north banks of the Zaire, and not far from its mouth. Its chief port is Cubinda, called alſo Kabenda, or Cubenda, ſituated on the mouth of a river of the ſame name about five leagues north of Cape Palmerino, on the north ſide of the Zaire's mouth. The bay is very commodious for trade, or wooding and watering along the ſhore. It is flat and marſhy in ſome places; but aſcends gradually about three miles inland, and then forms itſelf into a ridge of hill. On the aſcent of theſe is ſituated a town belonging to the father-in-law of the king above mentioned, where he conſtantly kept a ſtock of wood ready cut, to ſell to foreign ſhips at an eaſy rate. From theſe wood-piles, ſouth-weſt along the bay, lie ſcattered a number of fiſhermen's huts, on each ſide a ſmall freſh water river which falls into the bay; and thence all the water for ſhips is brought in caſks to the mouth of the river, which is ſo ſhallow, that even at full flood it can only be entered by a yawl carrying a caſk or two. The town ſtands on the round point of the bay looking to the weſtward; and the Engliſh have a factory on the ſouth-weſt of the road.

The country round the bay is moſtly barren; owing chiefly to the lazineſs of the inhabitants, which often occaſions a ſcarcity of proviſions. The wild beaſts ſwarm ſo in the woods, that they deſtroy all the tame kinds; ſo there are no cattle bred here but hogs. From the woods in this county ſome monkeys have been brought away, which in ſhape and ſtature reſembled the human ſpecies. Civet-cats abound here in great plenty, and parrots may be bought for three or four ordinary knives. The coaſts abound ſo with oyſters, that the ſailors quickly load their boats with them; they being found lying in great heaps like ſmall rocks. The natives follow the occupation of fiſhing more than any other. They fiſh both on the ſea and in the rivers, making uſe of drag-nets, which have long canes fixed at equal diſtances, inſtead of corks, to ſhow when any fiſh is caught. Theſe nets are made of a peculiar kind of root, which, after being beaten, may be ſpun like hemp.

The dreſs of the inhabitants is the ſame with that of the Congoeſe. They allow polygamy, and the beſt beloved wife hath the command of the reſt; but is no leſs liable to be turned out, if ſhe proves unfaithful. The ladies of the blood-royal have the privilege of chooſing their huſbands out of any, even the meaneſt rank; and even the power of life and death over them; as likewiſe over their paramours, if any of them are caught tripping: but the huſbands are by no means entitled to expect the ſame fidelity from their royal ladies. Women of the lower rank are obliged, when they receive a ſtranger, to admit them for a night or two into their embraces. This obliged the miſſionaries, who travelled through this country, to give notice of their approach to any of their houſes, that none of the female ſex might enter within their doors.—Their religion conſiſts chiefly in a variety of ſuperſtitious cuſtoms; ſuch as powdering their public and domeſtic idols with the duſt of a kind of red wood, on the firſt day of the moon, and paying a kind of worſhip to that planet. If, on that night, it happens to ſhine clear and bright, they cry out, "Thus may I renew my life as thou doſt;" but if the air is cloudy, they imagine the moon hath loſt her virtue, and pay her no reſpect. We do not hear of their offering any ſacrifices to their idols; though they commonly conſult them about the ſucceſs of their enterpriſes, thefts, or ſuch like. The king of Congo ſtill ſtyles himſelf ſovereign of Angoy; but the king of this little ſtate pays neither tribute nor homage to any foreign power.

ANGRA, a city of Tercera one of the Azores; the capital, not only of that iſland, but of all the reſt, and the reſidence of the governor. It is ſeated on the ſouth ſide, near the middle of the longeſt diameter of the iſland, on the edge of the ſea. The harbour is the only tolerable one in the whole iſland, being equally ſecured againſt ſtorms and the efforts of an enemy. It is of the form of a creſcent; the extremes of which are defended by two high rocks, that run ſo far into the ſea as to render the entrance narrow, and eaſily covered by the batteries on each ſide. From this harbour the town is ſaid to be derive its name, the word *Angra* ſignifying a creek, bay, or ſtation for ſhipping; and this is the only convenient one among all the Azores. The opening of the port is from the eaſt to the ſouth-weſt; and, according to Frezier, it is not above four cables-length in breadth, and not two of good bottom. Here ſhips may ride in great ſafety during the ſummer; but as ſoon as the winter begins, the ſtorms are ſo furious, that the only ſafety for ſhipping is the putting to ſea with all poſſible expedition. Happily, however, theſe ſtorms are preceded by infallible ſigns, with which experience has made the inhabitants perfectly well acquainted. On theſe occaſions the Pico, a high mountain in another of Azores, is overcaſt with thick clouds, and grows exceedingly dark; but what they look upon as the moſt certain ſign is the fluttering and chirping of flocks of birds round the city for ſome days before the ſtorm begins.

The town is well-built and populous, is the ſee of a biſhop, under the juriſdiction of the archbiſhop of Liſbon. It hath five pariſhes, a cathedral, four monaſteries, as many nunneries, beſides an inquiſition and biſhop's court, which extends its juriſdiction over all the Azores, Flores, and Corvo. It is ſurrounded by a good wall, a dry ditch of great depth and breadth, and defended by a ſtrong caſtle rendered famous by the impriſonment of king Alphonſo by his brother Peter in 1668. Though moſt of the public and private buildings have a good appearance externally, they are but indifferently furniſhed within; but for this poverty the Portugueſe excuſe themſelves, by ſaying, that too much furniture would prove inconvenient in ſo warm a climate.

At Angra are kept the royal magazines for anchors, cables, ſails, and other ſtores for the royal navy, or occaſionally for merchantmen in great diſtreſs. All maritime affairs are under the inſpection of an officer called *Deſembergrador*, who hath ſubordinate officers and pilots for conducting ſhips into the harbour, or to proper watering-places. The Engliſh, French, and Dutch, have each a conſul reſiding here, though the commerce of any of theſe nations with the Azores is very inconſiderable.

ANGRIVARII, (Tacitus); a people of Germany, ſituated between the Weſer and the Ems, and eaſtward reaching beyond the Weſer, as far as the Cheruſci, on which ſide they raiſed a rampart (Tacitus); to the ſouth, having the Tubantes on the Ems, and on the Weſer where it bends to the foreſt Bacemis; to the weſt, the Ems and the confines of the Bructeri; and to the north, the territory of the Angrivarii lay between the Chamavi and Anſibarii. Ptolemy places them between the Cauchi and Suevi or Catti. Suppoſed now to contain a part of the country of Schaumburg, the half of the biſhopric or principality of Minden: to the ſouth, the greateſt part of the biſhopric of Oſnabrug, the north part of the country of Teclenburg, and a part of the country of Ravenſberg. A trace of the name of the people ſtill remains in the appellation *Engern*, a ſmall town in the county of Ravenſberg.

ANGUILLA, one of the Weſt-India or Carribbee iſlands, lying in about 15° N. Lat. It has its name from its ſnake-like form; and is about ten leagues in length and three in breadth. It was firſt diſcovered by the Engliſh in 1650, when it was filled with alligators and other noxious animals; but they, finding the ſoil fruitful, and proper for raiſing tobacco and corn, ſettled a colony on it, and imported live cattle, which have ſince multiplied exceedingly. But the colony not being ſettled under any public encouragement, each planter laboured for himſelf, and the iſland became a prey to every rapacious invader, which diſheartened the inhabitants ſo much that all induſtry was loſt among them. Their chief ſuffering was from a party of wild Iriſh, who landed here after the Revolution, and treated them worſe than any of the French pirates who had attacked them before. The people of Barbadoes, and other Engliſh Carribbees, knowing the value of the ſoil, ſeveral of them removed to Anguilla, where they remained for many years, and even carried on a profitable trade, though without any government either civil or eccleſiaſtical. In 1745, their militia, though not exceeding 100 men, defended a breaſtwork againſt 1000 French who came to attack them, and at laſt obliged them to retire with the loſs of 150 men, beſides carrying off ſome of their arms and colours as trophies of their victory. Since that time the inhabitants have ſubſiſted moſtly by farming; though they ſtill plant ſugar, and the iſland is ſaid to be capable of great improvements.

ANGUINA. See TRICOSANTHES.

ANGUILLIFORM, an appellation given by zoologiſts, not only to the different ſpecies of eels, but to other animals reſembling them in ſhape.

ANGUINUM OVUM, a fabulous kind of egg, ſaid to be produced by the ſaliva of a cluſter of ſerpents, and poſſeſſed of certain magical virtues. The ſuperſtition in reſpect to theſe was very prevalent among the ancient Britons, and there ſtill remains a ſtrong tradition of it in Wales. The account Pliny[*] gives of it is as follows: "Præterea eſt ovorum genus in magna Galliarum fama, omiſſum Græcis. Angues innumeri æſtate convoluti, ſalivis faucium corporumque ſpumis artifici complexu glomerantur; anguinum appellatur. Druidæ ſibilis id dicunt in ſublime jactari, ſagoque oportere intercipi, ne tellurem attingat: profugere raptorum equo: ſerpentes enim inſequi, donec arceantur amnis alicujus interventu."—Of which the following may ſerve as a tranſlation: (from *Maſon's Caractacus*; the perſon ſpeaking, a Druid.)

But tell me yet
From the grot of charms and ſpells,
Where the matron ſiſter dwells,
Brennus, has thy holy hand
Safely brought the Druid wand,
And the potent *Adder-ſtone*,
Gender'd 'fore the autumnal moon?
When, in undulating twine,
The foaming ſnakes prolific join;
When they hiſs, and when they bear
Their wond'rous egg aloof in air:
Thence before to earth it fall,
The *Druid* in his hallow'd pall,
Receives the prize,
And inſtant flies,
Follow'd by the envenom'd brood,
'Till he croſs the cryſtal flood.

This wondrous egg ſeems to be nothing more than a bead of glaſs, uſed by the Druids as a charm to impoſe on the vulgar, whom they taught to believe, that the poſſeſſor would be fortunate in all his attemps, and that it would gain him the favour of the great.

[*] Lib. xix. c. 3.

Our modern Druideſſes (ſays Mr Pennant, from whom we extract) give much the ſame account of the *ovum anguinum*, *glain neidr*, as the Welſh call it, or the *adder-gem*, as the Roman philoſopher does; but ſeem not to have ſo exalted an opinion of its powers, uſing it only to aſſiſt children in cutting their teeth, or to cure the chincough, or to drive away an ague.

Theſe beads are of a very rich blue colour; ſome plain, others ſtreaked. For their figure, ſee Plate XXXIV. fig. 22. nº 1, 2, 3.

ANGUIS, or SNAKE, in zoology, a genus belonging to the order of amphibia ſerpentes. The characters of the anguis are theſe: They are ſquamous or ſcaly in the belly and under the tail; without any ſcuta.* There are 15 ſpecies of the anguis, viz. 1. The eryx, a native of Britain and likewiſe of America, is about a ſpan in length, and about the thickneſs of a man's finger. One from Aberdeenſhire, deſcribed by Mr Pennant, was 15 inches long; tongue broad and forked; noſtrils ſmall, round, and placed near the tip of the noſe; eyes lodged in oblong fiſſures above the angle of the mouth; belly of a bluiſh lead colour, marked with ſmall white ſpots irregularly diſpoſed: The reſt of the body of a greyiſh brown, with three longitudinal duſky lines; one extending from the head along the back to the point of the tail; the others broader, and extending the whole length of the ſides. It was entirely covered with ſmall ſcales; largeſt on the upper part of the head. 2. The fragilis, blind-worm, or ſlow-worm, grows to about a foot in length, and the thickneſs of a man's little finger: the irides are red; the head is ſmall; the neck ſtill more ſlender; from that part the body grows ſuddenly, and continues of an equal bulk to the tail, which ends quite blunt. The colour of the back is cinerous, marked with very ſmall lines compoſed of minute black ſpecks: the ſides are of a reddiſh caſt; the belly duſky; both marked like the back. The tongue is broad and forky; the teeth are minute, but numerous; the ſcales ſmall. The motion of this ſerpent is ſlow, from which, and from the ſmallneſs of the eyes, are derived its name. It reſembles the viper in the manner of producing its young, which are put forth alive. It frequents gardens and paſtures, where it lives principally under ground feeding on worms. Like others of the genus, they lie torpid during winter, and are ſometimes found in vaſt quantities twiſted together. 3. The ventralis, or glaſs-ſnake of Cateſby, has 127 ſquamæ on the belly, and 223 on the tail. The head is very ſmall, and the tongue of a ſingular form. The upper part of the body is of a colour blended brown and green, moſt regularly and elegantly ſpotted with yellow, the undermoſt part of which is brighteſt. The ſkin is very ſmooth; and ſhining with ſmall ſcales, more cloſely connected, and of a different ſtructure from thoſe of other ſerpents. A ſmall blow with a ſtick will cauſe the body to ſeparate, not only at the place ſtruck, but at two or three other places, the muſcles being articulated in a ſingular manner quite through to the vertebra. They appear earlier in the ſpring than any other ſerpent, and are numerous in the ſandy woods of Virginia and Carolina. They are generally ſaid to be harmleſs. 4. The jaculus, or dart-ſnake, is about three hand-breadths long, and about the thickneſs of one's little finger. Its colour is a milky grey on the back, variegated with ſmall black ſpots like ſo many eyes; and on the belly it is perfectly white. The neck is wholly black; and from that two milk-white ſtreaks run all the way along the back to the tail: the black ſpots alſo are each ſurrounded with a ſmall circle of white. It has its name from its vibrating its body in the manner of a dart. It is a native of Egypt, Libya, and the iſlands of the Mediterranean. 5. The quadrupes: The body of this ſpecies is cylindrical, with 14 or 15 longitudinal aſh-coloured ſtreaks; the teeth are extremely ſmall; it has no ears: the feet are at a great diſtance from each other, very ſhort, with five toes and ſmall nails; but the toes are ſo minute, that they can hardly be numbered: It is a native of Java. 6. The bipes, is a native of the Indies; it has two ſhort feet, with two toes, near the anus. In every ſcale of the bipes there is a brown point. 7. The meleagris, is likewiſe a native of the Indies; it has ſmall teeth, but no ears. This ſpecies has a great reſemblance to the former. 8. The colubrina, an inhabitant of Egypt, is beautifully variegated with pale and yellow colours. 9. The maculata, a native of America, is yellow, and interſperſed with aſh-coloured lines on the back: the head is ſmall in proportion to the body. 10. The reticulata, a native of America, has browniſh ſcales, with a white margin. 11. The ceraſtes, with 200 ſquamæ on the belly and 15 on the tail, is a native of Egypt. 12. The lumbricalis, a native of America, has 230 ſquamæ on the belly and 7 on the tail; its colour is a yellowiſh white. 13. The platura: The head is oblong and without teeth; the body is about a foot and a half long, black above and white below; the tail is about one-ninth of the length of the animal, much compreſſed or flatted, and variegated with black and white; the ſcales are roundiſh, ſmall, not imbricated, but they cannot be numbered. 14. The laticauda, a native of Surinam: the tail is compreſſed, acute, pale, with browniſh belts. 15. The ſcytale, a native of the Indies, with 220 ſquamæ on the belly and 13 on the tail. The head is ſmall and oval, and the eyes are little; the body is cylindrical, about a foot and a half long, covered with oval obtuſe ſcales: the tail is thick and obtuſe like the head; its colour is white, interſperſed with browniſh rings; the margins of the ſcales are of an iron colour; and the top of the head is blue.—According to Linnæus, none of this genus are poiſonous.

* See Plates XVII. and XXXI.

ANGURIA, the WATER-MELON: A genus of the diandria order, belonging to the monœcia claſs of plants; and in the natural method ranking under the 34th order, *Cucurbitaceæ*. The eſſential characters are theſe: the *male* calyx is quinquefid, and the corolla quinquepetalous: The *female* calyx and corolla the ſame: The pericarpium is a pome beneath, with two cells: The ſeeds are numerous.

Species. Of this genus, Linnæus reckons three ſpecies, the trilobata, pedata, and trifoliata. The fruit is cultivated in Spain, Portugal, Italy, and other warm countries of Europe; as alſo in Africa, Aſia, and America; where it is eſteemed on account of its wholeſome cooling quality.

Culture. To have this fruit good, ſome ſeeds muſt be procured of three or four years old; new ſeeds being apt to produce vigorous plants, which are ſeldom ſo fruitful as thoſe of a moderate ſtrength. Theſe are to be ſown in the hot-bed for early cucumbers. Some new dung is to be prepared in the beginning of February, which ſhould be thrown into a heap to heat, as is practiſed for early cucumbers. The bed is then to be made in the ſame manner as for the muſk-melon, covering the dung about five inches thick with loamy earth; but as theſe plants require much more room than either cucumbers or common melons, there ſhould be but one plant put into a three-light frame. A hill of the ſame loamy earth ſhould therefore be raiſed a foot and a half high, in the middle light of each frame; into which, when the bed is of a proper temper for heat, the plants ſhould be carefully planted, obſerving to water and ſhade them until they have taken good root. As to other particulars, their management differs very little from that of the muſk-melon: only they muſt frequently have freſh air admitted to them; and, when the nights are cold, the glaſſes muſt be covered with mats to keep the beds warm.

ANGUS, a diſtrict of the country of Forfar, in Scotland. It was an earldom belonging to the Douglaſes, now extinct.

ANGUSTICLAVIA, in Roman antiquity, a tunica embroidered with little purple ſtuds. It was worn by the Roman knights, as the laticlavia was by the ſenators.

ANHALT, an iſland of Denmark, in North Jutland, lying in the Categut, eight miles from the coaſt of Jutland, ten from Zealand, and ſeven from Holland. It is dangerous for ſeamen, for which reaſon there is a light-houſe.

Anhalt, a principality of Germany, in the circle of Upper Saxony, is a long narrow tract, ſituated for the moſt part betwixt the rivers Elbe and Saal, about 90 miles in length from eaſt to weſt, but of unequal breadth, the greateſt being on the eaſt ſide, which is but 35 miles. The houſe of Anhalt, from whence the electors of Saxony and Brandenburg are ſaid to derive their original, is a very ancient and honourable family. The beſt genealogiſts deduce their origin from Berenthobaldus, who made war upon the Thuringians in the ſixth century: it has produced many princes who make a great figure in the German hiſtory. Joachim Erneſt, who died in 1586, left five ſons, who divided the principality among them. All of them having children, and being of equal authority, they unanimouſly agreed to ſubmit to the eldeſt of the family, who has the ſupreme government, which is *Anhalt-Deſſau*. The others are, *Anhalt-Bernburg*, *Anhalt-Schaumburg*, *Anhalt-Coethen*, and *Anhalt-Zerbſt*. The Saxons acknowledge that the inhabitants of theſe little independent ſovereignties live in the land of milk and honey. Theſe petty princes poſſeſs lands ſufficient for their expences, the revenues being reckoned about half a million of dollars. The tax on lands is four *per cent.* which, rating them at 20 years purchaſe, is not quite one ſhilling in the pound. Upon an emergency the ſubjects are able to raiſe half a million extraordinary. The towns in theſe little ſtates are not ſo numerous in proportion to the extent of country as in Saxony, but better peopled. It is bounded on the S. by the country of Mansfield, on the W. by the duchy of Halberſtadt, on the E. by the duchy of Saxony, and on the N. by the duchy of Magdeburg. It abounds in corn, and is watered by the Salde and Mulda; its principal trade is in beer.

ANHELATIO, or Anhelitus, among phyſicians, a ſhortneſs of breath.

ANIAN, the name of a ſtrait formerly ſuppoſed to lie between the north-eaſt of Aſia and the north-weſt of America; but now found to exiſt only in imagination.

Anian is alſo the name of a barren ſandy deſart lying on the eaſt coaſt of Africa. It is ſo exceſſively hot and otherwiſe inhoſpitable, that it contains but very few inhabitants, except ſome wandering Arabs who live in camps.

ANIELLO, or Massaniello. See Hiſtory of Naples.

ANJENGO, a ſmall town and factory, with a fort, on the coaſt of Malabar, in the peninſula on this ſide the Ganges, belonging to the Engliſh Eaſt-India Company. The fort is ſmall, but neat and ſtrong; it is a ſquare with four baſtions, having eight guns mounted on each, carrying a ball of 18 pounds. Two of theſe baſtions face the ſea, the other two the country. Beſides theſe, there is a line of 18 or 20 guns pointing towards the ſea, of 18 and 24 pounders. About a piſtol-ſhot from the back of the fort runs a river, which, beſides being a ſecurity to the factory, adds much to the agreeable ſituation of the place. This river has its ſource in ſome diſtant mountains; and, deſcending in a courſe from the north and eaſt, it afterwards turns in ſeveral pleaſing meanders ſo far to the weſt as to waſh the bottom of the factory's garden, and at laſt winding to the ſouth, it empties itſelf into the ſea. Several beautiful ſmall iſlands too, which are waſhed by its current, diverſify the ſcenery, and greatly heighten the beauty of the proſpect. This ſettlement ſupplies the Eaſt-India Company with pepper; and its ſituation is alſo very convenient for giving proper intelligence to their Company's ſhips touching here from Europe, or from any part of India. E. Long. 76. 1. N. Lat. 7. 0.

ANIL, in botany, a ſynonime of a ſpecies of indigofera. See Indigofera.

ANIMA, among divines and naturaliſts, denotes the ſoul, or principle of life, in animals. See Soul.

Anima, among chemiſts, denotes the volatile or ſpirituous parts of bodies.

Anima Hepatis, is a name by which ſome call *ſal martis* or *ſalt of iron*, on account of its ſuppoſed efficacy in diſeaſes of the liver.

Anima Mundi, a certain pure ethereal ſubſtance or ſpirit, diffuſed, according to many of the ancient philoſophers, through the maſs of the world, informing, actuating, and uniting the divers parts thereof into one great, perfect, organical, and vital body or animal. Plato treats at large of the ψυχη τȣ κοσμȣ, in his *Timæus*; and is even ſuppoſed to be the author of the *dogma*; yet are interpreters much at a loſs about his meaning. Ariſtotle, however, taking it in the common and obvious ſenſe, ſtrenuouſly oppoſes it. The modern Platoniſts explain their maſter's *anima mundi* by a certain univerſal ethereal ſpirit, which in the heavens exiſts perfectly pure, as retaining its proper nature; but on earth pervading elementary bodies, and intimately mixing with all the minute atoms thereof, it aſſumes ſomewhat of their nature, and becomes of a peculiar kind.—So the poet:

Spiritus intus alit, totoſque infuſa per artus
Mens agitat molem, et magno ſe corpore miſcet.

They add, that this *anima mundi*, which more immediately reſides in the celeſtial regions as its proper ſeat, moves and governs the heavens in ſuch a manner, as that the heavens themſelves firſt received their exiſtence from the fecundity of the ſame ſpirit: for that this *anima*, being the primary ſource of life, every where breathed a ſpirit like itſelf, by virtue whereof various kinds of things were framed conformable to the divine ideas.

ANIMA Saturni, a white powder obtained by pouring diſtilled vinegar on litharge, of conſiderable uſe in enamelling. See ENAMEL.

ANIMADVERSION, in matters of literature, is uſed to ſignify, ſometimes correction, ſometimes remarks upon a book, &c. and ſometimes a ſerious conſideration upon any point.

ANIMAL, in natural hiſtory, an organized and living body, which is alſo endowed with ſenſation: thus, minerals are ſaid to grow or increaſe, plants to grow and live, but animals alone to have ſenſation.

It is this property of ſenſation alone that can be deemed the eſſential characteriſtic of an animal; and by which the animal and vegetable kingdoms ſeem to be ſo eſſentially ſeparated, that we cannot even imagine the leaſt approximation of the one to the other. Thoſe naturaliſts, indeed, who have ſuppoſed the diſtinction between animals and vegetables to conſiſt in any thing elſe than what we have already mentioned, have found themſelves greatly embarraſſed; and have generally agreed, that it was extremely difficult, if not impoſſible, to ſettle the boundaries between the animal and vegetable kingdoms. But this difficulty will be eaſily ſeen to ariſe from their taking the characteriſtic marks of the animal kingdom, from ſomething that was evidently common to both. Thus Boerhaave attempted to diſtinguiſh an animal from a vegetable, by the former having a mouth, which the latter has not: but here, as the mouth of an animal is only the inſtrument by which nouriſhment is conveyed to its body, it is evident that this can be no eſſential diſtinction, becauſe vegetables alſo require nouriſhment, and have inſtruments proper for conveying it into their bodies; and where the end is the ſame, a difference in the means can never be eſſential. The fixing the difference in an animal's having a gula, ſtomach, and inteſtines, as is done by Dr Tyſon, is as little to the purpoſe.

The power of moving from one place to another, hath by many been thought to conſtitute their difference; and indeed, in moſt caſes, it is the obvious mark by which we diſtinguiſh an animal from a vegetable: but Lord Kames hath given ſeveral very curious inſtances of the locomotive power of plants; ſome of which, he ſays, would do honour to an animal.—“ Upon the ſlighteſt touch, the ſenſitive plant ſhrinks back and folds up its leaves, ſimilar to a ſnail; which on the ſlighteſt touch retires within its ſhell. A new ſpecies of the ſenſitive plant hath been lately diſcovered. See DIONÆA. If a fly perch upon one of its flower-leaves, it cloſes inſtantly, and cruſhes the inſect to death. There is not an article in botany more admirable than a contrivance, viſible in many plants, to take advantage of good weather, and to protect themſelves againſt bad. They open and cloſe their flowers and leaves in different circumſtances: ſome cloſe before ſunſet, ſome after: ſome open to receive rain, ſome cloſe to avoid it. The petals of many flowers expand in the ſun; but contract at night, or on the approach of rain. After the ſeeds are fecundated, the petals no longer contract. All the trefoils may ſerve as a barometer to the huſbandman; they always contract their leaves on an impending ſtorm. Some plants follow the ſun, others turn from it. Many plants, on the ſun's receſs, vary the poſition of their leaves, which is ſtyled the *ſleep of plants*. A ſingle plant [†] was lately diſcovered in Bengal. Its leaves are in continual motion all day long; but when night approaches, they fall down from an erect poſture to reſt.

[†] A ſpecies of the *Hedyſarum*. See that article.

“ A plant has a power of directing its roots for procuring food. The red whortle-berry, a low evergreen plant, grows naturally on the tops of our higheſt hills, among ſtones and gravel. This ſhrub was planted in an edging to a rich border, under a fruit-wall. In two or three years, it over-ran the adjoining deep-laid gravel-walk; and ſeemed to fly from the border, in which not a ſingle runner appeared. An effort to come at food in a bad ſituation, is extremely remarkable in the following inſtance. Among the ruins of Newabbey, formerly a monaſtery in Galloway, there grows on the top of a wall a plane-tree about 20 feet high. Straitened for nouriſhment in that barren ſituation, it ſeveral years ago directed roots down the ſide of the wall, till they reached the ground ten feet below; and now the nouriſhment it afforded to thoſe roots during the time of their deſcending is amply repaid, having every year ſince that time made vigorous ſhoots. From the top of the wall to the ſurface of the earth, theſe roots have not thrown out a ſingle fibre; but are now united in a ſingle root.

“ Plants, when forced from their natural poſition, are endowed with a power to reſtore themſelves. A hop-plant, twiſting round a ſtick, directs its courſe from ſouth to weſt, as the ſun does. Untwiſt it, and tie it in the oppoſite direction: it dies. Leave it looſe in the wrong direction: it recovers its natural direction in a ſingle night. Twiſt a branch of a tree ſo as to invert its leaves, and fix it in that poſition: if left in any degree looſe, it untwiſts itſelf gradually, till the leaves be reſtored to their natural poſition. What better can an animal do for its welfare? A root of a tree meeting with a ditch in its progreſs, is laid open to the air. What follows? It alters its courſe like a rational being, dips into the ground, ſurrounds the ditch, riſes on the oppoſite ſide to its wonted diſtance from the ſurface, and then proceeds in its original direction. Lay a wet ſponge near a root laid open to the air; the root will direct its courſe to the ſponge. Change the place of the ſponge; the root varies its direction. Thruſt a pole into the ground at a moderate diſtance from a ſcandent plant: the plant directs its courſe to the pole, lays hold of it, and riſes on it to its natural height. A honeyſuckle proceeds in its courſe, till it be too long for ſupporting its weight; and then ſtrengthens itſelf by ſhooting into a ſpiral. If it meet with another plant of the ſame kind, they coaleſce for mutual ſupport; the one ſcrewing to the right, the other to the left. If a honeyſuckle twig meets with a dead branch, it ſcrews from the right to the left. The claſpers of briony ſhoot into a ſpiral, and lay hold of whatever comes in their way for ſupport. If, after completing a ſpiral of three rounds, they meet with nothing, they try again by altering their courſe."——

By comparing theſe and other inſtances of ſeeming voluntary motion in plants, with that ſhare of life wherewith ſome of the inferior kinds of animals are endowed, we can ſcarce heſitate at aſcribing the ſuperiority to the former; that is, putting ſenſation out of the queſtion. Muſcles, for inſtance, are fixed to one place as much as plants are; nor have they any power of motion, beſides that of opening and ſhutting their ſhells: and in this reſpect they have no ſuperiority over the motion of the ſenſitive plant; nor doth their action diſcover more ſagacity, or even ſo much, as the roots of the plane-tree mentioned by Lord Kames.

Mr Buffon, who ſeems to be deſirous of confounding the animal and vegetable kingdoms, denies ſenſation to be any eſſential diſtinction. "Senſation (ſays he) more eſſentially diſtinguiſhes animals from vegetables: but ſenſation is a complex idea, and requires ſome explication. For if ſenſation implied no more than motion conſequent upon a ſtroke or an impulſe, the ſenſitive plant enjoys this power. But if, by ſenſation, we mean the faculty of perceiving and comparing ideas, it is uncertain whether brute animals are endowed with it. If it ſhould be allowed to dogs, elephants, &c. whoſe actions ſeem to proceed from motives ſimilar to thoſe by which men are actuated, it muſt be denied to many ſpecies of animals, particularly to thoſe which appear not to poſſeſs the faculty of progreſſive motion. If the ſenſation of an oyſter, for example, differed only in degree from that of a dog; why do we not aſcribe the ſame ſenſation to vegetables, though in a degree ſtill inferior? This diſtinction, therefore, between the animal and vegetable, is neither ſufficiently general nor determined.

"From this inveſtigation we are led to conclude, that there is no abſolute and eſſential diſtinction between the animal and vegetable kingdoms; but that nature proceeds, by imperceptible degrees, from the moſt perfect to the moſt imperfect animal, and from that to the vegetables; and the freſh-water polypus may be regarded as the laſt of animals and the firſt of plants."

It were to be wiſhed, that philoſophers would on ſome occaſions conſider, that a ſubject may be dark as well on account of their inability to ſee, as when it really affords no light. Our author boldly concludes, that there is no eſſential difference between a plant and an animal, becauſe we aſcribe ſenſation to an oyſter, and none to the ſenſitive plant; but we ought to remember, that though we cannot perceive a diſtinction, it may nevertheleſs exiſt. Before Mr Buffon, therefore, had concluded in this manner, he ought to have proved that ſome vegetables were endowed with ſenſation.

It is no doubt, however, as much incumbent on thoſe who take the contrary ſide of the queſtion, to prove that vegetables are not endowed with ſenſation, as it was incumbent on Mr Buffon to have proved that they are. But a little attention will ſhow us, that the difficulty here proceeds entirely from our inability to ſee the principle of ſenſation. We perceive this principle in ourſelves, but no man can perceive it in another. Why then does every individual of mankind conclude that his neighbour has the ſame ſenſations with himſelf? It can only be from analogy. Every man perceives his neighbour formed in a a manner ſimilar to himſelf; he acts in a ſimilar manner on ſimilar occaſions, &c. Juſt ſo it is with brute animals. It is no more doubtful that they have ſenſations, than that we have them ourſelves. If a man is wounded with a knife, for inſtance, he expreſſes a ſenſe of pain, and endeavours to avoid a repetition of the injury. Wound a dog in the ſame manner, he will alſo expreſs a ſenſe of pain; and, if you offer to ſtrike him again, will endeavour to eſcape, before he feels the ſtroke. To conclude here, that the action of the dog proceeded from a principal different from that of the man, would be abſurd and unphiloſophical to the laſt degree.

We muſt further take notice, that there are ſenſations eſſentially diſtinct from one another; and in proportion as an animal is endowed with more or fewer of theſe different ſpecies, it is more or leſs perfect as an animal: but, as long as one of them remains, it makes not the leaſt approach to the vegetable kingdom; and, when they are all taken away, is ſo far from becoming a vegetable, that it is only a maſs of dead matter. The ſenſes of a perfect animal, for inſtance, are five in number. Take away one of them, ſuppoſe ſight; he becomes then a leſs perfect animal, but is as unlike a vegetable as before. Suppoſe him next deprived of hearing: his reſemblance to a vegetable would be as little as before; becauſe a vegetable can neither feel, taſte, nor ſmell, and we ſuppoſe him ſtill to enjoy theſe three ſenſes. Let us, laſtly, ſuppoſe him endowed only with the ſenſe of feeling, which, however, ſeems to include that of taſte, and he is no more a vegetable than formerly, but only an imperfect animal. If this ſenſe is then taken away, we connect him not with the vegetable kingdom, but with what Mr Buffon calls *brute-matter*. It is to this kingdom, and not to the vegetable, that animals plainly approximate as they deſcend. Indeed, to ſuppoſe an approximation between the vegetable and animal kingdoms, is very abſurd: for, at that rate, the moſt imperfect animal ought to be the moſt perfect plant; but we obſerve no ſuch thing. All animals, from the higheſt to the loweſt, are poſſeſſed of vegetable life; and that, as far as we can perceive, in an equal degree, whether the animal-life is perfect or imperfect: nor doth there ſeem to be the ſmalleſt connection between the higheſt degree of vegetation and the loweſt degree of ſenſation. Though all animals, therefore, are poſſeſſed of vegetable life, theſe two ſeem to be as perfectly diſtinct and incommenſurate to one another as any two things we can poſſibly imagine.

The power of vegetation, for inſtance, is as perfect in an onion or leek, as in a dog, an elephant, or a man: and yet, though you threaten a leek or an onion ever ſo much, it pays no regard to your words, as a dog would do; nor, though you wound it, does it avoid a ſecond ſtroke. It is this principle of ſelf-preſervation in all animals, which, being the moſt powerful one in their nature, is generally taken, and with very good reaſon, as the true characteriſtic of animal-life. This principle is undoubtedly a conſequence of ſenſation; and as it is never obſerved to take place in vegetables, we have a right to ſay that the foundation of it, namely ſenſation, belongs not to them. There is no animal, which makes any motion in conſequence of external impulſe where danger is threatened, but what puts itſelf in a poſture of defence; but no vegetable whatever

ever does ſo. A muſcle, when it is touched, immediately ſhuts its ſhell; and as this action puts it in a ſtate of defence, we conclude that it proceeded from the principle of ſelf-preſervation. When the ſenſitive plant contracts from a touch, it is no more in a ſtate of defence than before; for whatever would have deſtroyed it in its expanded ſtate, will alſo do it in its contracted ſtate. We conclude, therefore, that the motion of the ſenſitive plant proceeds only from a certain property called by phyſicians *irritability*; and which, though our bodies poſſeſs it in an eminent degree, is a characteriſtic neither of animal nor vegetable life, but belongs to us in common with brute-matter. It is certain, that an electrified ſilk-thread ſhews a much greater variety of motions than any ſenſitive plant. If a bit of ſilk-thread is dropt on an electrified metal-plate, it immediately erects itſelf; ſpreads out the ſmall fibres like arms; and, if not detained, will fly off. If a finger is brought near it, the thread ſeems greedily to catch at it. If a candle approaches, it claps cloſe to the plate, as if afraid of it.—Why do we not conclude that the thread in this caſe is really afraid of the candle? For this plain reaſon, That its ſeeming flight is not to get away from the candle, but to get towards the electrified metal; and, if allowed to remain there, will ſuffer itſelf to be burnt without offering to ſtir.—The ſenſitive plant, in like manner, after it has contracted, will ſuffer itſelf to be cut in pieces, without making the leaſt effort to eſcape. The caſe is not ſo with the meaneſt animal. An hedge-hog, when alarmed, draws its body together, and expands its prickles, thereby putting itſelf in a poſture of defence. Throw it into water; and the ſame principle of ſelf-preſervation prompts it to expand its body and ſwim. A ſnail, when touched, withdraws itſelf into its ſhell: but if a little quicklime is ſprinkled upon it, ſo that its ſhell is no longer a place of ſafety, it is thrown into agonies, and endeavours to avail itſelf of its locomotive power in order to eſcape the danger. In muſcles and oyſters, indeed, we cannot obſerve this principle of ſelf-preſervation ſo ſtrongly, as nature has deprived them of the power of progreſſive motion: but, as we obſerve them conſtantly to uſe the means which nature has given them for ſelf-preſervation, we can have no reaſon to think that they are deſtitute of that principle upon which it is founded.

But there is no need of arguments drawn from the inferior creation. We ourſelves are poſſeſſed both of the animal and vegetable life, and certainly muſt know whether there is any connection between vegetation and ſenſation or not.—We are conſcious that we exiſt; that we hear, ſee, &c.: but of our vegetation we are abſolutely inconſcious. We feel a pleaſure, for inſtance, in gratifying the calls of hunger and thirſt; but of the proceſs by which our aliment is formed into chyle, the chyle mixed with the blood, the circulation of that fluid, and the ſeparation of all the humours from it, we are altogether ignorant. If we then, who are more perfect than other vegetables, are utterly inſenſible of our own vegetable life, why ſhould we imagine that the leſs perfect vegetables are ſenſible of it?

To illuſtrate our reaſoning here by an example.—The direction of the roots of the plane-tree mentioned by Lord Kames, ſhows as much ſagacity, if we are to look only to the outward action, as can be obſerved in any motion of the moſt perfect animal whatever; nevertheleſs, we have not the leaſt ſuſpicion, either that the tree ſaw the ground at a diſtance, or that it was informed of its being there by the reſt of its roots. If a wound is made in the body of a man, and a loſs of ſubſtance is to be repaired, the ſame ſagacity will be obſerved in the arrangement of the fibres, not only as if they were animated, but they will diſpoſe of themſelves ſeemingly with a degree of wiſdom far ſuperior to what we have any idea of; yet this is done without our having the leaſt knowledge either how it is done, or of its being done at all. We have therefore in ourſelves a demonſtration, that vegetable life acts without knowing what it does: and if vegetables are ignorant of their moſt ſagacious actions, why ſhould we ſuſpect that they have a ſenſation, let it be ever ſo obſcure, of any of their inferior ones, ſuch as contracting from a touch, turning towards the ſun, or advancing to meet a pole?

Thus we may eaſily give Mr Buffon a reaſon why we aſcribe ſenſation to an oyſter, and none to a vegetable; namely, becauſe we perceive the vegetable do nothing but what is alſo performed in our own bodies, without our having the leaſt ſenſation of it; whereas an oyſter puts itſelf in a defenſive poſture on the approach of danger; and this being an action ſimilar to our own upon a like occaſion, we conclude that it proceeds from the ſame principle of ſenſation. Here it may alſo be obſerved, that though the inferior animals are deficient in the number, they are by no means ſo in the acuteneſs of their ſenſations; on the contrary, though a muſcle or an oyſter is probably endowed with no other ſenſe than that of feeling, yet this ſenſe is ſo exquiſite, that it will contract upon the ſlighteſt touch, ſuch as we would be altogether inſenſible of.

As to that power of contractility, or iritability, which is obſerved in ſome plants; our ſolids have it, when deprived both of vegetable and animal life: for a muſcle, cut out of a living body, will continue to contract, if it is irritated by pricking it, after it has neither ſenſation nor vegetation.

A very good moral reaſon may alſo be adduced why we do not believe vegetables to be endowed with ſenſation.—Had they been ſo, we muſt ſuppoſe them to ſuffer pain when they are cut or deſtroyed; and, if ſo, what an unhappy ſtate muſt they be in, who have not the leaſt power to avoid the injuries daily offered them? In fact, the goodneſs of the Deity is very conſpicuous in not giving to vegetables the ſame ſenſations as to animals; and, as he hath given them no means of defence, though we have not been told it by himſelf, we might have known that he gave them for food to animals; and, in this caſe, to have endowed them with ſenſation would have been a piece of cruelty. Though animals without number prey upon one another, yet all of them have ſome means of defence; from whence we may juſtly conclude, that their mutual deſtruction was not an original appointment of the Creator, but what he foreſaw would happen in the courſe of time, and which he therefore gave every one of them ſome means of guarding againſt. It may no doubt be here objected, that the giving ſome means of ſelf-defence to every animal cannot be reckoned a ſufficient proof that it was not the original deſign of the Creator that they ſhould be deſtroyed, ſeeing theſe means are not always effectual for their preſervation.—This objection, however,

ever, cannot be completely obviated without a ſolution of the queſtion concerning the origin of evil among the works of a perfectly good Being. But whatever difficulty there may be in ſolving this queſtion, it is certain, that, as ſome means of ſelf-defence is given to every animal, it has been the original deſign of the Creator, that in all caſes one ſpecies of animals ſhould not be deſtroyed at the pleaſure of any other ſpecies; and as no means of ſelf-defence is given to any vegetable, it is plain that they have been deſtined for a prey to every ſpecies of animals that had acceſs to them. Philoſophers have inſiſted much on the neceſſity of one animal's devouring another, that there might be room ſufficient for all; but this, ſo far from being a ſyſtem worthy of the divine wiſdom, ſeems to us to be a reflection upon it, as if the Author of nature could not have found means to preſerve the life of one part of his creatures, without the deſtruction and miſery of the reſt. The ſacred writings leave us at no loſs to ſee how this carnivorous diſpoſition came in; and, in the next world, this piece of perfection (as the ſanguinary philoſophers above-mentioned would have it to be) ſeems to be left out; for there, it is ſaid, "They ſhall not hurt nor de-"ſtroy; the lion ſhall eat ſtraw like the ox, and there "ſhall be no more pain."

When ſpeaking of the food of plants, we took occaſion to mention a certain power, totally different from that of attraction or repulſion, by which the food of a plant, after it was attracted, or otherwiſe brought to it, was aſſimilated to its ſubſtance. This power which we there diſtinguiſh by the name of *tranſmutation*, belongs in a more eminent degree to animals. The alimentary ſubſtance is changed into two kinds of matter. (1.) An excrementitious one, which paſſes off through the inteſtines; and (2.) A fluid, which is the direct pabulum of the animal. Different ſubſtances, however, are not equally changeable by this proceſs. The human ſtomach is not capable of acting upon any animal ſubſtance till it has loſt its vital principle: the ſtomachs of ſome animals cannot act upon creatures of their own ſpecies: ſome have an apparatus for grinding their food after it is ſwallowed, &c. and there are no animals but what are ſubject to death by taking certain ſubſtances into their ſtomach. Some ſubſtances alſo, though they reſiſt the action of the ſtomach, and paſs unchanged into the ſyſtem, produce no bad effects. Thus, madder will turn the bones of animals red; rhubarb will communicate its purgative nature to the milk, and its deep yellow colour to the urine.—All theſe changes, however, ſeem to belong to the vegetative part of our ſyſtem: for as every one of them are performed without our knowledge of the manner how; and not only ſo, but while we are abſolutely unconſcious of their being done; we can have no reaſon to ſuppoſe, that the *animal* life, properly ſo called, is at all connected with them, any farther than as they are at preſent the means of preſerving the creature alive, and making the connection betwixt the principle of life and this viſible creation.

The deſcription and claſſing of animals make a conſiderable part of Natural Hiſtory, known by the name of *Zoology*. See the article ZOOLOGY.

For particulars relating to different animals, their analogous ſtructure, ſagacity, inſtinct, peculiarities, &c. ſee COMPARATIVE *Anatomy*, INSTINCT, MIGRATION, AMPHIBIOUS, QUADRUPED, SINGING, ORNITHOLOGY, VIVIPAROUS, OVIPAROUS, ICHTHYOLOGY, ENTOMOLOGY, &c.

ANIMAL, uſed adjectively, denotes any thing belonging to, or partaking of, the nature of animals. Thus, animal actions, thoſe that are peculiar to animals; ſuch are ſenſation and muſcular motion.

ANIMAL-Flower, in zoology, a name given to ſeveral ſpecies of animals belonging to the genus of ACTINIA of Linnæus. They have likewiſe been diſtinguiſhed by the names of *Urtica Marina*, or *Sea-nettle*, from their ſuppoſed property of ſtinging; and *Sea-anemone*, from their claws or tentacles being diſpoſed in regular circles, and tinged with a variety of bright lively colours, reſembling the petals of ſome of our moſt beautiful flowers. As to one ſpecies particularly, mentioned by Abbé Diequemarre, (Phil. Tranſ. for 1773, art. 37.) the pureſt white, carmine, and ultramarine, are ſaid to be ſcarce ſufficient to expreſs their brilliancy. The bodies of ſome of them are hemiſpherical, of others cylindrical, and of others ſhaped like a fig. Their ſubſtance likewiſe differs; ſome are ſtiff and gelatinous, others fleſhy and muſcular; but all of them are capable of altering their figure when they extend their bodies and claws in ſearch of food. They are found in many of the rocky coaſts of the Weſt-India iſlands, and likewiſe on ſome parts of the coaſt of England.

They have only one opening, which is in the centre of the uppermoſt part of the animal; round this are placed rows of fleſhy claws; this opening is the mouth of the animal, and is capable of great extenſion. The animals themſelves, though exceedingly voracious, will bear long faſting. They may be preſerved alive a whole year, or perhaps longer, in a veſſel of ſea-water, without any viſible food; but, when food is preſented, one of them will ſucceſſively devour two muſcles in their ſhells, or even ſwallow a whole crab as large as a hen's egg. In a day or two the crab-ſhell is voided at the mouth, perfectly cleared of all the meat. The muſcle-ſhells are likewiſe diſcharged whole, with the two ſhells joined together, but entirely empty, ſo that not the leaſt particle of fiſh is to be perceived on opening them. An anemone of one ſpecies will even ſwallow an individual of another ſpecies; but, after retaining it ten or twelve hours, will throw it up alive and uninjured. Through this opening alſo it produces its young ones alive, already furniſhed with little claws, which, as ſoon as they fix themſelves, they begin to extend in ſearch of food.

One of the extremities of the ſea-anemone reſembles, as we have ſaid, the outward leaves of that flower; while its limbs are not unlike the ſhag or inner part of it. By the other extremity it fixes itſelf, as by a ſucker, to the rocks or ſtones lying in the ſand; but it is not totally deprived of the power of progreſſive motion, as it can ſhift its ſituation, though very ſlowly.

A particular ſpecies of animal-flowers has been found in ſome of the Britiſh Weſt-India iſlands; and the following account of them was publiſhed by the Philoſophical Tranſactions, vol. 75. by Mr Ellis, in a letter to Lord Hillſborough.

"This compound animal, which is of a tender fleſhy ſubſtance, conſiſts of many tubular bodies, ſwelling gently towards the upper part, and ending like a bulb or very ſmall onion; on the top of each is its mouth, ſurrounded by one or two rows of tentacles, or claws, which when contracted look like circles of beads.

“The lower part of all theſe bodies have a communication with a firm fleſhy wrinkled tube, which ſticks faſt to the rocks, and ſends forth other fleſhy tubes, which creep along them in various directions. Theſe are full of different ſizes of theſe remarkable animals, which riſe up irregularly in groups near to one another.

“This adhering tube, that ſecures them faſt to the rock, or ſhelly bottom, is worthy of our notice. The knobs that we obſerve, are formed in ſeveral parts of it by its inſinuating itſelf into the inequalities of the coral rock, or by graſping pieces of ſhells, part of which ſtill remain in it, with the fleſhy ſubſtance grown over them.

“This ſhows us the inſtinct of nature that directs theſe animals to preſerve themſelves from the violence of the waves, not unlike the anchoring of muſcles, by their fine ſilken filaments that end in ſuckers; or rather like the ſhelly baſis of the ſerpula, or worm-ſhell, the tree-oyſter, and the ſlipper barnacle, &c. whoſe baſes conform to the ſhape of whatever ſubſtance they fix themſelves to, graſping it faſt to their teſtaceous claws, to withſtand the fury of a ſtorm.

“When we view the inſide of this animal diſſected lengthwiſe, we find like a little tube leading from the mouth to the ſtomach, from whence there riſe eight wrinkled ſmall guts, in a circular order, with a yellowiſh ſoft ſubſtance in them; theſe bend over in the form of arches towards the lower part of the bulb, from whence they may be traced downwards, to the narrow part of the upright tube, till they come to the fleſhy adhering tube, where ſome of them may be perceived entering into a papilla, or the beginning of an animal of the like kind, moſt probably to convey it nouriſhment till it is provided with claws: the remaining part of theſe ſlender guts are continued on in the fleſhy tube, without doubt for the ſame purpoſe of producing and ſupporting more young ones from the ſame common parent.

“The many longitudinal fibres that we diſcover lying parallel to each other, on the inſide of the ſemi-tranſparent ſkin, are all inſerted in the ſeveral claws round the animal's mouth, and are plainly the tendons of the muſcles, for moving and directing the claws at the will of the animal: theſe may be likewiſe traced down to the adhering tube.

“As this ſpecimen has been preſerved in ſpirits, the colour of the animal, when living, cannot be certainly known; it is at preſent of a pale yellowiſh brown.

“With regard to its name, it may be called *Actinia ſociata*, or the *Cluſter Animal-flower*.”

The Abbé Dicquemarre, by many curious though cruel, experiments related in the Phil. Tranſ. for 1773, has ſhown that theſe animals poſſeſs, in a moſt extraordinary degree, the power of reproduction; ſo that ſcarce any thing more is neceſſary to produce as many ſea-anemonies as we pleaſe, than to cut a ſingle one into as many pieces. A ſea-anemone being cut in two by a ſection through the body, that part, where the limbs and mouth are placed, eat a piece of a muſcle offered to it ſoon after the operation, and continued to feed and grow daily for three months after. The food ſometimes paſſed through the animal; but was generally thrown up again, conſiderably changed, as in the perfect ſea-anemone. In about two months, two rows of limbs were perceived growing out of the part where the inciſion was made. On offering food to this new mouth, it was laid hold of and eat; and the limbs continually increaſing, the animal gradually became as perfect as thoſe which had never been cut. In ſome inſtances, however, he found, that, when one of theſe creatures was cut through, new limbs would be produced from the cut place, thoſe at the mouth remaining as before; ſo that a monſtrous animal was the conſequence, having two mouths, and feeding at both ends. Having put ſome of them into a pan of water, ſet over a ſlow fire, he found that they loſt their life at 50 degrees of Reamur's thermometer. To avoid the imputation of cruelty in theſe experiments, the author argues the favourable conſequences that have attended his operations on the ſea-anemonies which have been ſo fortunate as to fall into his hands; as he hath not only multiplied their exiſtence, but alſo renewed their youth; which laſt, he adds, “is ſurely no ſmall advantage.”

In Hughes's Natural Hiſtory of Barbadoes an account is alſo given of ſeveral ſpecies of animal-flowers. They are there deſcribed as only found in a baſon in one particular cave; and of the moſt remarkable ſpecies mentioned by him we have the following deſcription.

“In the middle of the baſon, there is a fixed ſtone, or rock, which is always under water. Round its ſides, at different depths, ſeldom exceeding 18 inches, are ſeen, at all times of the year, iſſuing out of little holes, certain ſubſtances that have the appearance of fine radiated flowers, of a pale yellow, or a bright ſtraw colour, ſlightly tinged with green, having a circular border of thick-ſet petals, about the ſize of, and much reſembling thoſe of a ſingle garden-marigold, except that the whole of this ſeeming flower is narrower at the diſcus, or ſetting on of the leaves, than any flower of that kind.

“I have attempted to pluck one of theſe from the rock, to which they are always fixed; but never could effect it: for as ſoon as my fingers came within two or three inches of it, it would immediately contract cloſe together its yellow border, and ſhrink back into the hole of the rock; but if left undiſturbed for about four minutes, it would come gradually in ſight, expanding, though at firſt very cautiouſly, its ſeeming leaves, till at laſt it appeared in its former bloom. However, it would again recoil, with a ſurpriſing quickneſs, when my hand came within a ſmall diſtance of it. Having tried the ſame experiment by attempting to touch it with my cane, and a ſmall ſlender rod, the effect was the ſame.

“Though I could not by any means contrive to take or pluck from the rock one of theſe animals entire; yet I once cut off (with a knife which I had held for a long time out of ſight, near the mouth of an hole out of which one of theſe animals appeared) two of theſe ſeeming leaves. Theſe, when out of the water, retained their ſhape and colour; but, being compoſed of a membrane-like ſubſtance, ſurpriſingly thin, it ſoon ſhrivelled up, and decayed.”

The reproductive power of the Barbadoes animal-flower is prodigious. Many people coming to ſee theſe ſtrange creatures, and occaſioning ſome inconvenience

nience to a perſon through whoſe grounds they were obliged to paſs, he reſolved to deſtroy the objects of their curioſity; and, that he might do ſo effectually, cauſed all the holes out of which they appeared to be carefully bored and drilled with an iron inſtrument, ſo that we cannot ſuppoſe but their bodies muſt have been entirely cruſhed to a pulp: nevertheleſs, they again appeared in a few weeks from the very ſame places.

Plate XXXII. fig. 1. repreſents the actinia ſociata, or cluſtered animal-flower, deſcribed by Mr Ellis, with its radical tube adhering to a rock: (a) One of the animals ſtretching out its claws. Fig. 2. A perpendicular diſſection of one of the bodies, to ſhow the gullet, inteſtines, ſtomach, and fibres or tendons that move the claws: (a) A young one ariſing out of the adhering tube. Fig. 3. The actinia aſter, or animal-flower of the newly ceded iſlands. Fig. 4. The actinia anemone, or ſea-anemone from the ſame place. Fig. 5. The under part of the ſame by which it adheres to the rocks. Fig. 6. The actinia helianthus, or the ſea-ſunflower from ditto. Fig. 7. The under part of the ſame. Fig. 8. The actinia dianthus, or ſea-carnation, from the rocks at Haſtings in Suſſex. This animal adheres by its tail, or ſucker, to the under part of the projecting rocks oppoſite to the town; and, when the tide is out, has the appearance of a long white fig: this is the form of it when put into a glaſs of ſea-water. It is introduced here as a new variety of this animal not yet deſcribed.

ANIMAL-Food. See FOOD.

ANIMAL-Oeconomy. This ſubject is explained under ANATOMY.

ANIMAL-Magnetiſm. See MAGNETISM.

ANIMAL-Spirit. See *NERVOUS Fluid.*

ANIMAL-Syſtem denotes the whole claſs of beings endowed with animal life, otherwiſe called *Animal KINGDOM.*

ANIMALS, the preparation of, for collections or muſeums. See QUADRUPEDS, BIRDS, REPTILES.

Pairing of ANIMALS. See PAIRING.

1 Common acceptation of the word.

ANIMALCULE, in general, ſignifies a little animal; and thus the term might be applied to every animal which is conſiderably inferior in ſize to ourſelves. It hath been cuſtomary, however, to diſtinguiſh by the name of *animalcules* only ſuch animals as are of a ſize ſo diminutive, that their true figure cannot be diſcerned without the aſſiſtance of glaſſes; and more eſpecially it is applied to ſuch as are altogether inviſible to the naked eye, and cannot even be perceived to exiſt but by the aſſiſtance of microſcopes.

2 Different ſizes of animalcules.

By the help of magnifying glaſſes, we are brought into a kind of new world; and numberleſs animals are diſcovered, which, from their minuteneſs, muſt otherwiſe for ever have eſcaped our obſervation: and how many kinds of theſe inviſibles there may be, is ſtill unknown; as they are diſcerned of all ſizes, from thoſe which are barely inviſible to the naked eye, to ſuch as reſiſt the action of the microſcope, as the fixed ſtars do that of the teleſcope, and with the beſt magnifiers hitherto invented appear only as ſo many moving points.

The ſmalleſt living creatures our inſtruments can ſhow are thoſe that inhabit the waters: for though poſſibly animalcules equally minute, or perhaps more ſo, may fly in the air, or creep upon the earth, it is ſcarce poſſible to bring ſuch under our examination; but water being tranſparent, and confining the creatures in it, we are able, by applying a drop of it to our glaſſes, to diſcover, to a certain degree of ſmallneſs, all that it contains.—Some of the moſt curious of theſe animalcules, which have been deſcribed by microſcopical obſervers, we ſhall here give an account of.

3 Hair-like inſect.

4 Its extreme ſmallneſs, &c.

1. *The Hair-like Inſect.* This is ſo called by Mr Baker on account of its ſhape; being extremely ſlender, and frequently an hundred and fifty times as long as broad. The body or middle part, which is nearly ſtraight, appears, in ſome, compoſed of ſuch rings as the wind pipe of land-animals is made up of; but in others, ſeems rather ſcaled, or made up of rings that obliquely croſs one another. Its two ends are hooked or bent, pretty nearly in the ſame degree, but in a direction oppoſite to one another; and as no eyes can be diſcerned, it is difficult to judge which is the head or tail. Its progreſſive * motion is very ſingular, being performed by turning upon one end as a centre, and deſcribing almoſt a quarter of a circle with the other, as repreſented in the figure. Its motions are very ſlow, and require much patience and attention in the obſerver. Theſe creatures are ſo ſmall, that millions of millions of them might be contained in an inch ſquare. When viewed ſingly, they are exceedingly tranſparent, and of a beautiful green colour; but when numbers of them are brought together, they become opaque, loſe their green colour, and grow entirely black.

* Plate, XXXIII. fig. 1.

5 Delights in ſociety.

Notwithſtanding the extreme minuteneſs of theſe animalcules, they ſeem to be fond of ſociety; for, after viewing for ſome time a parcel of them taken up at random, they will be ſeen diſpoſing themſelves in a kind of regular order †. If a multitude of them are put into a jar of water, they will form themſelves into a regular body, and aſcend ſlowly to the top, where, after they have remained for ſome time expoſed to the air, their green colour changes to a beautiful ſky-blue. When they are weary of this ſituation, they form themſelves into a kind of rope, which ſlowly deſcends as low as they intend; but if they happen to be cloſe to the ſide of the jar, they will deſcend upon it. They are ſo nearly of the ſpecific gravity of water itſelf, that they will either remain at the bottom, float on the ſurface, or be ſuſpended in the middle, according as they are originally placed, or as they themſelves have a mind.

† Fig. 2.

6 Seems poſſeſſed of a conſiderable degree of ſagacity.

A ſmall quantity of the matter containing theſe animalcules ‡ having been put into a jar water, it ſo happened, that one part went down immediately to the bottom, whilſt the other continued floating on the top. When things had remained for ſome time in this condition, each of theſe ſwarms of animalcules began to grow weary of its ſituation, and had a mind to change its quarters. Both armies, therefore, ſet out at the ſame time, the one proceeding upwards, and the other downwards; ſo that, after ſome hours journey, they met in the middle. A deſire of knowing how they would behave on this occaſion, engaged the obſerver to watch them carefully; and to his ſurpriſe he ſaw the army that was marching upwards, open to the right and left, to make room for thoſe that were deſcending. Thus, without confuſion or intermixture, each held on its way; the army that was going up, marching in two columns to the top, and the other proceeding in one column to the bottom, as if each had been under the direction of wiſe leaders.

‡ Fig. 3.

The hair-like inſect was firſt diſcovered in a ditch at Norwich, 7 Found in prodigious quantity.

Norwich, one end of which communicates with the river there, and the other end with a ſecond ditch into which ſeveral kennels empty themſelves. The length of this ditch, when Mr Baker wrote his account of this animalcule, was as leaſt 100 yards, and its breadth nine. The bottom, for more than a foot thick, was covered with a blackiſh green ſubſtance, in appearance like mud, made up for the moſt part of theſe inſects; but, ſuppoſing only an half or a quarter part of it to be compoſed of them, according to the dimenſions we have given, their numbers muſt exceed all imagination.

2. *Eels in paſte*, &c. When paſte is allowed to ſtand till it becomes ſour, it is then found to be the habitation of numberleſs animalcules, which may be diſcerned by the naked eye; and though their form cannot be perfectly diſtinguiſhed, their motion is very perceptible, and the whole paſte will ſeem to be animated. Fig. 4. repreſents one of theſe anguillæ magnified.

8 Eels in paſte viviparous.

The moſt remarkable property of theſe inſects is, that they are viviparous. If one of them is cut thro' near the middle, ſeveral oval bodies of different ſizes will be ſeen to iſſue forth. Theſe are young anguillæ, each of them coiled up and incloſed in its proper membrane, which is ſo exquiſitely fine, as ſcarce to be diſcernible by the greateſt magnifier, while it incloſes the embryo animal. The largeſt and moſt forward immediately break through this covering, unfold themſelves, and wriggle about in the water nimbly; others get out, uncoil, and move themſelves about more ſlowly; and the leaſt mature continue entirely without motion. The *uterus*, or veſſel that contains all theſe oval bodies, is compoſed of many ringlets, not unlike the aſpera arteria of land-animals, and ſeems to be conſiderably elaſtic; for as ſoon as the animalcule is cut in two, the oval bodies are thruſt out with ſome degree of violence, from the ſpringing-back or action of this bowel. An hundred and upwards of the young ones have been ſeen to iſſue from the body of one ſingle eel, whereby the prodigious increaſe of them may be accounted for; as probably ſeveral ſuch numerous generations are produced in a ſhort time. They ſeem to be all prolific; and unleſs trial happens to be made upon one that has brought forth all its young, or when the paſte has been kept for a very long time, the experiment will always ſucceed.—This property of theſe eels being viviparous renders it highly improbable that they ever become flies.

Animalcules of a ſimilar kind are likewiſe found in vinegar; and like thoſe already deſcribed, are found to be viviparous. But it is not only in acid matters that ſuch appearances are obſerved.

9 Similar creatures found in blighted wheat.

In ſome fields of wheat, many grains may be obſerved, that appear blackiſh outwardly, as if ſcorched; but, when opened, are found to contain a ſoft white ſubſtance, which, attentively conſidered, appears to be nothing elſe than a congeries of threads or fibres lying cloſe to each other in a parallel direction, much reſembling the unripe down of ſome thiſtles on cutting open the flower-heads before they begin to blow. This fibrous matter diſcovers not the leaſt ſign of life or motion, unleſs water is applied; but immediately on wetting, provided the grains of wheat have been newly gathered, the ſuppoſed fibres ſeparate, and appear to be living creatures. Their motions at firſt are very languid; but gradually become more vigorous, twiſting and wriggling themſelves ſomewhat in the manner of the eels in paſte, but always ſlower than they, and with a great deal of leſs regularity.

If the grains of wheat are grown dry by keeping, and in that condition are cut open, the fibrous matter is very diſtinguiſhable; and, on putting water to it, will ſeparate with great readineſs, and ſeem like fine tubes or threads tapering at both ends: but not the leaſt motion will be perceived till they have been in water for ſeveral hours, and ſometimes they will never move at all.

10 How diſcoverable.

But if the ſame grains are ſteeped in water for three or four hours, or buried for ſome days in the earth till they are fully ſaturated with moiſture, and then opened with a penknife; on taking out a ſmall portion of the white matter carefully, and ſpreading it thin upon a ſlip of glaſs, the animalcules will be ſeen bundled together, and extended longitudinally, but without motion: and though, upon the application of water, they will not revive ſo ſoon as thoſe taken from freſh grains, whoſe moiſture has never been exhaled; yet, after remaining an hour or two in water, they are conſtantly found alive and vigorous, even though the grains have been kept in a dry condition for ſeveral years.

11 Precautions neceſſary in making the experiment

—It is neceſſary, however, to adapt, in ſome meaſure, the time of continuing the grains in water or earth to the age and dryneſs of them: for if they are not opened before they are too much ſoftened, the animalcules will be dead; and unleſs the huſks are opened to let thoſe creatures out after they have been ſteeped, they inevitably periſh in them: otherwiſe, they will continue alive in water for many months; and ſhould the water dry away, may be revived again by giving them a freſh ſupply.

12 Proteus why ſo called.

3. *The Proteus.* This animacule has been dignified by Mr Baker with the name of *Proteus*, on account of its aſſuming a great number of different ſhapes, ſo as ſcarce to be known as the ſame animal in its various transformations; and indeed unleſs it be carefully watched while paſſing from one ſhape to another, it will often become ſuddenly inviſible, as happened more than once to Mr Baker.

13 Where found.

When water, wherein any ſort of vegetable has been infuſed, or animals preſerved, has ſtood quietly for ſome days, or weeks, in any glaſs or other veſſel, a ſlimy ſubſtance will be collected about the ſides: ſome of which being taken up with the point of a penknife, placed on a ſlip of glaſs in a drop of water, and looked at through the microſcope, will be found to harbour ſeveral kinds of little animals that are ſeldom found ſwimming about at large; among which the proteus is one.

14 Its ſhape, colour, &c.

Its ſhape is better underſtood from the figure, than from any deſcription that could be given. Its ſubſtance and colour ſeems to reſemble that of a ſnail; and its whole ſhape ſeems to bear a conſiderable reſemblance to that of a ſwan. It ſwims to and fro with great vivacity: but will now and then ſtop for a minute or two; during which time its long neck is uſually employed as far as it can reach, forwards, and on every ſide, with a ſomewhat ſlow, but equable motion, like that of a ſnake, frequently extending thrice the length of its body, and ſeemingly in ſearch of food.

There are no eyes, nor any opening in the head like a mouth, to be diſcerned: but its actions plainly prove it to be an animal that can ſee; for though multitudes of different animalcules ſwim about in the ſame water, and its own progreſſive motion is very ſwift, it never ſtrikes againſt any of them, but directs its courſe between them with a dexterity wholly unaccountable ſhould we ſuppoſe it deſtitute of ſight.

15 Its tranſformations. When the proteus is alarmed, it ſuddenly draws in its long neck, repreſented in fig. 5. and 6. transforming itſelf into the ſhape repreſented in fig. 7. when it becomes more opaque, and moves about very ſlowly with the large end foremoſt. When it has continued ſome time in this poſture, it will often, inſtead of the head and neck it had formerly, put forth a new one, with a kind of wheel machinery, repreſented fig. 8. the motions of which draw a current of water to it from a conſiderable diſtance. Having often pulled in and thruſt out this ſhort head, ſometimes with and ſometimes without the wheel-work, the creature, as if weary, will remain motionleſs for a while; then its head and long neck will be very ſlowly protruded, as in fig. 9. and it ſoon reſumes its former agility. Sometimes it diſpoſes of its neck and head as repreſented in fig. 10.

16 Vorticella, where found. 4. *The Wheel-Animal, or Vorticella.* This wonderful animalcule is found in rain water that has ſtood ſome days in leaden gutters, or in hollows of lead on the tops of houſes; or in the ſlime or ſediment left by ſuch water; and perhaps may alſo be found in other places: but if the water ſtanding in gutters of lead, or the ſediment left behind it, has any thing of a red colour in it, one may be almoſt certain of finding them therein. Though it diſcovers no ſigns of life except when in the water, yet it is capable of continuing alive for many months after it is taken out of the water, and kept in a ſtate as dry as duſt. In this ſtate it is of a globular ſhape, exceeds not the bigneſs of a grain of ſand, and no ſigns of life appear: but, being put into water, in the ſpace of half an hour, a languid motion begins, the globule turns itſelf about, lengthens itſelf by ſlow degrees, aſſumes the form of a lively maggot, and moſt commonly in a few minutes afterwards puts out its wheels; ſwimming vigorouſly through the water, as if in ſearch of food; or elſe, fixing itſelf by the tail, works the wheels in ſuch a manner as to bring its food to it.

Fig. 23. and 24. ſhow the wheel-animal in its globular form; fig. 11. and 12. in its maggot ſtate; and fig. 13, 14, 15, 16, 17, 18, 19, 20, 21, and 22. ſhow the different appearances of its wheels, and alſo its various intermediate changes between the globular and maggot ſtate.

17 Its wheel-work deſcribed. The moſt remarkable part of this animalcule is its wheel-work. This conſiſts of a couple of ſemicircular inſtruments, round the edges of which many little fibrillæ move themſelves very briſkly, ſometimes with a kind of rotation, and ſometimes in a trembling or vibrating manner. When in this ſtate, it ſometimes unfaſtens its tail, and ſwims along with a great deal of ſwiftneſs, ſeemingly in purſuit of its prey. Sometimes the wheels ſeem to be entire circles, armed with ſmall teeth like thoſe of the balance-wheel of a watch, appearing projected forwards beyond the head, and extending ſideways ſomewhat wider than its diameter. The teeth or cogs of theſe wheels ſeem to ſtand very regularly at equal diſtances: but the figure of them varies according to their poſition, the degree of their protruſion, and perhaps the will of the animal itſelf. They appear ſometimes like minute oblong ſquares, riſing at right angles from the periphery of a circle, like ancient battlements on a round tower; at other times they terminate in ſharp points, and all together reſemble a kind of Gothic crown. They are often ſeen in a kind of curvular direction, all bending the ſame way, and ſeeming like ſo many hooks; and now and then the ends of them will be perceived to be clubbed like mallets. This figure, however, as well as the firſt, they aſſume but rarely.

18 Shows all the marks of real rotation. As theſe wheels are every where exceſſively tranſparent, except about their circular rim or edge, where the cogs are ſet, it is very difficult to determine by what contrivance they are turned about, or what their real figure is, though they ſeem exactly to reſemble wheels moving round upon an axis. It is alſo hardly poſſible to be certain whether thoſe circular bodies in which the teeth are ſet, are of a flat form, or hollow and conical; but they ſeem rather to be of a conical figure. The difficulty of conceiving how an articulation could be contrived ſo as to cauſe a real rotation, hath cauſed many people imagine that there was a deception in this caſe: But Mr Baker aſſures us, that when the wheels are fully protruded, they never fail to ſhow all the viſible marks of a regular rotation; and, in ſome poſitions, the ſame cogs or teeth may be traced by the eye during a complete revolution.

19 Shows great quickneſs of ſenſation. All the actions of this creature ſeem to imply ſagacity and quickneſs of ſenſation. At the leaſt touch or motion in the water, they inſtantly draw in their wheels; and Mr Baker conjectures, that their eyes are lodged ſomewhere about the wheels: becauſe, while in the maggot-ſtate, its motions are ſlow and blundering; but, after the wheels are protruded, they are performed with great regularity, ſwiftneſs, and ſteadineſs.

Notwithſtanding the minuteneſs of this animalcule, the microſcope generally diſcovers others in the ſame drop of water, compared with which the wheel-animal may be ſaid to be a whale. The tranſparency of its body, therefore, allows its internal parts to be ſeen, which cannot be perceived in the minuteſt animalcules on account of the ſmallneſs of their ſize. Fig. 15. 20 Deſcription of its internal parts. *a*, Is the appearance of the head; and though it is every where tranſparent, a ring or circle more particularly remarkable for its clearneſs is commonly perceived about the middle of the forehead, a little above the mouth. This, Mr Baker thinks, might juſtly be called the ſeat of the brain. Many veſſels which ſeem to take their origin from thence are diſcernible in the head, wherein ſome tranſparent fluid appears continually agitated by a kind of fluctuating motion.

The thorax, *b*, is joined to the head by a very ſhort neck, *c*, and appears to be about the ſixth part of the whole length of the animal. In the middle of the thorax is placed the heart, *d*, where its ſyſtole and diaſtole are plainly viſible. It is ſeen through the back of the inſect, ſhutting and opening alternately with great regularity and exactneſs. Its ſize is proportionable to the creature's bigneſs; and its ſhape, during the ſyſtole, is nearly circular, being compoſed ſeemingly of two ſemilunar parts, which then approach each other laterally, and form between them a roundiſh or horſe-ſhoe like figure, whoſe upper ſide is flat, and the under one convex. The diaſtole is performed by a ſeeming ſeparation, or opening, of theſe two ſemilunar parts, whereby the tranverſe diameter of the heart is very much enlarged. This ſeparation begins exactly in the middle of the lower part next the tail; and opens to ſuch a conſiderable width upwards, that the two parts, when at their utmoſt diſtenſion, ſeem only joined by an arched veſſel at their anterior end. The alternate motions of contraction and dilatation are performed with great ſtrength and vigour, in pretty much the ſame time as the pulſation of the arteries of a man in health. The motions of the heart are communicated to all the internal parts of the thorax; and ſeem to extend a great deal farther; for a ſtrict examination diſcovers, at the ſame time, throughout the whole animal, contractions and dilatations going on, that are apparently correſpondent thereto. Theſe motions of the heart, however, are ſometimes ſuſpended, or imperceptible, for two or three minutes; after which they are renewed, and go on again with the ſame regularity as before. From the under part of the thorax proceeds a ſmall tranſparent horn repreſented at *a* fig. 11. and 12. It is never viſible but when the animal turns on its back or ſide.

The blood or circulating fluid of the wheel-animal is ſo abſolutely colourleſs, that the current of it through the veſſels is indiſtinguiſhable by glaſſes. A ſort of irregular agitation of ſome fluid is indeed perceived, which is perhaps a compound motion of currents running different ways, and forming ſuch an appearance, tho' no ſingle current is any where diſtinctly viſible.

Immediately below the thorax is another anular diviſion, *e*, joining upwards to the thorax, and downwards to the abdomen, the entrance whereof it ſerves occaſionally to enlarge or diminiſh. The abdomen, *f*, is by much the largeſt part of the animal, and contains the ſtomach and inteſtines. When the inſect is full of food, theſe bowels appear opaque and of a blood-red colour, extending quite through the belly and great part of the tail, and exhibiting a variety of contractions and dilatations. The belly is capable of ſtretching out greatly in length, or being ſhortened very much, and widening its diameter. It aſſumes many ſhapes, and becomes occaſionally a caſe for all the other parts of the body.

21 other kinds of wheel-animals.

Beſides the abovementioned one, there are found in the waters ſeveral other ſpecies of animals furniſhed with wheels, ſome of which appear to have a rotatory, and others a vibratory, motion. Fig. 25. repreſents a kind found in the ditch at Norwich, where the hair-like inſect is produced. They differ from the foregoing only in having very long tails. Fig. 26, 27, and 28, repreſent a ſpecies of wheel-animals, which are alſo covered with ſhells. The body of this ſpecies conſiſts of three parts, in like manner as the other; only the thorax and abdomen, in this, are not ſeparated by any gut, or intermediate veſſel, but are joined immediately together. The heart is plainly perceived, having a regular ſyſtole and diaſtole, at *a*, as in the former ſpecies. Theſe creatures occaſionally draw themſelves entirely within their ſhells; and the ſhell then appears terminated by ſix ſhort ſpikes on one ſide and two on the other.

22 Manner of producing their young ones.

The young ones of this ſpecies are carried in oval ſacculi, or integuments, faſtened externally to the lower part of their ſhells ſomewhere about the tail: theſe ſacculi are ſometimes opaque only at one end, and ſeemingly empty at the other; ſometimes they appear opaque in the middle, with a tranſparency all round, as in fig. 26. When a young one is about to burſt its integuments, the parent aſſiſts it greatly, by wagging its tail, and ſtriking the oval bag, ſo that the young one's head becomes as it were forced into the water, though the tail cannot be ſo ſoon diſengaged. In this condition the young one ſets its wheel a-going, and exerts all its endeavours to free itſelf from its confinement. When it has got clear, it ſwims away, wagging its tail as the old one does, and leaving the integument adhering to the ſhell of the parent. The old one then uſes a number of efforts to get rid of this incumbrance, ſtriking againſt it with her tail; fixing the end of her tail upon it, and then darting her body forward; with ſeveral very odd motions not eaſy to be deſcribed. This kind of wheel-animals are great tormentors of the water-flea, *Pulex aquaticus arboreſcens* of Swammerdam; of which a figure is given from that author (Plate XXXIV.): fig. 2. ſhows the natural ſize of the flea; and fig. 1. ſhows it magnified, with ſome of the wheel-animals adhering to it. Theſe inſects are often found in great numbers in the ſame water: and when that is the caſe, it is not uncommon to diſcover five or ſix of theſe cruſtaceous wheel-animals faſtened by their tail to the ſhell or horns of the flea; cauſing it, ſeemingly, a vaſt deal of uneaſineſs; nor can they be driven away, or ſhaken off, by all the efforts the flea can uſe for that purpoſe.

Fig. 28. *b*.

23 Inſect the Pulex Aquaticus.

24 Bell-flower animal.

5. *The bell-flower Animal, or Plumed Polype.* Theſe animalcules dwell in colonies together, from ten to fifteen (ſeldom falling ſhort of the former number, or exceeding the latter), in a ſlimy kind of mucilaginous or gelatinous caſe; which, out of the water, has no determined form, appearing like a little lump of ſlime; but, when expanded therein, has ſome reſemblance to the figure of a bell with its mouth upwards; and is uſually about half an inch long, and a quarter of an inch in diameter. Theſe bells, or colonies, are to be found adhering to the large leaves of duckweed, and other aquatic plants. They may be moſt eaſily diſcovered by letting a quantity of water, with duckweed in it, ſtand quietly for three or four hours in glaſs-veſſels in a window, or other place whence a ſtrong light comes: for then, if any are about the duckweed, they will be found, on careful inſpection, extending themſelves out of their caſes, and making an elegant appearance.

25 Where diſcovered.

The bell, or caſe, which theſe animals inhabit, being very tranſparent, all the motions of its inhabitants may be diſcerned through it diſtinctly. It ſeems divided internally into ſeveral apartments, or rather to contain ſeveral ſmaller ſacculi, each of which incloſes one of theſe animals. The openings at the tops of theſe ſacculi, are but juſt ſufficient to admit the creature's head and a ſmall part of its body to be thruſt out beyond them, the reſt remaining always in the caſe. It can, however, occaſionally retire into its caſe altogether; and never fails to do ſo when alarmed by any ſudden motion of the water, or of the veſſel which contains it.

26 Motions of the whole colony.

Beſides the particular and ſeparate motion which each of theſe creatures is able to exert within its own caſe, and independent of the reſt; the whole colony together has a power of altering the poſition of the bell, or even of removing it from one place to another; and hence this bell is ſometimes found ſtanding perfectly upright, as in fig. 29. and 33. and ſometimes bending the upper part downwards, as in fig. 30. As theſe animalcules ſeem not to chooſe to ſtay together in ſocieties whoſe number exceeds 15, when the colony happens to increaſe in number, the bell may be obſerved to ſplit gradually, beginning from about the middle of the upper or anterior extremity, and proceeding downwards towards the bottom, as in fig. 32. till they at laſt ſeparate entirely, and become two complete colonies independent of each other, one of which ſometimes removes to another part of the veſſel.

27 Deſcription of an individual.

The arms of each individual of this colony are ſet round the head, to the number of 40, having each the figure of an Italic *ſ*, one of whoſe hooked ends is faſtened to the head; and altogether, when expanded, compoſe a figure ſhaped ſomewhat like a horſe's-ſhoe, convex on one ſide next the body, but gradually opening and turning outwards, ſo as to leave a conſiderable area within the outer extremities of the arms. When the arms are thus extended, the creature, by giving them a vibrating motion, can produce a current in the water, which brings the animalcules, or whatever other minute bodies are within the ſphere of its action, with great velocity to its mouth, ſituated between the arms; where they are taken in if liked, or driven away by a contrary motion. The food is conveyed immediately from the mouth or opening between the arms, through a narrow neck, into a paſſage ſeemingly correſpondent to the œſophagus in land-animals; down which it paſſes into the ſtomach, where it remains for ſome time, and then is voided upwards, in ſmall round pellets, thro' a gut whoſe exit is near the neck. The body conſiſts of three diviſions; in the uppermoſt of which are contained all the abovementioned inteſtines, which are only to be diſcerned when the creature is full, at which time they become opaque. The other two diviſions, which are probably fixed to the bell, ſeem to be of no other uſe than to give the creature a power of contraction and extenſion. The arms are not able to contract like thoſe of the common polype; but, when the animal retires into its caſe, they are brought together in a cloſe and curious order, ſo as to be eaſily drawn in. Though their general appearance when expanded is that of a cup whoſe baſe and top are of an horſe-ſhoe form, they ſometimes ſeparate into four parts, and range themſelves as in fig. 36. ſo as to reſemble four ſeparate plumes of feathers.

28 Seem to have a perception of light.

Tho' their eyes cannot be diſcovered, yet Mr Baker thinks they have ſome perception of the light: for when kept in the dark, they always remain contracted; but on being expoſed to the light of the ſun or of a candle, they conſtantly extend their arms, and ſhow evident ſigns of being pleaſed.

Fig. 29. repreſents one complete colony or bell ſtanding erect, with all the animals out of their kingdom, and their arms extended, exhibiting altogether a very pretty appearance. *a* repreſents two oval bodies, ſuppoſed by Mr Baker to be eggs.

Fig. 30. ſhows all the creatures withdrawn into their cells, and the end of the bell hanging downwards.

Fig. 33. ſhows the bell erect, with only one of the animals coming out, in order to ſhow its connection with the bell.

Fig. 34. ſhows the head and arms of a ſingle polype cloſing together, and diſpoſing themſelves in order to be drawn into the ball.

Fig. 35. ſhows one complete animal greatly magnified, to ſhow its ſeveral parts more diſtinctly; viz. *a*, the head, reſembling a horſe-ſhoe; *b b*, the arms ſeen from one ſide; *c*, The narrow neck; *d*, the œſophagus; *e*, the ſtomach; *f*, the gut or laſt inteſtine thro' which the food paſſes after being digeſted in the ſtomach; *g*, the anus, where the feces are diſcharged in little pellets; *h i*, that part of the bell which ſurrounds the body of the animal, and cloſes upon it when it retires down.

Fig. 37. the head and arms ſeen in front.

29 Globe-animal.

6. *The Globe-animal.* This animalcule, repreſented fig. 38. ſeems exactly globular, having no appearance of either head, tail, or fins. It moves in all directions, forwards or backwards, up or down, either rolling over and over like a bowl, ſpinning horizontally like a top, or gliding along ſmoothly without turning itſelf at all. Sometimes its motions are ſlow, at other times very ſwift; and when it pleaſes, it can turn round, as it were upon an axis, very nimbly, without removing out of its place. The whole body is tranſparent, except where the circular black ſpots are ſhown in the figure. Some of the animals have no ſpots, and others from one to ſeven. The ſurface of the whole body appears, in ſome, as if all over dotted with points; in others, as if granulated like ſhagreen: but their more general appearance is, as if beſet thinly round with ſhort moveable hairs or briſtles, which probably are the inſtruments by which their motions are performed. Theſe animalcules may be ſeen by the naked eye, but appear only like moving points.

30 Pipe-animal.

7. *The Pipe-animal.* Theſe creatures are found on the coaſt of Norfolk, living in ſmall tubes or caſes of ſandy matter, in ſuch multitudes as to compoſe a maſs ſometimes of three feet in length. Fig. 39. ſhows a piece of ſuch a congeries broke off, where *a a a a* repreſent the mouths or openings of the pipes wherein the little animals make their abode. Fig. 40. ſhows one ſingle pipe, with its inhabitants, ſeparated from the reſt, and magnified nine or ten times in diameter. The pipe or caſe *b* is made of ſand, intermixed here and there with minute ſhells, and all cemented together by a glutinous ſlime, probably iſſuing from the animal's own body *c*, which is compoſed of muſcular ringlets like thoſe of a worm, capable of great extenſion or contraction. The anterior end or head, *d*, is exceedingly beautiful, having round it a double row of little arms diſpoſed in a very regular order, and probably capable of extenſion, in order to catch its food, and bring it to its mouth.

31 Sometimes found petrified.

Some of theſe tubes are found petrified, and conſtitute one ſpecies of ſyringoides.

32 Inſect with net-like arms.

8. *An inſect with net-like arms.* The properties and ſhape of this little animal are very extraordinary. It is found only in caſcades, where the water runs very ſwift. There theſe inſects are found in cluſters, ſtanding erect on their tails; and reſembling, when all together, the combs of bees at the time they are filled with their aureliæ. On being taken out of the water, they ſpin threads, by which they hang exactly in the ſame manner as the garden-ſpider. Fig. 42. ſhows one of theſe inſects magnified. Its body appears curiouſly turned as on a lathe; and at the tail are three ſharp ſpines, on which it raiſes itſelf, and ſtands upright in the water: but the moſt curious apparatus is about its head, where it is furniſhed with two inſtruments like fans or nets, which ſerve to provide its food. Theſe it frequently ſpreads out and draws in again; and when drawn up they

are folded together with the utmoſt nicety and exactneſs, ſo as to be indiſcernible when brought cloſe to the body. At the bottom of of theſe fans a couple of claws are faſtened to the lower part of the head, which, every time the nets are drawn in, conduct to the mouth of the animal whatever is taken in them. When the creature doth not employ its nets, it thruſts out a pair of ſharp horns, as in fig. 41. where the inſect is ſhown magnified about 400 times.

33 **Surpriſing property of ſpoiling water.**

Some of theſe creatures being kept with water in a vial, moſt of them died in two days; and the reſt, having ſpun themſelves tranſparent caſes (which were faſtened either to the ſides of the glaſs, or to pieces of graſs put into it), ſeemed to be changed into a kind of chryſalis: but before taking this form, they appeared as in fig. 43. which ſhape they likewiſe aſſumed when weary with catching their food, or when lying in wait for it. None of them lived above three days; and though freſh water was given them two or three times a-day, yet in a few hours it would ſtink to a degree ſcarce conceivable, and that too at ſeveral yards diſtance, though, in proportion to the water, all the included inſects were not more than as 1 to 1,150,000. This makes it probable, that it is neceſſary for them to live in a rapid ſtream, leſt they ſhould be poiſoned by the effluvia iſſuing from their own bodies, as no doubt they were in the vial.

34 **An aquatic worm.**

35 **Its horn or proboſcis.**

9. *A curious aquatic worm.* This animalcule is ſhown, magnified, at fig. 31. It is found in ditch-water; and is of various ſizes, from $\frac{1}{40}$ to $\frac{1}{2}$ an inch in length. About the head it has ſomewhat of a yellowiſh colour; but all the reſt of the body is perfectly colourleſs and tranſparent, except the inteſtines, which are conſiderably opaque, and diſpoſed as in the figure. Along its ſides are ſeveral papillæ, with long hairs growing from them: it has two black eyes, and is very nimble. But the moſt remarkable thing in this creature is a long horn or proboſcis; which, in the large ones, may be ſeen with the naked eye, if the water is clear, and is ſometimes $\frac{1}{10}$ of an inch in length: this it waves to and fro as it moves in the water, or creeps up the ſide of the glaſs; but it is not known whether it is hollow, or of what uſe it is to the creature itſelf.

36 **Spermatic animals, when diſcovered.**

10. *Spermatic Animals*, and *Animalcula Infuſoria.* The diſcovery of living animalcules in the ſemen of moſt animals is claimed by Mr Liewenhoeck and Mr Nicholas Hartſoeker; who both ſay they publiſhed it about the end of the year 1677 or beginning of 1678: but Mr Liewenhoeck having given the moſt particular deſcription of, and made by far the greateſt number of experiments concerning them, the diſcovery is commonly attributed to him.

37 **General appearance the ſame in every animal.**

According to this naturaliſt, theſe animalcules are found in the ſemen maſculinum of every kind of animal; but their general appearance is very much the ſame, nor doth their ſize differ in proportion to the bulk of the animal to which they belong. The bodies of all of them ſeem to be of an oblong oval form, with long tapering ſlender tails iſſuing from them; and as by this ſhape they reſemble *tadpoles*, they have been frequently called by that name; tho' the tails of them, in proportion to their bodies, are much longer than the tails of tadpoles are: and it is obſervable, that the animalcules in the ſemen of fiſhes have tails much longer and more ſlender than the tails of thoſe in other animals; inſomuch, that the extremity of them is not to be diſcerned without the beſt glaſſes, and the utmoſt attention. Fig. 21. N° 1, 2, 3, 4, repreſent the ſpermatic animalcula of the rabbit; and N° 5, 6, 7, 8, thoſe of a dog; according to Mr Liewenhoeck.

Plate, XXXIV.

38 **Inconceivable numbers and minuteneſs.**

The numbers of theſe animalcula are inconceivable. On viewing with a microſcope the milt or ſemen maſculinum of a living cod-fiſh, innumerable multitudes of animalcules were found therein, of ſuch a diminutive ſize, that he ſuppoſed at leaſt 10,000 of them capable of being contained in the bulk of a grain of ſand; whence he concludes, that the milt of this ſingle fiſh contained more living animalcules than there are to be found people living in the whole world. To find the comparative ſize of theſe animalcules, Mr Liewenhoeck placed an hair of his head near them; which hair, through his microſcope, appeared an inch in breadth; and he was ſatisfied, that at leaſt 60 ſuch animalcules could eaſily lie within that diameter; whence, their bodies being ſpherical, it follows, that 216,000 of them are but equal to a globe whoſe diameter is the breadth of a hair. He obſerved, that when the water wherewith he had diluted the ſemen of a cod-fiſh was exhaled, the little bodies of the animalcules burſt in pieces; which did not happen to thoſe in the ſemen of a ram: and this he imputes to the greater firmneſs and conſiſtency of the latter, as the fleſh of a land-animal is more compact than fiſh.

39 **Are continually in motion.**

Theſe animalcules appear to be very vigorous, and tenacious of life; for they may be obſerved to move long after the animal from which they are taken is dead. They have this peculiarity alſo, that they are continually in motion, without the leaſt reſt or intermiſſion, provided there is fluid ſufficient for them to ſwim about in. Theſe animalcula are peculiar to the ſemen; nothing that has the leaſt token of life being diſcovered, by the beſt glaſſes, either in the blood, ſpittle, urine, gall, or chyle. Great numbers, however, are to be found in the whitiſh matter that ſticks between the teeth; ſome of which are of an oval figure, and others reſemble eels.

40 **Animalcula Infuſoria.**

41 **Mr Liewenhoeck's account of animalcules in rain-water.**

The *Animalcula Infuſoria*, take their name from their being found in all kinds either of vegetable or animal infuſions. Indeed, there is ſcarce any kind of water, unleſs impregnated with ſome mineral ſubſtance, but what will diſcover living creatures.—Mr Liewenhoeck ſays, that at firſt he could diſcern no living creatures in rain-water; but after ſtanding ſome days, he diſcovered innumerable animalcules, many thouſands of times leſs than a grain of ſand, and in proportion to a mite as a bee is to a horſe.—In other rain-water, which had likewiſe ſtood ſome time, he found the ſmalleſt ſort he had ever ſeen; and, in a few days more, met with others eight times as big as theſe, and almoſt round.—In another quantity of rain-water, that had been expoſed like the former, he diſcovered a kind of animalcules with two little horns in continual motion. The ſpace between the horns was flat, though the body was roundiſh, but tapering a little towards the end; where a tail appeared, four times as long as the body, and the thickneſs of a ſpider's web. He obſerved ſeveral hundreds of theſe within the ſpace a grain of ſand would occupy. If they happened on the leaſt filament or ſtring, they were entangled in it; and then would extend their bodies into an oblong round, and ſtruggle hard to diſengage their tails. He obſerved a ſecond ſort of an oval figure, and imagined the head to ſtand at the ſharpeſt end. The body was flat, with ſeveral ſmall feet moving exceeding quick, but not diſcernible without a great deal of attention. Sometimes they changed their ſhape into a perfect round, eſpecially when the water began to dry away. He met alſo with a third ſort, twice as long as broad, and eight times ſmaller than the firſt: yet in theſe he diſcerned little feet; whereby they moved very nimbly. He perceived likewiſe a fourth ſort, a thouſand times ſmaller than a louſe's eye, and which exceeded all the reſt in briſkneſs: he found theſe turning themſelves round, as it were upon a point, with the celerity of a top. And he ſays, there were ſeveral other ſorts.

42
Surpriſing production of theſe animalcules.

The production of *animalcula infuſoria* is very ſurpriſing. In four hours time, an infuſion of cantharides has produced animalcula leſs than even the tails of the ſpermatic animals we have already deſcribed. Neither do they ſeem to be ſubject to the fate of other animals; but, ſeveral kinds of them at leaſt, by dividing themſelves in two, to enjoy a ſort of immortality. Nor do the common methods by which other animals are deſtroyed, ſeem to be effectual for deſtroying their vital principle. Hot mutton-gravy, ſecured in a phial with a cork, and afterwards ſet among hot aſhes to deſtroy as effectually as poſſible every living creature that could be ſuppoſed to exiſt in it, has nevertheleſs been found ſwarming with animalcules after ſtanding a few days.

43
Mr Ellis's account of animalcules from infuſion of potatoes.

In the Philoſophical Tranſactions, Vol. LIX. we have the following curious account, given us by Mr Ellis, of animalcules produced from an infuſion of potatoes and of hempſeed.

"On the 25th of May 1768, Fahrenheit's thermometer 70°, I boiled a potatoe in the New-River water till it was reduced to a mealy conſiſtence. I put part of it, with an equal proportion of the boiling liquor, into a cylindrical glaſs-veſſel that held ſomething leſs than half a wine-pint, and covered cloſe immediately with a glaſs-cover. At the ſame time, I ſliced an unboiled potatoe; and, as near as I could judge, put the ſame quantity into a glaſs-veſſel of the ſame kind; with the ſame proportion of New-River water not boiled; and covered it with a glaſs-cover; and placed both veſſels cloſe to each other.

"On the 26th of May, 24 hours afterwards, I examined a ſmall drop of each, by the firſt magnifier of Wilſon's microſcope, whoſe focal diſtance is reckoned at $\frac{1}{50}$ part of an inch; and, to my amazement, they were both full of animalcula of a linear ſhape, very diſtinguiſhable, moving to and fro with great celerity; ſo that there appeared to be more particles of animal than vegetable life in each drop.

"This experiment I have repeatedly tried, and always found it to ſucceed in proportion to the heat of the circumambient air; ſo that even in winter, if the liquors are kept properly warm, at leaſt in two or three days the experiment will ſucceed.

"What I have obſerved are infinitely ſmaller than ſpermatic animals, and of a very different ſhape: the truth of which every accurate obſerver will ſoon be convinced of, whoſe curioſity may lead him to compare them; and I am perſuaded he will find they are no way akin.

"At preſent I ſhall paſs over many other curious obſervations, which I have made on two years experiments, in order to proceed to the explaining a hint which I received laſt January from Mr De Sauſſure of Geneva, when he was here; which is, that he found one kind of theſe animalcula infuſoria that increaſe by dividing acroſs into nearly two equal parts.

"I had often ſeen this appearance in various ſpecies a year or two ago, as I found upon looking over the minutes I had taken when I made any new obſervation; but always ſuppoſed the animal, when in this ſtate, to be in coition.

"Not hearing, till after M. De Sauſſure left this kingdom, from what infuſion he had made his obſervation; his friend Dr de la Roche of Geneva informed me, the latter end of February laſt, that it was from hempſeed.

44
From an infuſion of hempſeed.

"I immediately procured hempſeed from different ſeedſmen in diſtant parts of the town. Some of it I put into New-River water, ſome into diſtilled water, and ſome I put into very hard pump-water. The reſult was, that in proportion to the heat of the weather, or the warmth in which they were kept, there was an appearance of millions of minute animalcula in all the infuſions; and, ſome time after, ſome oval ones made their appearance, as at fig. 3. *b c*. Theſe were much larger than the firſt, which ſtill continued; theſe wriggled to and fro in an undulatory motion, turning themſelves round very quick all the time that they moved forwards.

45
Divide themſelves in two.

I was very attentive to ſee theſe animals divide themſelves; and at laſt I perceived a few of the appearance of fig. 3. *a*, as it is repreſented by the firſt magnifier of Wilſon's microſcope; but I am ſo well convinced by experience that they would ſeparate, that I did not wait to ſee the operation: however, as the following ſketches, which I have drawn from five other ſpecies, will very fully explain this extraordinary phenomenon, there will be no difficulty in conceiving the manner of the firſt. See fig. 4, 5, 6, 7, 8.

"The proportion of the number of theſe animals which I have obſerved to divide in this manner, to the reſt, is ſcarce 1 to 50; ſo that it appears rather to ariſe from hurts received by ſome few animalcula among the many, than to be the natural manner in which theſe kinds of animals multiply; eſpecially if we conſider the infinite quantity of young ones which are viſible to us through the tranſparent ſkins of their bodies, and even the young ones that are viſible in thoſe young ones while in the body of the old ones.

"But nothing more plainly ſhows them to be zoophytes than this circumſtance, That when, by accident, the extremity of their bodies has been ſhrivelled for want of a ſupply of freſh water, the applying more freſh water has given motion to the part of the animal that was ſtill alive; by which means, this ſhapeleſs figure has continued to live and ſwim to and fro all the time it was ſupplied with freſh water.

46
Beroë deſcribed.

"I cannot finiſh this part of my remarks on theſe animals, without obſerving, that the excellent Linnæus has joined the *beroë* with the *volvox*, one of the animalcula infuſoria. The beroë is a marine animal, found on our coaſts; of a gelatinous tranſparent nature, and of an oval or ſpherical form, about half an inch to an inch diameter; divided like a melon into longitudinal ribs, each of which is furniſhed with rows of minute fins; by means of which, this animal, like the animalcula infuſoria, can ſwim in all directions with great ſwiftneſs.

Animalcule.

ſwiftneſs. In the ſame manner I have ſeen moſt of thoſe minute animals move ſo ſwift that we could not account for it, without ſuppoſing ſuch a proviſion in nature, which is really true, but cannot be ſeen till the animals grow faint for want of water; then, if we attend, we may with good glaſſes plainly diſcover them.

47 Method of diſcovering the fins of animalcules.

"I have lately found out, by mere accident, a method to make their fins appear very diſtinctly, eſpecially in the larger kind of animalcula, which are common to moſt vegetable infuſions; ſuch as the terebella. This has a longiſh body, with a cavity or groove at one end, like a gimlet: by applying, then, a ſmall ſtalk of the horſe-ſhoe geranium (or geranium zonale of Linnæus), freſh broken, to a drop of water in which theſe animalcula are ſwimming, we ſhall find that they will become torpid inſtantly; contracting themſelves into an oblong oval ſhape, with their fins extended like ſo many briſtles all round their bodies. The fins are in length about half the diameter of the middle of their bodies. Before I diſcovered this expedient, I tried to kill them by different kinds of ſalts and ſpirits; but though they were deſtroyed by this means, their fins were ſo contracted, that I could not diſtinguiſh them in the leaſt. After lying in this ſtate of torpidity for two or three minutes, if a drop of clean water is applied to them, they will recover their ſhape, and ſwim about immediately, rendering their fins again inviſible."

Fig. 3, 4, 5, 6, 7, 8. repreſent different ſpecies of animalcula infuſoria, mentioned by Mr Ellis as belonging to the genus of volvox of Linnæus.

Fig. 3. repreſents the volvox ovalis, or egg-ſhaped volvox; at (b) and (c) it is expreſſed in its natural ſhape; at (a) the manner in which it becomes two animals, by ſeparating acroſs the middle. This was found in the infuſion of hempſeed; but is found in other vegetable infuſions, particularly that of tea-ſeed.

Fig. 4. is the volvox torquilla, or wryneck. At (a) is repreſented its divided ſtate; at (b) and (c) its natural ſtate: this is common to moſt vegetable infuſions, as is the following.

Fig. 5. is the volvox volutans, or the roller. At (a) the animal is ſeparated, and becomes two diſtinct beings, each ſwimming about and providing for itſelf; this is often the prey of another ſpecies of this genus, eſpecially while it is weak by this ſeparation, not being ſo active for ſome time till it can recover itſelf. At (c) the animal appears to be hurt on one ſide; this impreſſion in a little time is ſucceeded by another in the oppoſite ſide, as at (b), which ſoon occaſions a diviſion. At (d) is the ſide-view, and at (e) the front-view, of the natural ſhape of the animal.

Fig. 6. is the volvox oniſcus, or wood-louſe. At (a) is the natural ſhape of it, as it appears full of little hairs both at the head and tail; with thoſe at the head, it whirls the water about to draw its prey to it; the feet, which are many, are very viſible, but remarkably ſo in a ſide-view at (d). At (b) it is repreſented beginning to divide; and at (c) the animals are ready to part: in this ſtate, as if in exquiſite pain, they ſwim round and round, and to and fro, with uncommon velocity, violently agitated till they get aſunder. This was found in an infuſion of different kinds of pine-branches.

Fig. 7. is the volvox terebella, or the gimlet. This is one of the largeſt of the kind, and is very viſible to the naked eye. It moves along ſwiftly, turning itſelf round as it ſwims, juſt as if boring its way. (a) and (b) are two views of its natural ſhape, (c) ſhows the manner of its dividing. When they are ſeparated, the lower animal rolls very awkwardly along, till it gets a groove in the upper part. (d) repreſents one of them lying torpid, by means of the juice of the horſe-ſhoe geranium, with its fins extended. This animal is found in many infuſions, particularly of graſs or corn.

Fig. 8. is the volvox vorax, or glutton. This animal was found in an infuſion of the Tartarian pine; it varies its ſhape very much, contracting and extending its proboſcis, turning it to and fro, in various directions, as at a, b, c, d, e. It opens its proboſcis underneath the extremity, when it ſeizes its prey. The leſs active animals, that have lately been divided, ſuch as thoſe at fig. 3. (a), and at fig. 4. (a), ſerve it as food, when they come in its way: theſe it ſwallows down inſtantly, as it is repreſented at fig. 8. h and i. At (f) it is ready to divide, and at (g) it is divided; where the hinder-part of the divided animal has got a proboſcis or beak, to procure nouriſhment for itſelf, and ſoon becomes a diſtinct being from the fore-part.

Thus we have given as full an account as our limits would admit, of the moſt curious kinds of animalcules that have hitherto been obſerved. We cannot, however, diſmiſs this ſubject, without taking notice of ſome of the moſt remarkable hypotheſes which have been formed concerning their nature and origin.

48 Doctrine of equivocal generation exploded.

Before the invention of microſcopes, the doctrine of equivocal generation, both with regard to animals and plants of ſome kinds, was univerſally received: but this inſtrument ſoon convinced every intelligent perſon, that thoſe plants which formerly were ſuppoſed to be produced by equivocal generation aroſe from ſeeds, and the animals, in like manner, from a male and female. But as the microſcope threw light upon one part of nature, it left another involved in darkneſs; for the origin of the animalcula infuſoria, or of the ſpermatic animals already mentioned, remains as yet as much unknown as that of many other kinds was when the doctrine of equivocal generation reigned in full force.

49 Suppoſed diſcovery concerning generation.

The diſcovery of ſpermatic animalcules was thought to throw ſome light on the myſterious affair of generation itſelf, and theſe minute creatures were imagined to be each of them individuals of the ſame ſpecies with the parent. Here the infinite number of theſe animalcules was an objection, and the difficulty remained as great as before; for, as every one of theſe animalcules behoved to be produced from a male and female, to explain their origin by animalcular generation in the ſame manner, was only explaining generation by itſelf.

This hypotheſis, therefore, having proved unſatisfactory, others have been invented. M. Buffon, particularly, hath invented one, by which he at once annihilates the whole animalcular world; and in this he hath been followed by ſeveral very ingenious philoſophers. For a particular account of this, ſo far as it concerns generation, we muſt refer to that article; but as he gives ſuch a particular account of his having examined the human ſemen, that we cannot doubt of his accuracy, we ſhall here contraſt his account with that of Mr Liewenhoeck already mentioned.

50 **M. Buffon's experiments on the human ſemen.**

Having procured the ſeminal veſſels of a man who died a violent death, he extracted all the liquor from them while they were ſtill warm; and having examined a drop of it with a double microſcope, it had the appearance fig. 9. Large filaments appeared, which in ſome places ſpread out into branches, and in others intermingled with one another. Theſe filaments clearly appeared to be agitated by an internal undulatory motion, like hollow tubes, which contained ſome moving ſubſtance. He ſaw diſtinctly this appearance changed for that fig. 10. Two of theſe filaments, which were joined longitudinally, gradually ſeparated from each other in the middle, alternately approaching and receding, like two tenſe cords fixed by the ends, and drawn aſunder in the middle. Theſe filaments were compoſed of globules that touched one another, and reſembled a chaplet of beads. After this, he obſerved the filaments ſwelled in ſeveral places, and perceived ſmall globular bodies iſſue from the ſwelled parts, which had a vibratory motion like a pendulum. Theſe ſmall bodies were attached to the filaments by ſmall threads, which gradually lengthened as the bodies moved. At laſt, the ſmall bodies detached themſelves entirely from the filaments, drawing after them the ſmall thread, which looked like a tail. When a drop of the ſeminal liquor was diluted, theſe ſmall bodies moved in all directions very briſkly; and had he not ſeen them ſeparate themſelves from the filaments, he would, he ſays, have thought them to be animals. The ſeminal matter was at firſt too thick, but gradually became more fluid; and, in proportion as its fluidity increaſed, the filaments diſappeared, but the ſmall bodies became exceedingly numerous. Each of them had a long thread or tail attached to it, from which it evidently endeavoured to get free. Their progreſſive motion was extremely ſlow, during which they vibrated to the right and left, and at each vibration they had a rolling unſteady motion, in a vertical direction.

At the end of two or three hours, the ſeminal matter becoming ſtill more fluid, a greater number of theſe moving bodies appeared. They were then more free of incumbrances; their tails were ſhorter; their progreſſive motion was more direct, and their horizontal motion greatly diminiſhed. In five or ſix hours, the liquor had acquired almoſt all the fluidity it could acquire, without being decompoſed. Moſt of the ſmall bodies were now diſengaged from their threads; their figure was oval. They moved forward with conſiderable quickneſs, and, by their irregular motions backward and forward, they had now more than ever the appearance of animals. Thoſe that had tails adhering to them, ſeemed to have leſs vivacity than the others; and of thoſe that had no tails, ſome altered both their figure and their ſize. In twelve hours, the liquor had depoſited at the bottom of the vial a kind of aſh-coloured gelatinous ſubſtance, and the fluid at top was almoſt as tranſparent as water. The little bodies being now entirely freed from their threads, moved with great agility, and ſome of them turned round their centres. They alſo often changed their figures, from oval becoming round, and often breaking into ſmaller ones. Their activity always increaſed as their ſize diminiſhed. In 24 hours, the liquor had depoſited a greater quantity of gelatinous matter, which, being with ſome difficulty diluted in water, exhibited an appearance ſomewhat reſembling lace. In the clear ſemen itſelf only a few ſmall bodies were now ſeen moving; next day, theſe were ſtill farther diminiſhed; and after this nothing was to be ſeen but globules, without the leaſt appearance of motion. Moſt of the abovementioned appearances are ſhown fig. 10, 11, 12, 13, 14, 15, 16. Fig. 17. and 18. repreſent an appearance of the globules in another experiment, in which they arranged themſelves in troops, and paſſed very quickly over the field of the microſcope. In this experiment they were found to proceed from a ſmall quantity of gelatinous mucilage.

From theſe experiments, M. Buffon concludes, that what have been called ſpermatic animals, are not creatures really endowed with life, but ſomething proper to compoſe a living creature; and he diſtinguiſhes them by the name of *organic particles*. The ſame individual kinds of animals he declares he has found in the fluids ſeparated from the ovaria of females; and for the truth of this appeals to the teſtimony of Mr Needham, who was an eye witneſs of his experiments.

51 **Needham's experiments on the milt of the calmar.**

He alſo brings an additional proof of his doctrine from Mr Needham's obſervations on the milt of the *calmar*, a ſpecies of cuttle-fiſh. Here the ſpermatic animals, at leaſt what have the only appearance of life, are vaſtly larger than in any other creature, ſo as to be plainly viſible to the naked eye. When magnified, they appear as at fig. 19. and 20. *a*. Their firſt appearance is at fig. 19. *a* and *b*, when they reſemble ſprings incloſed in a tranſparent caſe. Theſe ſprings were equally perfect at firſt as afterwards; only in time they contracted themſelves, and became like a kind of ſcrew. The head of the caſe is a ſpecies of valve which opens outward, and through which every thing within may be forced out. It contains, beſides, another valve *b*, a little barrel *c*, and a ſpongy ſubſtance *d e*. Thus the whole machine conſiſts of an outer tranſparent cartilaginous caſe *a*, the ſuperior extremity of which is terminated by a round head formed by the caſe itſelf, and performs the office of a valve. This external caſe contains a tranſparent tube; which includes the ſpring, a piſton or valve, a little barrel, and a ſpongy ſubſtance. The ſcrew occupies the ſuperior part of the tube and caſe, the piſton and barrel are ſituated in the middle, and the ſpongy ſubſtance occupies the inferior part. Theſe machines pump the liquor of the milt; the ſpongy ſubſtance is full of this liquor; and before the animal ſpawns, the whole milt is only a congeries of theſe bodies which have ſucked up all the liquor of it. Whenever theſe ſmall machines are taken out of the body of the animal, and put in water, or expoſed to the air, they begin to act, as repreſented fig. 19. and 20; the ſpring mounts up, and is followed by the piſton, the barrel, and the ſpongy ſubſtance which contains the liquor: and, as ſoon as the ſpring and the tube in which it is contained begin to iſſue out of the caſe, the ſpring plaits, and the whole internal apparatus moves, till the ſpring, the piſton, and the barrel, have entirely eſcaped from the caſe. When this is effected, all the reſt inſtantly follow, and the milty liquor which had been pumped in, and confined in the ſpongy ſubſtance, runs out through the barrel.

Fig. 20.

52 **Concluſion againſt the exiſtence of animalcules**

According to this account, the milt of the calmar contains no animalcules; and therefore we may from analogy conclude, that the ſmall moving bodies which are to be ſeen in the ſemen of other animals, are not really creatures endowed with life. M. Buffon extends the analogy ſtill further; and concludes, that all the moving bodies which are to be found in the infuſions either of animal or vegetable ſubſtances are of a ſimilar nature. "To diſcover (ſays he) whether all the parts of animals, and all the ſeeds of plants, contained moving organic particles, I made infuſions of the fleſh of different animals, and of the ſeeds of more than 20 different ſpecies of vegetables; and after remaining ſome days in cloſe glaſſes, I had the pleaſure of ſeeing organic moving particles in all of them. In ſome they appeared ſooner, in others later; ſome preſerved their motions for months, and others ſoon loſt it. Some at firſt produced large moving globules reſembling animals, which changed their figure, ſplit, and became gradually ſmaller. Others produced only ſmall globules, whoſe motions were extremely rapid; and others produced filaments, which grew longer, ſeemed to vegetate, and then ſwelled and poured forth torrents of moving globules."

53 Baron Munchanſen's theory.

54 Diſproved by Mr Ellis.

This laſt obſervation gave riſe to a new ſyſtem. Baron Munchanſen, perceiving that the laſt mentioned moving globules, after moving for ſome time, began again to vegetate, concluded that they were firſt animals and then plants.—This ſtrange hypotheſis Mr Ellis has overturned in the paper already quoted; in which he aſſerts, that they are no other than the ſeeds of that genus of fungi called *mucor* or *mouldineſs*, and that their motion is owing to numbers of minute animalcules attacking them for food. "Having (ſays he), at the requeſt of Dr Linnæus, made ſeveral experiments on the infuſion of muſhrooms in water, in order to prove the theory of Baron Munchanſen, that their ſeeds are firſt animals, and then plants (which he takes notice of in his ſyſtem of Nature, p. 1326, under the genus of chaos, by the name of *chaos fungorum ſeminum*), it appeared evidently, that the ſeeds were put into motion by very minute animalcules, which proceeded from the putrefaction of the muſhroom: for, by pecking at theſe ſeeds, which are reddiſh, light, round bodies, they moved them about with great agility in a variety of directions; while the little animals themſelves were ſcarce viſible, till the food they had eaten had diſcovered them. The ſatisfaction I received from clearing up this point, led me into many other curious and intereſting experiments.

"The ingenious Mr Needham ſuppoſes theſe little tranſparent ramified filaments, and jointed or coralloid bodies, which the microſcope diſcovers to us on the ſurface of moſt animal and vegetable infuſions when they become putrid, to be zoophytes, or branched animals: but to me they appear, after a careful ſcrutiny with the beſt glaſſes, to be of that genus of fungi called *mucor*, or *mouldineſs*; many of which Michelius has figured, and Linnæus has accurately deſcribed.

"Their vegetation is ſo amazingly quick, that they may be perceived in the microſcope even to grow and feed under the eye of the obſerver.

"Mr Needham has pointed out to us a ſpecies that is very remarkable for its parts of fructification. (See Philoſophical Tranſactions, vol. xlv. tab. 5. fig. 3. a, A.). This, he ſays, proceeded from an infuſion of bruiſed wheat.

"I have ſeen the ſame ſpecies ariſe from the body of a dead fly, which was become putrid by lying floating for ſome time in a glaſs of water, where ſome flowers had been in the month of Auguſt 1768. This ſpecies of mucor ſends forth a maſs of tranſparent filamentous roots; from whence ariſe hollow ſtems, that ſupport little oblong oval ſeed-veſſels, with a hole on the top of each. From theſe I could plainly ſee minute globular ſeeds iſſue forth in great abundance with an elaſtic force, and turn about in the water as if they were animated.

"Continuing to view them with ſome attention, I could juſt diſcover that the putrid water which ſurrounded them was full of the minuteſt animalcula; and that theſe little creatures began to attack the ſeeds of the mucor for food, as I have obſerved before in the experiment on the ſeeds of the larger kind of fungi or muſhrooms. This new motion continued the appearance of their being alive for ſome time longer: but, ſoon after many of them aroſe to the ſurface of the water, remaining there without motion; and a ſucceſſion of them afterwards coming up, they united together in little thin maſſes, and floated to the edge of the water, remaining there quite inactive during the time of obſervation.

As this diſcovery cleared up many doubts which I had received from reading Mr Needham's learned diſſertation, I put into the glaſs ſeveral other dead flies, by which means this ſpecies of mucor was propagated ſo plentifully, as to give me an opportunity of frequently trying the ſame experiment to my full ſatisfaction.

"Laſtly, Theſe jointed coralloid bodies, which Mr Needham calls *chaplets* and *pearl necklaces*, I have ſeen frequently very diſtinctly. Theſe appear not only on an infuſion of bruiſed wheat when it becomes putrid, but on moſt other bodies when then they throw up a viſcid ſcum and are in a ſtate of putrefaction. Theſe, then, are evidently no more than the moſt common mucor, the ſeeds of which are every where floating in the air; and bodies in this ſtate afford them a natural proper ſoil to grow upon. Here they ſend downwards their fine tranſparent ramified roots into the moiſture which they float upon; and from the upper part of the ſcum, their jointed coralloid branches riſe full of ſeed into little grove-like figures. When a ſmall portion of theſe branches and ſeeds are put into a drop of the ſame putrid water upon which the ſcum floats, many of theſe millions of little animalcula with which it abounds, immediately ſeize them as food, and turn them about with a variety of motions, as in the experiments on the ſeeds of the common muſhrooms, either ſingly, or two or three ſeeds connected together; anſwering exactly to Mr Needham's deſcription, but evidently without any motion of their own, and conſequently not animated."

55 M. Buffon's opinion of different kinds of naimalcules.

M. Buffon, however, is not content with denying life only to thoſe beings where the ſigns of it are the moſt equivocal; but includes in the ſame rank of organic particles, almoſt every animal too ſmall to be diſcovered by the naked eye, and even ſome of thoſe whoſe motions are evidently perceptible to the eye. "Almoſt all microſcopic animals (ſays he), are of the ſame nature with the moving bodies in the ſeminal fluids and infuſions of animal and vegetable ſubſtances. The eels in paſte, in vinegar, &c. are all of the ſame nature, and derived from the ſame origin. There are, perhaps, as many beings that either live or vegetate, produced by a fortuitous aſſemblage of organic particles,

cles, as by a conſtant and ſucceſſive generation. Some of them, as thoſe of the calmar, are only a kind of machines, which, though exceedingly ſimple, are very active. Others, as the ſpermatic animalcules, ſeem to imitate the movements of animals. Others reſemble vegetables in their manner of growth and extenſion. There are others, as thoſe of blighted wheat, which at pleaſure can be made alternately either to live or die, and it is difficult to know to what they ſhould be compared. There are ſtill others, and in great numbers, which are at firſt a kind of animals, then become a ſpecies of vegetables, and again return alternately to their vegetable ſtate. The eels in paſte have no other origin than the union of the organic particles of the moſt eſſential part of the grain. The firſt eels that appear are certainly not produced by other eels; but though they are not propagated themſelves they fail not to engender other living eels. By cutting them with the point of a lancet, we diſcover ſmaller eels iſſuing in great numbers out of their bodies. The body of this animal ſeems to be only a ſheath or ſac, containing a multitude of ſmaller animals, which perhaps are other ſheaths of the ſame kind, in which the organic matter is aſſimilated into the form of eels."

56
His reaſoning inconcluſive.

Though we can by no means pretend to account for the appearance of theſe animalcules, yet we cannot help obſerving, that our ignorance of the cauſe of any phenomenon is no argument againſt its exiſtence. Though we are not able to account in a ſatisfactory manner for the origin of the native Americans, we ſuppoſe M. Buffon himſelf would reckon it abſurd to maintain that the Spaniards on their arrival there found only *organic particles* moving about in diſorder. The caſe is the very ſame with the eels in paſte. They are exceedingly minute in compariſon with us; but with the ſolar microſcope, Mr Baker has made them aſſume a more reſpectable appearance, ſo as to have a diameter of an inch and an half, or two inches, and a length proportionable. They ſwam up and down very briſkly; the motion of their inteſtines was plainly viſible; when the water dried up, they died with apparent agonies, and their mouths gaped very wide. Were we to find a creature of the ſize of this magnified eel, gaſping in a place where water had lately been, we certainly would never conclude it to be an *organic particle*, or a fortuitous aſſemblage of them; but a fiſh. Why then ſhould we conclude otherwiſe with regard to the eel while in its natural ſtate, than that it is a little fiſh? In reaſoning on this ſubject, we ought always to remember, that, however eſſential the diſtinction of bodies into great and ſmall may appear to us they are not ſo to the Deity; with whom, as Mr Baker well expreſſes himſelf, "an atom is as a world, and a world but as an atom."—Were the Deity to exert his power for a little, and give a natural philoſopher a view of a quantity of paſte filled with eels, from each of whoſe bodies the light was reflected as when it paſſes through a ſolar microſcope; inſtead of imagining them organic particles, the paſte would appear like a little mountain, he would probably look upon the whole as a monſtrous aſſemblage of ſerpents, and be afraid to come near them. Wherever, therefore, we diſcover beings to appearance endowed with the principle of ſelf-preſervation, or whatever elſe we make the characteriſtic of animals, neither the ſmallneſs of their ſize, nor the impoſſibility of our knowing how they come there, ought to cauſe us doubt of their being really animated.—At the ſame time, it muſt alſo be remembered, that *motion* is not always a characteriſtic of animal life, even though the moving bodies ſhould avoid one another, or any ſeeming obſtacle placed in their way. We know, that inanimate bodies, when electrified, will avoid others endowed with an electricity of the ſame kind, and adhere to thoſe which have the oppoſite one. As we are by no means acquainted with the utmoſt powers of electricity, but on the contrary, from what we do know of it have all the reaſon in the world to conclude that it can produce effects utterly beyond our comprehenſion, it is impoſſible for us to know what ſhare it may have in producing the motions obſerved in vegetable infuſions, or in the ſemen of animals.—We may alſo further obſerve, that though in Mr Ellis's experiment of the boiled potatoe he took it for granted that every ſeed of animal life would be deſtroyed by the boiling water, yet even this cannot be proved; nay, on the contrary, it hath been proved by undeniable experiments, that the human body itſelf hath endured a heat of 240 degrees of Fahrenheit (28 degrees above that of boiling water) without injury. The eggs of theſe animalcula might therefore be ſtrong enough to reſiſt the heat hitherto uſed in Mr Ellis's or any other experiment.

57
Animals ſometimes found living in ſolid bodies.

A conſiderable objection to the exiſtence of animalcules in the ſemen or any other part of animal bodies, muſt ariſe from the total excluſion of air which is found ſo neceſſary to the life of larger animals. Some inſtances, however, have been obſerved of large animals being found in ſuch ſituations as they could not poſſibly have enjoyed the leaſt benefit from the air for a great number of years; and in this ſtate they have not only lived, but lived much longer than they would otherwiſe have done.

In Toulon harbour and the road, are found ſolid hard ſtones, and perfectly entire; containing, in different cells, ſecluded from all communication with the air, ſeveral living ſhell-fiſh, of an exquiſite taſte, called *Dactyli*, i. e. Dates: to come at theſe fiſh, the ſtones are broken with mauls. Alſo, along the coaſt of Ancona, in the Adriatic, are ſtones uſually weighing about 50 pounds, and ſometimes even more; the outſide rugged and eaſily broken, but the inſide ſo hard, as to require a ſtrong arm and an iron maul to break them: within them, and in ſeparate niches, are found ſmall ſhell-fiſh, quite alive, and very palatable, called *Solenes* or *Cappe lunghe*. Theſe facts are atteſted by Gaſſendi, Blondel, Mayol, the learned biſhop of Sulturara, and more particularly by Aldrovandi a phyſician of Bologna. The two latter ſpeak of it as a common fact which they themſelves ſaw.

In the volume for 1719, of the Academy of Sciences at Paris, is the following paſſage:

"In the foot of an elm, of the bigneſs of a pretty corpulent man, three or four feet above the root, and exactly in the centre, has been found a live toad, middle ſized, but lean, and filling up the whole vacant ſpace: no ſooner was a paſſage opened, by ſplitting the wood, than it ſcuttled away very haſtily: a more firm and ſound elm never grew; ſo that the toad cannot be ſuppoſed to have got into it. The egg whence it was formed, muſt, by ſome very ſingular accident, have been lodged in the tree at its firſt growth. There the creature had lived without air, feeding on the ſubſtance of the tree, and growing only as the tree grew. This is atteſted by Mr Hubert, profeſſor of philoſophy at Caen."

The volume for the year 1731 has a ſimilar obſervation, expreſſed in theſe words:

"In 1719, we gave an account of a fact, which, though improbable, was well atteſted; that a toad had been found living and growing in the ſtem of a middling elm, without any way for the creature to come out or to have got in. M. Seigne, of Nantes, lays before the academy a fact juſt of the very ſame nature, except that, inſtead of an elm, it was an oak, and larger than the elm, which ſtill heightens the wonder. He judges, by the time requiſite for the growth of the oak, that the toad muſt have ſubſiſted in it, without air, or any adventitious aliment, during 80 or 100 years. M. Seigne ſeems to have known nothing of the fact in 1719."

With the two foregoing may be claſſed a narrative of Ambroſe Paré chief ſurgeon to Henry III. king of France, who, being a very ſenſible writer, relates the following fact, of which he was an eye witneſs:

"Being (ſays he) at my ſeat, near the village of Mendon, and over-looking a quarry-man whom I had ſet to break ſome very large and hard ſtones; in the middle of one we found a huge toad, full of life, and without any viſible aperture by which it could get there. I began to wonder how it received birth, had grown and lived; but the labourer told me, it was not the firſt time he had met with a toad, and the like creatures, within huge blocks of ſtones and no viſible opening or fiſſure."

Obſervations of living toads, found in very hard and entire ſtones, occur in ſeveral authors, particularly Baptiſt Fulgoſa doge of Genoa, the famous phyſicians Agricola and Horſtius, and lord Verulam: others give very ſpecious accounts of ſnakes, frogs, crabs, and lobſters, being found alive, incloſed within blocks of marble, rocks, and large ſtones.

An inſtance ſimilar to theſe, of the truth of which we have no reaſon to doubt, was obſerved in England in the year 1773, where a large toad was found in the middle of a piece of coal having not the leaſt viſible crack or fiſſure.

58 The ſubject ſtill obſcure.

Upon the whole, therefore, though philoſophers are not yet able to diſcover how theſe minute creatures are produced; yet, that there really are animals much ſmaller than what we can diſcern with our naked eye, ſeems to be indiſputable. The ſubject, however, is ſtill evidently obſcure, and will no doubt require the utmoſt attention of philoſophers, as well as further improvements in the conſtruction of microſcopes, fully to inveſtigate it.

Animalcula are ſaid to be the cauſe of various diſorders. The itch, from ſeveral experiments, is affirmed to be a diſorder ariſing from the irritations of a ſpecies of animalcula found in the puſtules of that ailment; whence the communication of it by contact from one to another is eaſily conceived, as alſo the reaſon of the cure being effected by cutaneous applications. On this foundation ſome have attributed the ſmall-pox and meaſles, and infectious diſeaſes; others the epilepſy, &c. to animalcules. Langius goes farther, and pretends to reduce all diſeaſes in general to the ſame principle. A late writer at Paris, who aſſumed the title of an Engliſh phyſician, has done more. He not only accounts for all diſeaſes, but for the operations of all medicines, from the hypotheſis of animalcules. He has peculiar animals for every diſeaſe; ſcorbutic animalcules, podagrical animalcules, variolous animalcules, &c. all at his ſervice. Journ. des Sçav. tom. lxxxii. p. 535, &c.

But as moſt diſcoveries in natural philoſophy have laid a foundation for the warm imaginations of ſome men to form viſionary theories, to the great prejudice of real knowledge; ſo thoſe relating to animalcula have been drawn in, however improperly, to ſupport the moſt whimſical and chimerical ſyſtems.

Animalcules Inviſible.—Naturaliſts ſuppoſe another ſpecies or order of inviſible animalcules, *viz.* ſuch as eſcape the cognizance even of the beſt microſcopes, and give many probable conjectures in relation to them. Reaſon and analogy give ſome ſupport to the exiſtence of infinite imperceptible animalcules. The naked eye, ſay ſome, takes in from the elephant to the mite; but there commences a new order reſerved only for the microſcope, which comprehends all theſe from the mite to thoſe 27 millions of times ſmaller; and this order cannot be yet ſaid to be exhauſted, if the microſcope be not arrived at its laſt perfection. See further on this ſubject the article Microscope.

ANIMATED, or Animate, in a general ſenſe, denotes ſomething endowed with animal life. It alſo imports a thing to be impregnated with vermin or animalcules.

Animated Horſe-hairs. See *Horse-Hairs.*

ANIMATION ſignifies the informing an animal body with a ſoul.—The different hypotheſes of phyſicians and philoſophers, concerning the time of animation, have had their influence on the penal laws made againſt artificial abortions; it having been made capital to procure miſcarriage in the one ſtate, while in the other it was only deemed a venial crime. The emperor Charles V. by a conſtitution publiſhed in 1532, put the matter on another footing; inſtead of the diſtinction of an animated and unanimated fœtus, he introduced that of vital and non-vital fœtus, as a thing of more obvious and eaſy deciſion, and not depending on any ſyſtem either of creation, traduction, or infuſion. Accordingly a fœtus is ſaid, in a legal ſenſe, to be animated, when it is perceived to ſtir in the womb; which uſually happens about the middle of the term of geſtation.

ANIME, in heraldry, a term uſed when the eyes of a rapacious creature are borne of a different tincture from the creature itſelf.

Anime, a reſin exſuding from the trunk of a large American tree, called by Piſo *jetaiba*, by the Indians *courbaril*, (a ſpecies of Hymenæa). This reſin is of a tranſparent amber colour, a light agreeable ſmell, and little or no taſte. It diſſolves entirely, but not very readily, in rectified ſpirit of wine; the impurities, which are often in large quantity, remaining behind. The Brazilians are ſaid to employ anime in fumigations for pains and aches proceeding from a cold cauſe: with us, it is rarely, if ever, made uſe of for any medicinal purpoſes.

ANIMETTA, among eccleſiaſtical writers, denotes

notes the cloth wherewith the cup of the euchariſt is covered.

ANINGA, in commerce, a root which grows in the Antilles iſlands, and is pretty much like the China plant. It is uſed by ſugar-bakers for refining the ſugar.

ANJOU, a province and duchy of France, bounded on the eaſt by Touraine, on the ſouth by Poictou, on the weſt by Bretagne, and on the north by Maine. It is 70 miles in length, and in breadth 60. Through this province run five navigable rivers: the Loire, which divides it into two parts; the Vienne, the Toue, the Maienne, and the Sarte.

The air is temperate, and the country agreeably diverſified with hills and meadows. There are 33 foreſts of oak-trees mixed with beech. The country produces white-wine, wheat, barley, rye, oats, peaſe, beans, flax, hemp, walnuts, and ſome cheſnuts. In Lower Anjou they make cyder. There are fruit-trees of all kinds, and paſture proper for horſes. The greateſt riches of the province conſiſt in cows, oxen, and ſheep. There are ſeveral coal and iron mines; and yet there are but two forges in the whole province. There are quarries of marble and of ſlate; as well as quarries of white ſtone, proper for building, on the ſide of the river Loire. Here are alſo ſeveral ſaltpetre-works and ſome glaſs-houſes. The remarkable towns, beſides Angers the capital, are Saumur, Briſac, Pons de Cea, La Fleche, and Beaufort.

ANIO, (Cicero, Horace, Priſcian); Anien, (Statius); now *il Teverone:* a river of Italy, which falls into the Tiber, three miles to the north of Rome, not far from Antemnæ. It riſes in a mountain near Treba, (Pliny); and, running through the country of the Æquiculi, or Æqui, it afterwards ſeparated the Latins from the Sabines; but nearer its mouth, or confluence, it had the Sabines on each ſide. It forms three beautiful lakes in its courſe, (Pliny). In the territories of Tibur it falls from a great height, and there forms a very rapid cataract; hence the epithet *præceps*, and hence the ſteam cauſed by its fall, (Horace). *Anienus* is the epithet formed from it, (Virgil, Propertius): *Anienus* is alſo the god of the river, (Propertius, Statius).

ANISUM, or Aniſe. See Pimpinella.

ANKER, a liquid meaſure at Amſterdam. It contains about 32 gallons Engliſh meaſure.

ANKLE, in anatomy, the joint which connects the foot to the leg.—We have an account of the menſes being regularly evacuated at an ulcer of the ankle, *Edin. Med. Obſ.* vol. iii. art. 29.

ANN, or Annat, in Scots law, is half a year's ſtipend, which the law gives to the executors of Miniſters of the church of Scotland, over and above what was due to the miniſter himſelf, for his incumbency.

ANNA, one of the three principalities into which Arabia deſerta is divided.

Anna, one of the chief cities of the above principality, and formerly a famed mart-town, is ſituated in Lat. 33. 57. and E. Long. 42. 10. on the river Euphrates, in a fruitful and pleaſant ſoil. It has two ſtreets, which are divided by the river. That on the Meſopotamia ſide is about two miles long, but thinly peopled, and by none but tradeſmen; that on the oppoſite ſide is about ſix miles in length, and it is there that the principal inhabitants of the city dwell. Every houſe has ſome ground belonging to it; and theſe grounds are loaded with noble fruit-trees, as lemons, oranges, citrons, quinces, figs, dates, pomegranates, olives, all very large and in great plenty. Some of the flat grounds are ſown with corn and other grain, which yields likewiſe a conſiderable crop. This city is the common rendezvous of all the robbers that infeſt the country, and from which they diſperſe themſelves into all parts of the Deſart. Here they meet to conſult; here they hold their grand council, and deliberate where to rob next with ſucceſs. It is with great difficulty that the Turkiſh aga, and the janiſſaries, who are kept here, can levy the tribute impoſed by the Turks on all the commodities carried through this city, which is one of the great thorough-fares for the paſſing of the caravans that go to and from Aleppo, Tripoli, Damaſcus, Bagdad, and ſome other parts of the Turkiſh empire.

Anna Comnena. See Comnena.

ANNABON. See Annobon.

ANNALE, in the Church of Rome, a term applied to the maſſes celebrated for the dead during a whole year.

ANNALIS clavus, the nail which the Prætor, Conſul, or Dictator, drove into the wall of Jupiter's temple annually upon the Ides of September, to ſhow the number of years. But this cuſtom was ſuperſeded by reckoning years by conſulſhips. The ceremony was ſometimes performed to avert the plague, &c.

ANNALS, in matters of literature, a ſpecies of hiſtory, which relates events in the chronological order wherein they happened. They differ from perfect hiſtory in this, that annals are but a bare relation of what paſſes every year, as a journal is of what paſſes every day; whereas hiſtory relates not only the tranſactions themſelves, but alſo the cauſes, motives, and ſprings of actions. Annals require nothing but brevity; hiſtory demands ornament.—Cicero informs us of the origin of annals. To preſerve the memory of events, the *Pontifex Maximus*, ſays he, wrote what paſſed each year, and expoſed it on tables in his own houſe, where every one was at liberty to read; this they called *annales maximi;* and hence the writers who imitated this ſimple method of narrating facts were called *annaliſts.*

ANNAN, the capital of Annandale, a diviſion of Dumfriesſhire in Scotland; a ſmall town, containing 500 or 600 inhabitants, and ſituated on a river of the ſame name, in W. Long. 3°. N. Lat. 54. 40. This place, which is a royal borough, has ſome trade in wine, and exports annually between 20 and 30,000 Wincheſter buſhels (10 and 15,000 bolls) of corn. Veſſels of about 250 tons can come within half a mile of the town; and of 60, as high as the bridge; which conſiſts of five arches, defended by a gateway. A fabric for carding and ſpinning of cotton has lately been erected, and the town begins to increaſe. Here was formerly a caſtle; which was built by the Bruces after they became lords of Annandale. Upon the death of David II. the ſon of King Robert, in 1371, this caſtle (Lochmaben), and the lordſhip of Annandale, came to Thomas Randolf Earls of Murray, and went with his ſiſter Agnes to the Dunbars, Earls of March: after their forfeiture it went to the Douglaſſes, who alſo loſt it by the ſame fate; and then having come to

Alexander Duke of Albany, he, for rebelling againſt his brother King James III. and plundering the fair of Lochmaben in 1484, was alſo forfeit. Since which time it continued in the hands of the King, and became the great key of the weſt border.

The ſtewarty or diſtrict of Annandale, of which Lochmaben caſtle was the chief fortalice, is a fertile vale, 24 miles long and about 14 miles broad: from its vicinity to England, and the continual incurſions and predatory wars of the borderers, the greateſt part of it was uncultivated and common: but ſince the beginning of the preſent century, or rather within the laſt thirty years, all theſe waſtes and commons have been divided and brought into culture, and the country has aſſumed a new appearance; which may be aſcribed not only to the diviſion of the commons, but likewiſe to the improvement made in the roads, and particularly in the great weſtern road from Edinburgh to London by Moffat, Gratney, and Carlyſle, running through this vale, and carried on by ſome gentlemen of the country, after they had obtained an act of parliament for levying a toll to defray the expence of making and keeping it in repair.

Annandale formed a part of the Roman province of Valentia; and Severus's wall ending here, it abounds with Roman ſtations and antiquities. The camps at Birrens in Middlebie, and on the hill of Burnſwork, are ſtill entire, and their form is preſerved; and the traces and remains of a military road are now viſible in different parts of the country. The ruins of the houſe or caſtle of Auchincaſs, in the neighbourhood of Moffat, once the ſeat of that potent baron, Thomas Randolph, Earl of Murray, Lord of Annandale, and Regent of Scotland, in the minority of David II. covers above an acre of ground, and even now conveys an idea of the plan and ſtrength of the building. The ancient caſtle of Comlongan formerly belonging to the Murrays, Earls of Annandale, and now to Lord Stormont, is ſtill in a tolerable ſtate of preſervation; but except this caſtle and that of Hoddom, moſt of the other old fortalices and towers are now taken down, or in ruins.

Annandale is a marquiſate belonging to the Johnſtons, and the chief of the name.

ANNAND (William), dean of Edinburgh, in Scotland, the ſon of William Annand miniſter of Air, was born at Air in 1633. Five years after, his father was obliged to quit Scotland with his family, on account of their loyalty to the king, and adherence to the epiſcopal government eſtabliſhed by law in that country. In 1651, young Annand was admitted a ſcholar in Univerſity college in Oxford; and though he was put under the care of a preſbyterian tutor, yet he took all occaſions to be preſent at the ſermons preached by the loyal divines in and near Oxford. In 1656, being then bachelor of arts, he received holy orders from the hands of Dr Thomas Fulwar, biſhop of Ardfert or Kerry in Ireland, and was appointed preacher at Weſton on the green near Biceſter in Oxfordſhire, where he met with great encouragement from Sir Francis Norris lord of that manor. After he had taken his degree of maſter of arts, he was preſented to the vicarage of Leighton-Buzzard in Bedfordſhire; where he diſtinguiſhed himſelf by his edifying manner of preaching, till 1662, when he went into Scotland, in quality of chaplain to John Earl of Middleton the king's high-commiſſioner to the church of that kingdom. In the latter end of the year 1663, he was inſtituted to the tolbooth church at Edinburgh, and from thence was removed ſome years after to the trone church of that city, which is likewiſe a prebend. In April 1676, he was nominated by the king to the deanery of Edinburgh; and in 1685, he commenced Doctor of Divinity in the univerſity of St Andrew's. He wrote, 1. *Fides Catholica*, or The Doctrine of the Catholic Church in eighteen grand Ordinances, referring to the word, ſacraments, and prayer, in purity, number, and nature, catholically maintained, and publicly taught againſt heritics of all ſorts. Lond. 1661-2, 4to. 2. Solutions of many proper and profitable queſtions, ſuitable to the nature of each Ordinance, &c. printed with the Fides Catholica. 3. *Panem Quotidianem*; or A ſhort Diſcourſe tending to prove the legality, decency, and expediency, of ſet forms of prayers in the Churches of Chriſt, with a particular Defence of the Book of Common Prayer of the Church of England. Lond. 1661, 4to. 4. *Pater Noſter*, Our Father; or The Lord's Prayer explained, the ſenſe thereof, and duties therein, from Scripture, Hiſtory, and the Fathers, methodically cleared, and ſuccinctly opened. Lond. 1670, 8vo. 5. *Myſterium Pietatis*, or The Myſtery of Godlineſs, &c. Lond. 1672, 8vo. 6. *Doxologia*, or Glory to the Father, the Church's Hymn, reduced to glorifying the Trinity. Lond. 1672, 8vo. 7. *Dualitas*, or A twofold ſubject diſplayed and opened, conduceable to godlineſs and peace in order: firſt *Lex loquens*, the honour and dignity of magiſtracy, with the duties thereupon, &c. Secondly, *Duorum Unitas*, or The agreement of magiſtracy and miniſtry at the election of the honourable magiſtrates at Edinburgh, and opening of the Dioceſan Synod of the Reverend Clergy there. Edin. 1674, 4to. Dr Annand died the 13th of June 1689, and was honourably interred in the Grey-Friars church in Edinburgh.

ANNANO, a ſtrong fort of Italy, in the duchy of Milan. It has been twice taken by the French; but was reſtored to the duke of Savoy in 1706. It is ſeated on the river Tanaro, in E. Long. 8. 30. N. Lat. 44. 40.

ANNAPOLIS, the capital of Maryland, in North America; ſaid to be the wealthieſt town of its ſize in America. Situated at the mouth of the river Severn, about 30 miles ſouth of Baltimore. It was formerly known by the name of Severn, and received its preſent name in 1694, when it was made a port town, and the reſidence of a collector and naval officer. The houſes are generally large and elegant. The ſtreets generally diverge from the ſtate houſe like the radii of a circle, the ſtate houſe is the nobleſt building of the kind in America. W. Long. 78. 10. N. Lat. 39. 25.

ANNAPOLIS ROYAL, a town of Nova Scotia, is ſeated in the bay of Fundy; and, though a mean place, was formerly the capital of the province. It has one of the fineſt harbours in America, capable of containing 1000 veſſels at anchor in the utmoſt ſecurity. The place is alſo protected by a fort and garriſon. At the bottom of the harbour is a point of land, which divides two rivers; and on each ſide there are pleaſant meadows, which in ſpring and autumn are covered with all ſorts of freſh-water fowl. There is a trade carried on by the Indians with furs, which they exchange for European goods. W. Long. 64. 5. N. Lat. 45. 10.

Annates. Annealing.

ANNATES, among eccleſiaſtical writers, a year's income of a ſpiritual living.

Theſe were, in ancient times, given to the Pope through all Chriſtendom, upon the deceaſe of any biſhop, abbot, or pariſh-clerk, and were paid by his ſucceſſor. At the Reformation they were taken from the Pope, and veſted in the king; and, finally, Queen Anne reſtored them to the church, by appropriating them to the augmentation of poor livings.

ANNEALING, by the workmen called *nealing*, is particularly uſed in making glaſs: it conſiſts in placing the bottles, &c. whilſt hot, in a kind of oven, or furnace, where they are ſuffered to cool gradually; they would otherwiſe be too brittle for uſe.—Metals are rendered hard and brittle by hammering: they are therefore made red hot, in order to recover their malleability; and this is called *nealing*.

The difference between unannealed and annealed glaſs, with reſpect to brittleneſs, is very remarkable. When an unannealed glaſs-veſſel is broken, it often flies into a ſmall powder, with a violence ſeemingly very unproportioned to the ſtroke it has received. In general, it is in greater danger of breaking from a very ſlight ſtroke than from one of ſome conſiderable force. One of thoſe veſſels will often reſiſt the effects of a piſtol-bullet dropt into it from the height of two or three feet; yet a grain of ſand falling into it, will make it burſt into ſmall fragments. This takes place ſometimes immediately on dropping the ſand into it: but often the veſſel will ſtand for ſeveral minutes after, ſeemingly ſecure; and then, without any new injury, it will fly to pieces. If the veſſel be very thin, it does not break in this manner, but ſeems to poſſeſs all the properties of annealed glaſs.

The ſame phenomena are ſtill more ſtrikingly ſeen in glaſs drops or tears. They are globular at one end, and taper to a ſmall tail at the other. They are the drops which fall from the melted maſs of glaſs on the rods on which the bottles are made. They drop into the tubs of water which are uſed in the work; the greater part of them burſt immediately in the water. When thoſe that remain entire are examined, they diſcover all the properties of unannealed glaſs in the higheſt degree. They will bear a ſmart ſtroke on the thick end without breaking; but if the ſmall tail be broken, they burſt into ſmall powder with a loud exploſion. They appear to burſt with more violence, and the powder is ſmaller in an exhauſted receiver than in the open air. When they are annealed, they loſe thoſe properties.

Glaſs is one of thoſe bodies which increaſe in bulk when paſſing from a fluid to a ſolid ſtate. When it is allowed to cryſtallize regularly, the particles are ſo arranged, that it has a fibrous texture: it is elaſtic, and ſuſceptible of long continued vibrations; but when a maſs of melted glaſs is ſuddenly expoſed to the cold, the ſurface cryſtallizes, and forms a ſolid ſhell round the interior fluid parts: this prevents them from expanding when they become ſolid. They, therefore, have not the opportunity of a regular cryſtallization; but are compreſſed together with little mutual coheſion: On the contrary, they preſs outward to occupy more ſpace, but are prevented by the external cruſt. In conſequence of the effort of expanſion in the internal parts, the greater number of glaſs drops burſt in cooling; and thoſe which remain entire are not regularly cryſtallized. A ſmart ſtroke upon them communicates a vibration to the whole maſs, which is nearly ſynchronous in every part; and therefore the effort of expanſion has little more effect than if the body were at reſt; but the ſmall tail and the ſurface only are regularly cryſtallized. If the tail be broken, this communicates a vibration along the cryſtallized ſurface, without reaching the internal parts. By this they are allowed ſome expanſion; and overcoming the coheſion of the thin outer ſhell, they burſt it and are diſperſed in powder.

Annealing.

In an unannealed glaſs-veſſel the ſame thing takes place. Sometimes the vibration may continue for a conſiderable time before the internal parts overcome the reſiſtance. If the veſſel be very thin, the regular cryſtallization extends through the whole thickneſs; or at leaſt the quantity of compreſſed matter in the middle is ſo inconſiderable, as to be incapable of burſting the external plate.

By the proceſs of annealing, the glaſs is kept for ſome time in a ſtate approaching to fluidity; the heat increaſes the bulk of the cryſtallized part, and renders it ſo ſoft, that the internal parts have the opportunity of expanding and forming a regular cryſtallization.

A ſimilar proceſs is now uſed for rendering kettles and other veſſels of caſt-iron leſs brittle: of it the ſame explanation may be given. The greater number of metals diminiſh in bulk when they paſs from a fluid to a ſolid ſtate; iron, on the contrary, expands.

When caſt-iron is broken, it has the appearance of being compoſed of grains: forged or bar iron appears to conſiſt of plates. Forged iron has long been procured, by placing a maſs of caſt-iron under large hammers, and make it undergo violent and repeated compreſſion. A proceſs is now uſed for converting caſt-iron into forged, by heat alone. The caſt-iron is placed in an air-furnace, and kept for ſeveral hours in a degree of heat, by which it is brought near to a fluid ſtate. It is then allowed to cool gradually, and is found to be converted into forged-iron. This proceſs is conducted under a patent; although, if Reaumur's experiments upon caſt-iron be conſulted, it will appear not to be a new diſcovery.

By theſe experiments it is aſcertained, that if caſt-iron be expoſed for any length of time to a heat conſiderably below its melting point, the texture and properties are not changed: but if it be kept in a heat near the melting point, the ſurface ſoon becomes lamellated like forged-iron; and the lamellated ſtructure extends farther into the maſs in proportion to the length of time in which it is expoſed to that degree of heat. When it is continued for a ſufficient time, and then allowed to cool gradually, it is found to poſſeſs the lamellated ſtructure throughout.

Caſt-iron, then, is brittle, becauſe it has not had the opportunity of cryſtallizing regularly. When it is expoſed to cold while fluid, the ſurface becoming ſolid, prevents the inner parts from expanding and arranging themſelves into regular cryſtals. When caſt-iron is brought near to the melting-point, and continued for a ſufficient length of time in that degree of heat, the particles have the opportunity of arranging themſelves into that form of cryſtals by which forged-iron is diſtinguiſhed, and by which it poſſeſſes coheſion and all its properties.

There appears, therefore, to be no other eſſential difference between forged and caſt iron, except what ariſes from the cryſtallization. Caſt-iron is indeed often not ſufficiently purified from other ſubſtances which are mixed with the calx. It appears alſo to contain a conſiderable quantity of calx unreduced; for during the proceſs for converting it into forged-iron by heat alone, a pale flame riſes from the metal till near the end of the proceſs. This is owing to fixed air which the heat forces off from the calx. The expulſion of this air reduces the calx, and thereby frees the metal from that injurious mixture.

That this explanation of the annealing of iron is probable, appears alſo from the well-known fact of forged-iron being incomparably more difficult of fuſion than caſt-iron. A piece of forged iron requires a very violent heat to melt it; but when it is reduced to a ſmall powder, it melts in a much lower degree of heat. Iron diminiſhes in bulk when it paſſes into a fluid ſtate, while moſt other metals increaſe in volume. The expanſion which heat occaſions in bringing them to their melting point, will be favourable to their fluidity, by gradually bringing the particles to the ſame ſtate of ſeparation in which they are when the maſs is fluid; but the expanſion of iron by heat removes it farther from that ſtate, and keeps it in the ſtate which is favourable to the continuance of it in a cryſtallized form. It will not melt till the heat expand it ſo much that the coheſion of cryſtallization be overcome. When it is reduced to a minute powder before it be expoſed to the heat, it melts ſooner. The cryſtals having been deſtroyed, that coheſion has no effect in preventing it from paſſing into a ſtate of fluidity.

Upon the ſame principles may be explained the almoſt peculiar property of welding poſſeſſed by iron, and and the converſion of forged iron into ſteel.

But perhaps they may alſo be applied to platina, a metal which has lately gained much attention. It poſſeſſes ſome of the properties of iron. It is ſtill more difficult of fuſion than that metal. It is ſuſceptible of being welded. The natural grains of it can ſcarcely be melted in the focus of the moſt powerful burning glaſs; but when it is diſſolved in aqua regia, and precipitated by the vegetable alkali, it has been melted in ſmall globules by the blow-pipe. When precipitated by ſal ammoniac, it has been melted in a conſiderable maſs in the heat of a furnace; but it is ſaid to be hard and brittle.

Many attempts have been made to procure a maſs of it in a malleable ſtate, but without ſucceſs. It is ſaid that the proceſs is now diſcovered by a chemiſt in Spain. The treatment of the metal is probably very ſimple. Perhaps it only conſiſts in precipitating it in a minute powder from aqua regia, expoſing it to ſtrong heat which melts it, and keeping it for ſome time in a ſtate nearly fluid, that it may, like iron, cryſtallize regularly: by this it will poſſeſs all its metallic properties.

ANNE, Queen of Great-Britain, daughter of James II. when Duke of York, was born in 1664, and married to Prince George of Denmark in 1683, by whom ſhe had ſeveral children, but ſurvived them all. Upon the death of William III. March 8, 1702, ſhe ſucceeded to the throne, and to a war with France, which was proſecuted under her reign by the great Duke of Marlborough, with more glory than profit to the nation. She effected the long wiſhed-for union between England and Scotland, which took place May 1ſt, 1707; and dying Auguſt 1ſt, 1714, was ſucceeded by George Lewis Auguſtus Elector of Hanover, as the direct deſcendant from James I. by his daughter Elizabeth queen of Bohemia.

St Ann's Day, a feſtival of the Chriſtian church, celebrated by the Latins on the 26th of July, but by the Greeks on the 9th of December. It is kept in honour of Anne, or Anna, mother of the Virgin Mary.

ANNECY, a city of Savoy, ſeated between Chamberry and Geneva, on the banks of a lake of the ſame name, from whence run ſeveral brooks, which flow through the town, and uniting at length form a river. There are piazzas in moſt of the ſtreets of the town, which ſerve to ſhelter the inhabitants from rain. It has ſeveral collegiate and pariſh churches, as well as convents for men and women. The lake is about nine miles long and four broad. E. Long. 6. 12. N. Lat. 45. 53.

ANNESLEY (Arthur), Earl of Angleſey, and lord privy ſeal in the reign of King Charles II. was the ſon of Sir Francis Anneſley, Bart. Lord Mount Morris, and Viſcount Valentia, in Ireland; and was born at Dublin on the 10th of July 1614. He was for ſome time at the univerſity of Oxford, and afterwards ſtudied the law at Lincoln's-Inn. He had a conſiderable ſhare in the public tranſactions of the laſt century: for in the beginning of the civil war he ſat in the parliament held at Oxford; but afterwards became reconciled to the oppoſite party, and was ſent commiſſioner to Ulſter, to oppoſe the deſigns of the rebel Owen Roe Oneal. He engaged in ſeveral other affairs with great ſucceſs. He was preſident of the council of ſtate after the death of Oliver, and was principally concerned in bringing about the Reſtoration: ſoon after which King Charles II. raiſed him to the dignity of a Baron, by the title of Lord Anneſley, of Newport Pagnel, Bucks; and a ſhort time after, he was made Earl of Angleſey. During that reign he was employed in ſome very important affairs, was made treaſurer of the navy, and afterwards lord privy-ſeal. In October 1680, his lordſhip was charged by one Dangerfield, in an information delivered upon oath, at the bar of the houſe of commons, with endeavouring to ſtifle evidence in relation to the Popiſh plot, and to promote the belief of a Preſbyterian one. The uneaſineſs he received from this attack did not prevent his ſpeaking his opinion freely of thoſe matters in the houſe of lords, particularly in regard to the Popiſh plot. About the ſame time he anſwered the Lord Caſtlehaven's Memoirs, in which that nobleman endeavoured to paint the Iriſh rebellion in the lighteſt colours; and a ſharp diſpute was raiſed, which ended in the ſeals being taken from him. He was a perſon of great abilities, had uncommon learning, and was well acquainted with the conſtitution and laws of England. He wrote, beſides his Animadverſions on Caſtlehaven's Memoirs, 1. The Privileges of the Houſe of Lords and Commons ſtated. 2. A Diſcourſe on the Houſe of Lords. 3. Memoirs. 4. The Hiſtory of the Troubles in Ireland, from the rebellion in 1641 till the reſtoration. 5. Truth Unveiled, in behalf of the Church of England;—and ſome other works. He died in April 1686, in the 73d year of his age; and was ſucceeded by his ſon James.

Annexation, Annihilation.

ANNEXATION, in law, a term uſed to imply the uniting of lands or rents to the crown.

ANNIHILATION, the act of reducing any created being into nothing.

Chriſtians, Heathens, Jews, Siameſe, Perſians, divines, philoſophers, &c. have their peculiar ſyſtems, ſentiments, conjectures, not to ſay dreams, concerning annihilation; and we find great diſputes among them about the reality, the poſſibility, the means, meaſures, prevention, ends, &c. of annihilation.

The firſt notions of the production of a thing from, or reduction of it to, nothing, Dr Burnet ſhows, aroſe from the Chriſtian theology; the words *creation* and *annihilation*, in the ſenſe now given to them, having been equally unknown to the Hebrews, the Greeks, and the Latins.

The ancient philoſophers in effect denied all annihilation as well as creation, reſolving all the changes in the world into new modifications, without ſuppoſing the production of any thing new, or deſtruction of the old. By daily experience, they ſaw compounds diſſolved; and that in their diſſolution nothing periſhed but their union or connection of parts: when in death the body and ſoul were ſeparated, the man they held was gone, but that the ſpirit remained in its original the great ſoul of the world, and the body in its earth from whence it came; theſe were again wrought by nature into new compoſitions, and entered new ſtates of being which had no relation to the former.

The Perſian bramins hold, that after a certain period of time, conſiſting of 71 joogs, God not only annihilates the whole univerſe, but every thing elſe, angels, ſouls, ſpirits, and all, by which he returns to the ſame ſtate he was in before the creation; but that, having breathed a while, he goes to work again, and a new creation ariſes, to ſubſiſt 71 joogs more, and then to be annihilated in its turn. Thus they hold there have been almoſt an infinite number of worlds: but how many joogs are elapſed ſince the laſt creation, they cannot certainly tell; only in an almanac written in the Shanſcrit language in 1670, the world is ſaid to be then 3,892,771 years old from the laſt creation.

The Siameſe heaven is exactly the hell of ſome Socinians and other Chriſtian writers; who, ſhocked with the horrible proſpect of eternal torments, have taken refuge in the ſyſtem of annihilation. This ſyſtem ſeems countenanced by Scripture; for that the words *death*, *deſtruction*, and *periſhing*, whereby the puniſhment of the wicked is moſt frequently expreſſed in Scripture, do moſt properly import annihilation and an utter end of being. To this Tillotſon anſwers, that theſe words, as well as thoſe correſponding to them in other languages, are often uſed, both in Scripture and other writings, to ſignify a ſtate of great miſery and ſuffering, without the utter extinction of the miſerable. Thus God is often ſaid in Scripture to bring deſtruction on a nation, when he ſends judgments upon them, but without exterminating or making an end of them. So, in other languages, it is frequent, by *periſhing*, to expreſs a perſon's being made miſerable; as in that known paſſage in Tiberius's letter to the Roman ſenate: *Ita me dii, deæque omnes, pejus perdant, quam hodie perire me ſentio.* As to the word *death*, a ſtate of miſery which is as bad or worſe than death may properly enough be called by that name; and thus the puniſhment of wicked men after the day of judgment is in the book of Revelations frequently called the *ſecond death*.

Annihilation.

Some Chriſtian writers allow a long time of the moſt terrible torments of ſinners; and after that ſuppoſe that there ſhall be an utter end of their being. Of this opinion Irenæus appears to have been; who, according to M. du Pin, taught that the ſouls, at leaſt of the wicked, would not ſubſiſt eternally; but that, after having undergone their torments for a certain period, they would at laſt ceaſe to be at all. But Tillemont, Petit, Didier, and others, endeavour to defend Irenæus from this imputation, as being too favourable to the wicked.

It has been much diſputed among divines, whether, at the conſummation of all things, this earth is to be annihilated, or only purified, and fitted for the habitation of ſome new order of beings. Gerard in his Common Places, and Hakewil in his Apology, contend earneſtly for a total abolition or annihilation. Ray, Calmet, and others, think the ſyſtem of renovation or reſtitution more probable, and more conſonant to Scripture, reaſon, and antiquity. The fathers who have treated on the queſtion are divided; ſome holding that the univerſe ſhall not be annihilated, but only its external face changed; others aſſerting, that the ſubſtance of it ſhall be deſtroyed.

How widely have the ſentiments of mankind differed as to the poſſibility and impoſſibility of annihilation! According to ſome, nothing ſo difficult; it requires the infinite power of the Creator to effect it: ſome go further, and ſeem to put it out of the power of God himſelf. According to others, nothing ſo eaſy: Exiſtence is a ſtate of violence; all things are continually endeavouring to return to their primitive nothing; it requires no power at all; it will do itſelf; nay, what is more, it requires an infinite power to prevent it.

Many authors conſider preſervation as a continual reproduction of a thing, which, ſubſiſting no longer of itſelf, would every moment return into nothing. Gaſſendi on the contrary aſſerts, that the world may indeed be annihilated by the ſame power which firſt created it, but that to continue it there is no occaſion for any power of preſervation.

Some divines, of which number the learned Biſhop King ſeems to be, hold annihilation for the greateſt of all evils, worſe than even the utmoſt torments of hell-flames; while others, with ſome of the eaſtern philoſophers, acknowledge annihilation for the ultimate pitch of happineſs human nature is capable of; that ſovereign good, that abſolute beatitude, ſo long vainly ſought for by the philoſophers, is found here. No wonder it had been ſo long concealed; for who would have thought of looking for the *ſummum bonum*, where others have placed the ſum of miſery?

The ſaid prelate propoſes it as a queſtion, Whether ſuffering eternal torments be a greater evil than not exiſting? He thinks it highly probable, that the damned will be ſuch fools, that, feeling their own miſery in the moſt exquiſite degree, they will rather applaud their own conduct, and chooſe to be, and to be what they are, rather than not to be at all; fond of their condition, however wretched, like people enraged, they will perſiſt in their former ſentiments without opening their eyes to their folly, and perſevere by way of indignation and revenge. Mr Bayle refutes him on this head; but might, one would think, have ſaved himſelf the trouble.

The Talapoins hold it the ſupreme degree of happineſs to have the ſoul totally annihilated, and freed from the burden and ſlavery of tranſmigrations. They ſpeak of three Talapoins, who, after a great number of tranſmigrations, became gods; and when arrived at this ſtate, procured this further reward of their merit to be annihilated. The ultimate reward of the higheſt perfection man can arrive at is *nieurepan*, or annihilation; which at length is granted to thoſe who are perfectly pure and good, after their ſouls have wandered many thouſand years through various bodies.

ANNI NUBILES, in law denotes the marriageable age of a woman, viz. after ſhe has arrived at twelve.

ANNIVERSARY, the annual return of any remarkable day. Anniverſary days, in old times, more particularly denoted thoſe days in which an office was yearly performed for the ſouls of the deceaſed, or the martyrdom of the ſaints was yearly celebrated in the church.

ANNOBON, a ſmall iſland of Africa, on the coaſt of Loango, belonging to the Portugueſe. It lies in E. Long. 5. 10. S. Lat. 1. 50. and receives its name from being diſcovered on New-year's day. According to Pyrard, it is about five or ſix French leagues in compaſs; but Bandrand ſays, it is ten leagues round. Here are two high mountains, the tops of which being continually covered with clouds, occaſion frequent rains. On the ſouth-eaſt of the iſland are two rocks; one of which is low, and upon a level with the ſurface of the ſea; the other higher and larger, but both dangerous in the night to ſhipping; but between them the channel is deep and clear. Theſe rocks are inhabited by vaſt numbers of birds, ſo tame, that the ſailors frequently catch them with their hands. On the ſame ſide of the iſland is a convenient watering-place at the foot of a rivulet, which tumbles from the mountains down to a valley covered with orange and citron trees, &c. and affording a pleaſant and refreſhing ſhade; but the road on the north-weſt ſide is difficult and dangerous, though moſt frequented by ſhips who have no intention of touching upon the continent. In either place it is difficult to take in a ſufficient quantity of water, on account of the violent breakings of the ſea, and a ſtone intrenchment erected by the negroes, from which they annoy all ſtrangers that attempt to land. The true road for ſhipping lies on the north-eaſt ſide, where they may anchor in ſeven, ten, thirteen, or ſixteen fathoms, on a fine ſand cloſe to the land, oppoſite to the village where the negroes have thrown up their intrenchments.

The climate is wholeſome, and the air clear and ſerene for the greateſt part of the year. Every part of the iſland is watered by pleaſant brooks, and freſh-water ſprings, which, however, at the new and full moons, or in all high tides acquire a brackiſhneſs. The banks of every rivulet are covered with palms, whence the inhabitants extract their wine by inciſion. Here a number of fertile valleys, which produce Turkey corn, rice, millet, yams, potatoes, &c. and afford paſture for abundance of oxen, ſheep, goats, &c. Poultry and fiſh alſo abound here; but the only mercantile production is cotton, which is eſteemed equal in quality to any produced in India, though the quantity is ſmall.

In the year 1605, the Dutch admiral Matelief found 200 negroes, and two Portugueſe, on Annobon, moſt of them able to bear arms, expert in the uſe of them, and trained up in military diſcipline. La Croix ſays, it has a town oppoſite to the road that contains above 100 houſes, the whole ſurrounded by a parapet. Moſt of their dwellings are cane-huts. In the whole iſland there is not a ſingle houſe built of ſtone, and only two of wood, which belong to the Portugueſe. All the inhabitants are meanly clothed; the women go bare-headed, and have alſo the upper part of the body naked, modeſty being defended by a piece of linen wrapt under their ſtomach, and falling down in the form of a petticoat, or wide apron to the knees. As to the men, they wear only a linen girdle round the loins, with a ſmall flap before. The women carry their children on their backs, and ſuckle them over the ſhoulder. All the inhabitants are ſubject to the Portugueſe governor, who is the chief perſon in the iſland; at the ſame time that the negroes have their own chief, ſubordinate to him. They are all rigid catholics, having been either compelled or perſuaded by the arguments of the Portugueſe to embrace, and, like all other converts, they are bigotted in proportion to the novelty of their belief, and their ignorance of the true tenets.

ANNO DOMINI, i. e. the year of our Lord; the computation of time from our Saviour's incarnation.

ANNOMINATION, in rhetoric, the ſame with what is otherwiſe called *paronomaſia*. See PARONOMASIA.

ANNONA, in Roman antiquity, denotes proviſion for a year, of all ſorts, as of fleſh, wine, &c. but eſpecially of corn. Annona is likewiſe the allowance of oil, ſalt, bread, fleſh, corn, wine, hay, and ſtraw, which was annually provided by the contractors for the maintenance of an army.

ANNONA, the *Cuſtard Appæ*: A genus of the polygynia order, belonging to the polyandria claſs of plants; and in the natural method ranking under the 52d order, *Coadunatæ*. The characters are: The *calyx* is a triphyllous perianthium: The *corolla* conſiſts of ſix heart-ſhaped petals: The *ſtamina* have ſcarcely any filaments; the antheræ are numerous, ſitting on the receptaculum: The *piſtillum* has a roundiſh germen; no ſtyli; the ſtigmata obtuſe and numerous: The *pericarpium* is a large roundiſh, unilocular berry covered with a ſcaly bark: The *ſeeds* are numerous.

Species. 1. The reticulata, or cuſtard-apple, is a native of the Weſt-Indies, where it grows to the height of 25 feet, and is well furniſhed with branches on every ſide: the bark is ſmooth, and of an aſh colour; the leaves are of a light green, oblong, and have ſeveral deep tranſverſe ribs or veins, ending in acute points; the fruit is of a conical form, as large as a tennis-ball, of an orange colour when ripe, having a ſoft, ſweet, yellowiſh pulp, of the conſiſtence of a cuſtard, from whence it has its name. 2. The muricata, or ſour-ſop, rarely riſes above 20 feet high, and is not ſo well furniſhed with branches as the other; the leaves are broader, have a ſmooth ſurface without any furrows, and are of a ſhining green colour: the fruit is large, of an oval ſhape, irregular, and pointed at the top, of a greeniſh yellow colour, and full of ſmall knobs on the outſide: the pulp is ſoft, white, and of a ſour and ſweet taſte, intermixed, having many oblong, dark-coloured ſeeds. 3. The ſquamoſa, or ſweet-ſop, ſeldom riſes higher than 15 feet, and well furniſhed with branches on every ſide. The leaves have an agreeable ſcent when rubbed; the fruit is roundiſh and ſcaly, and when ripe turns of a purple colour, and hath a ſweet pulp. 4. The paluſtris, or water-apple, grows to the height of 30 or 40 feet. The leaves are oblong, pointed, with ſome ſlender furrows, and have a ſtrong ſcent when rubbed; the fruit is ſeldom eaten but by negroes. The tree grows in moiſt places in all the Weſt-India iſlands. 5. The Cherimola, with oblong ſcaly fruit, is a native of Peru, where it is much cultivated for the fruit, and grows to be a very large tree well furniſhed with branches. The leaves are of a bright green colour, and much larger than thoſe of any of the other ſorts. The fruit is oblong, and ſcaly on the out ſide, of a dark purple colour when ripe, and the fleſh is ſoft and ſweet, intermixed with many brown ſeeds which are ſmooth and ſhining. 6. The Africana, with ſmooth bluiſh fruit. 7. The Aſiatica, or purple apple. This grows in ſome of the French iſlands, as alſo in Cuba, in great plenty. The trees riſe to the height of 30 feet or more. The fruit is eſteemed by the inhabitants of thoſe iſlands, who frequently give them to ſick perſons. 8. The triloba, or North-American annona, called by the inhabitants *papaw*, is a native of the Bahama iſlands, and likewiſe of Virginia and Carolina. The trunks of the trees are ſeldom bigger than the ſmall of a man's leg, and are about 10 or 12 feet high, having a ſmooth greeniſh-brown bark. In March, when the leaves begin to ſprout, the bloſſoms appear, conſiſting of ſix greeniſh white petals. The fruit grows in cluſters of three, and ſometimes of four together: when ripe, they are yellow, covered with a thin ſmooth ſkin, which contains a yellow pulp of a ſweet luſcious taſte. In the middle of this pulp, lie in two rows twelve ſeeds, divided by as many thin membranes. All parts of the tree have a rank, if not a fetid ſmell, nor is the fruit reliſhed by many except negroes. Theſe trees grow in low ſhady ſwamps, and in a very fat ſoil.

Culture. The laſt ſort will thrive in the open air in Britain, if it is placed in a warm and ſheltered ſituation; but the plants ſhould be trained up in pots, and ſheltered in winter for two or three years till they have acquired ſtrength. The ſeeds frequently remain a whole year in the ground; and therefore the earth in the pots ought not to be diſturbed, though the plants do not come up the firſt year. If the pots where thoſe plants are ſown are plunged into a new hot-bed, they will come up much ſooner than thoſe that are expoſed to the open air. All the other ſorts require to be kept in a warm ſtove, or they will not live in Britain.

ANNONÆ PREFECTUS, in antiquity, an extraordinary magiſtrate, whoſe buſineſs it was to prevent a ſcarcity of proviſion, and to regulate the weight and fineneſs of bread.

ANNONAY, a ſmall town of France, in the Upper Vivarais, ſeated on the river Deunye. E. Long. 4. 52. N. Lat. 45. 15.

ANNOT, a ſmall city in the mountains of Provence in France. E. Long. 7. 0. N. Lat. 44. 4.

ANNOTATION, in matters of literature, a brief commentary or remark, upon a book or writing, in order to clear up ſome paſſage, or draw ſome concluſion from it.

ANNOTTA. See ANOTTA.

ANNUAL, in a general ſenſe, an appellation given to whatever returns every year, or is always performed within that ſpace of time.

ANNUAL Motion of the Earth. See ASTRONOMY.

ANNUAL Leaves, are ſuch leaves as come up afreſh in the ſpring, and periſh in winter. Theſe ſtand oppoſed to *Ever-greens.*

ANNUAL Plants, called alſo ſimply *annuals,* are ſuch as only live their year, *i. e.* come up in the ſpring and die again in the autumn; and accordingly are to be recruited every year.

ANNUALRENT is uſed, in Scots law, to denote an yearly profit due by a debtor in a ſum of money to a creditor for the uſe of it.

Right of ANNUALRENT, in Scots law, the original method of burdening lands with an yearly payment for the loan of money, before the taking of intereſt for money was allowed by ſtatute.

ANNUEL OF NORWAY, of which mention is made in the acts of parliament of king James III. was an annual payment of an hundred marks Sterling, which the kings of Scotland were obliged to pay to the kings of Norway, in ſatisfaction for ſome pretenſions which the latter had to the Scottiſh kingdom, by virtue of a conveyance made thereof by Malcom Kenmore, who uſurped the crown after his brother's deceaſe. This annuel was firſt eſtabliſhed in 1266; in conſideration whereof the Norwegians renounced all title to the ſucceſſion of the iſles of Scotland. It was paid till the year 1461, when the annuel, with all its arrears, was renounced in the contract of marriage between king James III. and Margaret daughter of Chriſtian I. king of Norway, Denmark, and Sweden.

ANNUITY, a ſum of money, payable yearly, half yearly, or quarterly, to continue a certain number of years, for ever, or for life.

An annuity is ſaid to be an arrear, when it continues unpaid after it falls due. And an annuity is ſaid to be in reverſion, when the purchaſer, upon paying the price, does not immediately enter upon poſſeſſion; the annuity not commencing till ſome time after.

Intereſt on annuities may be computed either in the way of ſimple or compound intereſt. But compound intereſt being found moſt equitable, both for buyer and ſeller, the computation by ſimple intereſt is univerſally diſuſed.

I. *Annuities for a certain time.*

PROBLEM I. Annuity, rate, and time, given, to find the amount, or ſum of yearly payments, and intereſt.

RULE. Make 1 the firſt term of a geometrical ſeries, and the amount of 1 l. for a year the common ratio; continue this ſeries to as many terms as there are years in the queſtion; and the ſum of this ſeries is the amount of 1l. annuity for the given years; which multiplied by the given annuity, will produce the amount ſought.

EXAMPLE. An annuity of 40l. payable yearly, is forborn and unpaid till the end of 5 years; What will then be due, reckoning compound intereſt at five *per cent.* on all the payments then in arrear?

1 : 1.05

1 5 5 4 5
1 : 1.05 : 1.1025 : 1.157625 : 1. 21550625 ? whoſe ſum is 5.52563125 l. ; and 5.25563125 × 40 = 221.02525 = 221 l. 0s. 6d. the amount ſought.

The amount may alſo be found thus: Multiply the given annuity by the amount of 1 l. for a year; to the product add the given annuity, and the ſum is the amount in 2 years; which multiply by the amount of 1 l. for a year; to the product add the given annuity, and the ſum is the amount in 3 years, &c. The former queſtion wrought in this manner follows.

40 am. in 1 year.	126.1 am. in 3 years
1.05	1.05
42.00	132.405
40	40
82 am. in 2 years,	172.405 am. in 4 years.
1.05	1.05
86.10	181.02525
40	40
126.1 am. in 3 years.	221.02525 am. in 5 years.

If the given time be years and quarters, find the amount for the whole years, as above; then find the amount of 1 l. for the given quarters; by which multiply the amount for the whole years; and to the product add ſuch a part of the annuity as the given quarters are of a year.

If the given annuity be payable half yearly, or quarterly, find the amount of 1 l. for half a year or a quarter; by which find the amount for the ſeveral half-years or quarters, in the ſame manner as the amount for the ſeveral years is found above.

Prob. 2. Annuity, rate, and time given, to find the preſent worth, or ſum of money that will purchaſe the annuity.

Rule. Find the amount of the given annuity by the former problem; and then, by compound intereſt, find the preſent worth of this amount, as a ſum due at the end of the given time.

Examp. What is the preſent worth of an annuity of 40l. to continue 5 years, diſcounting at 5 *per cent.* compound intereſt?

By the former problem, the amount of the given annuity for 5 years, at 5 *per cent.* is 221.02525; and by compound intereſt, the amount of 1 l. for 5 years, at 5 *per cent.* is 1.2762815625.

And, 1.2762815625) 221.02525000 (173.179 = 173 l. 3s. 7d. the preſent worth ſought.

The preſent worth may be alſo found thus: By compound intereſt, find the preſent worth of each year by itſelf, and the ſum of theſe is the preſent worth ſought. The former example done in this way follows.

1.2762815625) 40.0000000000 (31.3410
1.21550625) 40.0000000 (32.9080
1.157625) 40.00000 (34.5535
1.1025) 40.000 (36.2811
1.05) 40.0 (38.0952

Preſent worth, 173.1788

If the annuity to be purchaſed be in reverſion, find firſt the preſent worth of the annuity, as commencing immediately, by any of the methods taught above; and then, by compound intereſt, find the preſent worth of that preſent worth, rebating for the time in reverſion; and this laſt preſent worth is the anſwer.

Examp. What is the preſent worth of a yearly penſion or rent of 75 l. to continue 4 years, but not to commence till 3 years hence, diſcounting at 5 *per cent?*

.05 : 1 :: 75 : 1500
1.05×1.05×1.05×1.05 = 1.21550625
1.21550625) 1500.00000 (1234.05371
1500
1234.05371

265.94629, preſent worth of the annuity, if it was to commence immediately.
1.05×1.05×1.05 = 1.157625 *L. s. d.*
1.157625) 265.94629 (229.7344 = 229 14 $8\frac{1}{4}$

Prob. 3. Preſent worth, rate and time given, to find the annuity.

Rule. By the preceding problem, find the preſent worth of 1 l. annuity for the rate and time given; and then ſay, As the preſent worth thus found to 1 l. annuity, ſo the preſent worth given to its annuity; that is, divide the given preſent worth by that of 1 l. annuity.

Examp. What annuity, to continue 5 years, will 173l. 3s. 7d. purchaſe, allowing compound intereſt at 5 *per cent.*

.05 : 1 :: 1 : 20l.
1.05×1.05×1.05×1.05×1.05 = 1.2762815625
1.2762815625) 20.00000000 (15.6705.
20
15.6705.

4.3295 preſent worth of 1 l. annuity
4.329) 173.179 (40l. annuity. *Anſ.*

II. *Annuities for ever, or freehold Eſtates.*

In freehold eſtates, commonly called *annuities in fee-ſimple*, the things chiefly to be conſidered are, 1. The annuity or yearly rent. 2. The price or preſent worth. 3. The rate of intereſt. The queſtions that uſually occur on this head will fall under one or other of the following problems.

Prob. 1. Annuity and rate of intereſt given to find the price.

As the rate of 1 l. to 1 l. ſo the rent to the price.

Examp. The yearly rent of a ſmall eſtate is 40l: What is it worth in ready money, computing intereſt $3\frac{1}{2}$ *per cent?*

As .035 : 1 :: 40 : 1142.857142 = *L.* 1142 17 $1\frac{1}{2}$.

Prob. 2. Price and rate of intereſt given, to find the rent or annuity.

As 1 l. to its rate, ſo the price to the rent.

Examp. A gentleman purchaſes an eſtate for 4000l. and has $4\frac{1}{2}$ *per cent.* for his money: Required the rent?

As 1 : .045 :: 4000 : 1 :: 180l. rent ſought.

Prob. 3. Price and rent given, to find the rate of intereſt.

As the price to the rent, ſo 1 to the rate.

Examp. An eſtate of 180l. yearly rent is bought for 4000l.: What rate of intereſt has the purchaſer for his money?

As 4000 : 180 :: 1 :.045 rate ſought.

Annuity.

Prob. 4. The rate of intereſt given, to find how many years purchaſe an eſtate is worth.

Divide 1 by the rate, and the quot is the number of years purchaſe the eſtate is worth.

Examp. A gentleman is willing to purchaſe an eſtate, provided he can have 2½ *per cent.* for his money: How many years purchaſe may he offer?

.025)1.000(40 years purchaſe. *Anſ.*

Prob. 5. The number of years purchaſe, at which an eſtate is bought or ſold, given, to find the rate of intereſt.

Divide 1 by the number of years purchaſe, and the quot is the rate of intereſt.

Examp. A gentleman gives 40 years purchaſe for an eſtate: What intereſt has he for his money?

40)1.000(.025 rate ſought.

The computations hitherto are all performed by a ſingle diviſion or multiplication, and it will ſcarcely be perceived that the operations are conducted by the rules of compound intereſt; but when a reverſion occurs, recourſe muſt be had to tables of annuities on compound intereſt.

Prob. 6. The rate of intereſt, and the rent of a freehold eſtate in reverſion, given, to find the preſent worth or value of the reverſion.

By Prob 1. find the price or preſent worth of the eſtate, as if poſſeſſion was to commence preſently; and then, by the Tables, find the preſent value of the given annuity, or rent, for the years prior to the commencement; ſubtract this value from the former value, and the remainder is the value of the reverſion.

Examp. A has the poſſeſſion of an eſtate of 130l. *per annum*, to continue 20 years; B has the reverſion of the ſame eſtate from that time for ever: What is the value of the eſtate, what the value of the 20 years poſſeſſion, and what the value of the reverſion, reckoning compound intereſt at 6 *per cent?*

By Prob. 1. .06)130.00(2166.6666 value of the eſtate.
By Tables, 1491.0896 val. of the poſſeſſion.

675.5770 value of the reverſion.

Prob. 7. The price or value of a reverſion, the time prior to the commencement, and rate of intereſt, given, to find the annuity or rent.

By the Tables, find the amount of the price of the reverſion for the years prior to the commencement; and then by Prob. 3. find the annuity which that amount will purchaſe.

Examp. The reverſion of a freehold eſtate, to commence 20 years hence, is bought for 675.577l. compound intereſt being allowed at 6 *per cent.*: Required the annuity or rent?

L.
By the Tables the amount of 675.577l. for 20 years, at 6 *per cent* is } 2166.6

By Prob. 2. 2166.6×.06 = 130.0 rent ſought.

III. *Life Annuities.*

The value of annuities for life is determined from obſervations made on the bills of mortality. Dr Halley, Mr Simpſon, and Monſ. de Moivre, are gentlemen of diſtinguiſhed merit in calculations of this kind.

Dr Halley had recourſe to the bills of mortality at Breſlaw, the capital of Sileſia, as a proper ſtandard for the other parts of Europe, being a place pretty central, at a diſtance from the ſea, and not much crowded with traffickers or foreigners. He pitches upon 1000 perſons all born in one year, and obſerves how many of theſe were alive every year, from their birth to the extinction of the laſt, and conſequently how many died each year, as in the firſt of the following tables; which is well adapted to Europe in general. But in the city of London, there is obſerved to be a greater diſparity in the births and burials than in any other place, owing probably to the vaſt reſort of people thither, in the way of commerce, from all parts of the known world. Mr Simpſon, therefore, in order to have a table particularly ſuited to this populous city, pitches upon 1280 perſons all born in the ſame year, and records the number remaining alive each year till none were in life.

Annuity.

It may not be improper, however, to obſerve, that however perfect tables of this ſort may be in themſelves, and however well adapted to any particular climate, yet the concluſions deduced from them muſt always be uncertain, being nothing more than probabilities, or conjectures drawn from the uſual period of human life. And the practice of buying and ſelling annuities on lives, by rules founded on ſuch principles, may be juſtly conſidered as a ſort of lottery or chance-work, in which the parties concerned muſt often be deceived. But as eſtimates and computations of this kind are now become faſhionable, we ſhall ſubjoin ſome brief account of ſuch as appear moſt material.

Dr Halley's Table on the bills of mortality at Breſlaw.

Age.	*Perſ. liv.*	*A.*	*Perſ. liv.*	*A.*	*Perſ. liv.*	*A.*	*Perſ. liv.*
1	1000	24	573	47	377	70	142
2	855	25	567	48	367	71	131
3	798	26	560	49	357	72	120
4	760	27	553	50	346	73	109
5	732	28	546	51	335	74	98
6	710	29	539	52	324	75	88
7	692	30	531	53	313	76	78
8	680	31	523	54	302	77	68
9	670	32	515	55	292	78	58
10	661	33	507	56	282	79	49
11	653	34	499	57	272	80	41
12	646	35	490	58	262	81	34
13	640	36	481	59	252	82	28
14	634	37	472	60	242	83	23
15	628	38	463	61	232	84	20
16	622	39	454	62	222	85	15
17	616	40	445	63	212	86	11
18	610	41	436	64	202	87	8
19	604	42	427	65	192	88	5
20	598	43	417	66	182	89	3
21	592	44	407	67	172	90	1
22	586	45	397	68	162	91	0
23	579	46	387	69	152		

Mr Simpſon's Table on the bills of mortality at London.

Age.	*Perſ. liv.*	*A.*	*Perſ. liv.*	*A.*	*Perſ. liv.*	*A.*	*Perſ. liv.*
0	1280	24	434	48	220	72	59
1	870	25	426	49	212	73	54
2	700	26	418	50	204	74	49
3	635	27	410	51	196	75	45
4	600	28	402	52	188	76	41
5	580	29	394	53	180	77	38
6	564	30	385	54	172	78	35
7	551	31	376	55	165	79	32
8	541	32	367	56	158	80	29
9	532	33	358	57	151	81	26
10	524	34	349	58	144	82	23
11	517	35	340	59	137	83	20
12	510	36	331	60	130	84	17
13	504	37	322	61	123	85	14
14	498	38	313	62	117	86	12
15	492	39	304	63	111	87	10
16	486	40	294	64	105	88	8
17	480	41	284	65	99	89	6
18	474	42	274	66	93	90	5
19	468	43	264	67	87	91	4
20	462	44	255	68	81	92	3
21	455	45	246	69	75	93	2
22	448	46	237	70	69	94	1
23	441	47	228	71	64	95	0

From the preceding tables the probability of the continuance or extinction of human life is eſtimated as follows.

1. The probability that a perſon of a given age ſhall live a certain number of years, is meaſured by the proportion which the number of perſons living at the propoſed age has to the difference betweeen the ſaid number and the number of perſons living at the given age.

Thus, if it be demanded, what chance a perſon of 40 years has to live ſeven years longer? from 445, the number of perſons living at 40 years of age in Dr Halley's table, ſubtract 377, the number of perſons living at 47 years of age, and the remainder 68, is the number of perſons that died during theſe 7 years; and the probability or chance that the perſon in the queſtion ſhall live theſe 7 years is as 377 to 68, or nearly as 5½ to 1. But, by Mr Simpſon's table, the chance is ſomething leſs than that of 4 to 1.

2. If the year to which a perſon of a given age has an equal chance of arriving before he dies, be required, it may be found thus: Find half the number of perſons living at the given age in the tables, and in the column of age you have the year required.

Thus, if the queſtion be put with reſpect to a perſon of 30 years of age, the number of that age in Dr Halley's table is 531, the half whereof is 265, which is ſound in the table between 57 and 58 years; ſo that a perſon of 30 years has an equal chance of living between 27 and 28 years longer.

3. By the tables, the premium of inſurance upon lives may in ſome meaſure be regulated.

Thus, the chance that a perſon of 25 years has to live another year, is, by Dr Halley's table, as 80 to 1; but the chance that a perſon of 50 years has to live a year longer is only 30 to 1. And, conſequently, the premium for inſuring the former ought to be to the premium for inſuring the later for one year, as 30 to 80, or as 3 to 8.

Prob. I. To find the value of an annuity of 1 l. for the life of a ſingle perſon of any given age.

Monſ. de Moivre, by obſerving the decreaſe of the probabilities of life, as exhibited in the table, compoſed an algebraic theorem or canon, for computing the value of an annuity for life; which canon we here lay down by way of

Rule. Find the complement of life; and, by the tables, find the value of 1 l. annuity for the years denoted by the ſaid complement; multiply this value by the amount of 1 l. for a year, and divide the product by the complement of life; then ſubtract the quot from 1; divide the remainder by the intereſt of 1 l. for a year; and this laſt quot will be the value of the annuity ſought, or, in other words, the number of years purchaſe the annuity is worth.

Examp. What is the value of an annuity of 1 l. for an age of 50 years, intereſt at 5 *per cent.*?

86
50 are given.
—
36 complement of life.
By the tables, the value is, 16.5468
Amount of 1 l. for a year, 1 .05

827340
165468

Complement of life, 36)17.374140(.482615
From unity, viz. 1.000000
Subtract .482615

Intereſt of 1 l. .05).517385(10.3477 value ſought.

By the preceding problem is conſtructed the following table.

The value of 1 l. annuity for a ſingle life.

Age.	3 per c.	3½ per c.	4 per c.	4½ per c.	5 per c.	6 per c.
9=10	19.87	18.27	16.88	15.67	14.60	12.80
8=11	19.74	18.16	16.79	15.59	14.53	12.75
7=12	19.60	18.05	16.64	15.51	14.47	12.70
13	19.47	17.94	16.60	15.43	14.41	12.65
6=14	19.33	17.82	16.50	15.35	14.34	12.60
15	19.19	17.71	16.41	15.27	14.27	12.55
16	19.05	17.59	16.31	15.19	12.20	12.50
5=17	18.90	17.46	16.21	15.10	14.12	12.45
18	18.76	17.33	16.10	15.01	14.05	12.40
19	18.61	17.21	15.99	14.92	13.97	12.35
4=20	18.46	17.09	15.89	14.83	13.89	12.30
21	18.30	16.96	15.78	14.73	13.81	12.20
22	18.15	16.83	15.67	14.64	13.72	12.15
23	17.99	16.69	15.55	14.54	13.64	12.10
3=24	17.83	16.56	15.43	14.44	13.55	12.00
25	17.66	16.42	15.31	14.34	13.46	11.95
26	17.50	16.28	15.19	14.23	13.37	11.90
27	17.33	16.13	15.04	14.12	13.28	11.80
28	17.16	15.98	14.94	14.02	13.18	11.75
29	16.98	15.83	14.81	13.90	13.09	11.65
30	16.80	15.68	14.68	13.79	12.99	11.60
2=31	16.62	15.53	14.54	13.67	12.88	11.50
32	16.44	15.37	14.41	13.55	12.78	11.40
33	16.25	15.21	14.27	13.43	12.67	11.35
34	16.06	15.05	14.12	13.30	12.56	11.25
35	15.86	14.89	13.98	13.17	12.45	11.15
36	15.67	14.71	13.82	13.04	12.33	11.05
37	15.46	14.52	13.67	12.90	12.21	11.00
38	15.29	14.34	13.52	12.77	12 09	10.90
1=39	15.05	14.16	13.36	12.63	11.96	10.80
40	14.84	13.98	13.20	12.48	11.83	10.70
41	14.63	13.79	13.02	12.33	11.70	10.55
42	14.41	13.59	12.85	12.18	11.57	10.45
43	14.19	13.40	12.68	12.02	11.43	10.35
44	13.96	13.20	12.50	11.87	11.29	10.25
45	13.73	12.99	12.32	11.70	11.14	10.10
46	13.49	12.78	12.13	11.54	10.99	10.00
47	13.25	12.56	11.94	11.37	10.84	9.85
48	13.01	12.36	11.74	11.19	10.68	9.75
49	12.76	12.14	11.54	11.00	10.51	9.60
50	12.51	11.92	11.34	10.82	10.35	9.45
51	12.26	11.69	11.13	10.64	10.17	9.30
52	12.00	11.45	10.92	10.44	9.99	9.20
53	11.73	11.20	10.70	10.24	9.82	9.00
54	11.46	10.95	10.47	10.04	9.63	8.85
55	11.18	10.69	10.24	9.82	9.44	8.70
56	10.90	10.44	10.01	9.61	9.24	8.55
57	10.61	10.18	9.77	9.39	9.04	8.35
58	10.32	9.91	9.52	9.16	8.83	8.20
59	10.03	9.64	9.27	8.93	8.61	8.00
60	9.73	9.36	9.01	8.69	8.39	7.80

The value of 1 l. annuity for a ſingle life.

A.	3 per c.	3½ per c.	4 per c.	4½ per c.	5 per c.	6 per c.
61	9.42	9.08	8.75	8.44	8.16	7.60
62	9.11	8.79	8.48	8.19	7.93	7.40
63	8.79	8.49	8.20	7.94	7.68	7.30
64	8.46	8.19	7.92	7.67	7.43	6.95
65	8.13	7.88	7.63	7.39	7.18	6.75
66	7.79	7.56	7.33	7.12	6.91	6.50
67	7.45	7.24	7.02	6.83	6.64	6.25
68	7.10	6.91	6.75	6.54	6.36	6.00
69	6.75	6.57	6.39	6.23	6.07	5.75
70	6.38	6.22	6.06	5.92	5.77	5.50
71	6.01	5.87	5.72	5.59	5.47	5.20
72	5.63	5.51	5.38	5.26	5.15	4.90
73	5.25	5.14	5.02	4.92	4.82	4.60
74	4.85	4.77	4.66	4.57	4.49	4.30
75	4.45	4.38	4.29	4.22	4.14	4.00
76	4.05	3.98	3.91	3.84	3.78	3.65
77	3.63	3.57	3.52	3.47	3.41	3.30
78	3.21	3.16	3.11	3.07	3.03	2.95
79	2.78	2.74	2.70	2.67	2.64	2.55
80	2.34	2.31	2.28	2.26	2.23	2.15

The above table ſhows the value of an annuity of one pound for a ſingle life, at all the current rates of intereſt; and is eſteemed the beſt table of this kind extant, and preferable to any other of a different conſtruction. But yet thoſe who ſell annuities have generally one and a half or two years more value, than ſpecified in the table, from purchaſers whoſe age is 20 years or upwards.

Annuities of this ſort are commonly bought or ſold at ſo many years purchaſe; and the value aſſigned in the table may be ſo reckoned. Thus the value of an annuity of one pound for an age of 50 years, at 3 *per cent.* intereſt is 12.51; that is 12l. 10s. or twelve and a half years purchaſe. The marginal figures on the left of the column of age ſerve to ſhorten the table, and ſignify, that the value of an annuity for the age denoted by them, is the ſame with the value of an annuity for the age denoted by the numbers before which they ſtand. Thus the value of an annuity for the age of 9 and 10 years is the ſame; and the value of an annuity for the age of 6 and 14, for the age of 3 and 24, &c. is the ſame. The further uſe of the table will appear in the queſtions and problems following.

QUEST. 1. A perſon of 50 years would purchaſe an annuity for life of 200l.: What ready money ought he to pay, reckoning intereſt at 4½ *per cent.?*

L.
By the table the value of 1 l. is 10.8
Multiply by 200

Value to be paid in ready money 2164.00 *Anſ.*

QUEST. 2. A young merchant marries a widow lady of 40 years of age, with a jointure of 300l. a-year, and wants to diſpoſe of the jointure for ready money: What ſum ought he to receive, reckoning intereſt at 3½ *per cent.?*

	L.
By the table the value of 1 l. is	13.98
	300
Value to be received in ready money	4194.00 *Anſ.*

PROB. 2. To find the value of an annuity for the joint continuance of two lives, one life failing, the annuity to ceaſe.

Here there are two caſes, according as the ages of the two perſons are equal or unequal.

1. If the two perſons be of the ſame age, work by the following

RULE. Take the value of any one of the lives from the table; multiply this value by the intereſt of 1 l. for a year; ſubtract the product from 2; divide the foreſaid value by the remainder; and the quot will be the value of 1 l. annuity, or the number of years purchaſe ſought.

EXAMP. What is the value of 100l. annuity for the joint lives of two perſons, of the age of 30 years each, reckoning intereſt at 4 *per cent?*

By the table, one life of 30 years is	14.68
Multiply by	.04
Subtract the product	5872
From	2.0000
Remains	1.4128

And 1.4128) 14.68 (10.39 value of 1l. annuity.
And 10.39×100=1039 the value ſought.

2. If the two perſons are of different ages, work as directed in the following

RULE. Take the values of the two lives from the table; multiply them into one another, calling the reſult the firſt product; then multiply the ſaid firſt product by the intereſt of 1 l. for a year, calling the reſult the ſecond product; add the values of the two lives, and from their ſum ſubtract the ſecond product; divide the firſt product by the remainder, and the quot will be the value of 1 l. annuity, or the number of years purchaſe ſought.

EXAMP. What is the value of 70l. annuity for the joint lives of two perſons, whereof one is 40 and the other 50 years of age, reckoning intereſt at 5 *per cent?*

By the table the value of 40 years is	11 83
And the value of 50 years is	10.35
Firſt product,	122.4405
Multiply by	.05
Second product,	6.122025
Sum of the two lives,	22.180000
Second product deduct,	6.122025
Remainder,	16.057975

And 16.057975) 122.4405 (7.62 value of 1 l. annuity.
70
533.40 value ſought.

PROB. 3. To find the value of an annuity upon the longeſt of two lives; that is, to continue ſo long as either of the perſons is in life.

RULE. From the ſum of the values of the ſingle lives ſubtract the value of the joint lives, and the remainder will be the value ſought.

EXAMP. What is the value of an annuity of 1 l. upon the longeſt of two lives, the one perſon being 30, and the other 40 years of age, intereſt at 4 *per cent?*

By the table, 30 years is	14.68
40 years is	13.20
	27.88
Value of their joint lives, by Prob. 2. Caſe 2. is,	9.62
Value ſought,	18.26

If the annuity be any other than 1 l. multiply the anſwer found as above by the given annuity.

If the two perſons be of equal age, find the value of their joint lives by Caſe 1. of Prob. 2.

PROB. 4. To find the value of the next preſentation to a living.

RULE. From the value of the ſucceſſor's life ſubtract the joint value of his and the incumbent's life, and the remainder will be the value of 1 l. annuity; which multiplied by the yearly income, will give the ſum to be paid for the next preſentation.

EXAMP. A enjoys a living of 100l. *per annum*, and B would purchaſe the ſaid living for his life after A's death: The queſtion is, What he ought to pay for it, reckoning intereſt at 5 *per cent.* A being 60, and B 25 years of age?

	L.
By the table, B's life is	13.46
Joint value of both lives, by Prob. 2. is	6 97
The value of 1 l. annuity,	6.49
Multiply by	100
Value of next preſentation,	649.00

The value of a direct preſentation is the ſame as that of any other annuity for life, and is found for 1 l. by the table; which being multiplied by the yearly income, gives the value ſought.

PROB. 5. To find the value of a reverſion for ever, after two ſucceſſive lives; or to find the value of a living after the death of the preſent incumbent and his ſucceſſor.

RULE. By Prob 3. find the value of the longeſt of the two lives, and ſubtract that value from the value of the perpetuity, and the remainder will be the value ſought.

EXAMP. A, aged 50, enjoys an eſtate or living of 100l. *per annum;* B, aged 30, is entitled to his lifetime of the ſame eſtate after A's death; and it is propoſed to ſell the eſtate juſt now with the burden of A and B's lives on it: What is the reverſion worth, reckoning intereſt at 4 *per cent?*

	L.
By the table, A's life of 50 is	11.34
B's life of 30 is	14.68
Sum,	26.02
Value of their joint lives, found by Prob. 2. Caſe 2. is	8.60
Value of the longeſt life,	17.42 ſub.
From the value of the perpetuity,	25.00
Remains the value of 1 l. reverſion,	7.58
Multiply by	100
Value of the reverſion,	758.00

Prob. 6. To find the value of the joint continuance of three lives, one life failing, the annuity to ceaſe.

Rule. Find the ſingle values of the three lives from the table; multiply theſe ſingle values continually, calling the reſult the product of the three lives; multiply that product by the intereſt of 1 l. and that product again by 2, calling the reſult the double product; then, from the ſum of the ſeveral products of the lives, taken two and two, ſubtract the double product; divide the product of the three lives by the remainder, and the quot will be the value of the three joint lives.

Examp. A is 18 years of age; B 34, and C 56: What is the value of their joint lives, reckoning intereſt at 4 *per cent.*?

By the table, the value of A's life is 16.1, of B's 14.12, and of C's 10.01.

$16.1\times14.12\times10.01=2275.6$, product of the three lives,

.04

91.024

2

182.048, double product.

Product of A and B, $16.1\times14.12\times227.33$

A and C, $16.1\times10.01=161.16$

B and C, $14.12\times10.00=141.34$

Sum of all, two and two, - 529.83

Double product ſubtract - - 182.048

Remainder - 347.782

And 347.782)2275.600(6.54 value ſought.

Prob. 7. To find the value of an annuity upon the longeſt of three lives.

Rule. From the ſum of the values of the three ſingle lives taken from the table, ſubtract the ſum of all the joint lives, taken two and two, as found by Prob. 2. and to the remainder add the value of the three joint lives, as found by Prob 6. and that ſum will be the value of the longeſt life ſought.

Examp. A is 18 years of age, B 34, and C 56: What is the value of the longeſt of theſe three lives, intereſt at 4 *per cent*?

By the table, the ſingle value of A's life is 16.1

ſingle value of B's life is 14.12

ſingle value of C's life is 10.01

Sum of the ſingle values, 40.23

By Prob. 2. the joint value of A and B is 10.76

joint value of A and C is 8.19

joint value of B and C is 7.65

Sum of the joint lives, 26.60

Remainder, - 13.63

By Prob. 6. the value of the 3 joint lives is 6.54

Value of the longeſt of the 3 lives, 20.17

Other problems might be added, but theſe adduced are ſufficient for moſt purpoſes. The reader probably may wiſh that the reaſon of the rules, which, it muſt be owned, are intricate, had been aſſigned; but this could not be done without entering deeper into the ſubject than was practicable in this place. See Chances.

Annuities (Borrowing upon); one of the methods employed by government for raiſing ſupplies.

Of this there are two methods; that of borrowing upon annuities for terms of years, and that of borrowing upon annuities for lives.

During the reigns of king William and queen Anne, large ſums were frequently borrowed upon annuities for terms of years, which were ſometimes longer and ſometimes ſhorter. In 1693, an act was paſſed for borrowing one million upon an annuity of 14 *per cent.* or of 140,000*l.* a year for 16 years. In 1691, an act was paſſed for borrowing a million upon annuities for lives, upon terms which in the preſent times would appear very advantageous. But the ſubſcription was not filled up. In the following year the deficiency was made good by borrowing upon annuities for lives at 14 *per cent.*, or at little more than ſeven years purchaſe. In 1695, the perſons who had purchaſed thoſe annuities were allowed to exchange them for others of 96 years, upon paying into the exchequer 63 pounds in the hundred; that is, the difference between 14 *per cent.* for life, and 14 *per cent.* for 96 years, was ſold for 63 pounds, or for four and a half years purchaſe. Such was the ſuppoſed inſtability of government, that even theſe terms procured few purchaſers. In the reign of queen Anne, money was upon different occaſions borrowed both upon annuities for lives and upon annuities for terms of 32, of 89, of 98, and of 99 years. In 1719, the proprietors of the annuities for 32 years were induced to accept in lieu of them South Sea ſtock to the amount of eleven and a half years purchaſe of the annuities, together with an additional quantity of ſtock equal to the arrears which happened then to be due upon them. In 1720, the greater part of the other annuities for terms of years both long and ſhort were ſubſcribed into the ſame fund. The long annuities at that time amounted to 666,821*l.* 8*s.* 3½*d.* a year. On the 5th of January, 1775, the remainder of them, or what was not ſubſcribed at that time, amounted only to 136,453*l.* 12*s.* 8*d.*

During the two wars which begun in 1739 and in 1755, little money was borrowed either upon annuities for terms of years, or upon thoſe for lives. An annuity for 98 or 99 years, however, is worth nearly as much money as a perpetuity, and ſhould, therefore, one might think, be a fund for borrowing nearly as much. But thoſe who, in order to make family ſettlements, and to provide for remote futurity, buy into the public ſtocks, would not care to purchaſe into one of which the value was continually diminiſhing; and ſuch people make a very conſiderable proportion both of the proprietors and purchaſers of ſtock. An annuity for a long term of years, therefore, though its intrinſic value may be very nearly the ſame with that of a perpetual annuity, will not find nearly the ſame number of purchaſers. The ſubſcribers to a new loan, who mean generally to ſell their ſubſcription as ſoon as poſſible, prefer greatly a perpetual annuity redeemable by parliament, to an irredeemable annuity for a long term of years of only equal amount. The value of the former may be ſuppoſed always the ſame, or very nearly the ſame; and it makes, therefore, a more convenient transferable ſtock than the latter.

During the two laſt mentioned wars, annuities, either for terms of years or for lives, were ſeldom granted but

Annuity. ‖ Annuity ‖ Annunciada.

as premiums to the ſubſcribers to a new loan, over and above the redeemable annuity or intereſt upon the credit of which the loan was ſuppoſed to be made. They were granted, not as the proper fund upon which the money was borrowed; but as an additional encouragement to the lender.

Annuities for lives have occaſionally been granted in two different ways; either upon ſeparate lives, or upon lots of lives, which in French are called *Tontines*, from the name of their inventor. When annuities are granted upon ſeparate lives, the death of every individual annuitant diſburthens the public revenue ſo far as it was affected by his annuity. When annuities are granted upon tontines, the liberation of the public revenue does not commence till the death of all the annuitants comprehended in one lot, which may ſometimes conſiſt of twenty or thirty perſons, of whom the ſurvivors ſucceed to the annuities of all thoſe who die before them; the laſt ſurvivor ſucceeding to the annuities of the whole lot. Upon the ſame revenue more money can always be raiſed by tontines than by annuities for ſeparate lives. An annuity, with a right of ſurvivorſhip, is really worth more than an equal annuity for a ſeparate life, and from the confidence which every man naturally has in his own good fortune, the principle upon which is founded the ſucceſs of all lotteries, ſuch an annuity generally ſells for ſomething more than it is worth. In countries where it is uſual for government to raiſe money by granting annuities, tontines are upon this account generally preferred to annuities for ſeparate lives. The expedient which will raiſe moſt money, is almoſt always preferred to that which is likely to bring about in the ſpeedieſt manner the liberation of the public revenue.

In France a much greater proportion of the public debts conſiſts in annuities for lives than in England. According to a memoir preſented by the parliament of Bourdeaux to the king in 1764, the whole public debt of France is eſtimated at twenty-four hundred millions of livres; of which the capital for which annuities for lives had been granted, is ſuppoſed to amount to three hundred millions, the eighth-part of the whole public debt. The annuities themſelves are computed to amount to thirty millions a-year, the fourth part of one hundred and twenty millions, the ſuppoſed intereſt of that whole debt. It is not the different degrees of anxiety in the two governments of France and England for the liberation of the public revenue, which occaſions this difference in their reſpective modes of borrowing; it ariſes altogether from the different views and intereſts of the lenders.

In Britain, the ſeat of government being in the greateſt mercantile city in the world, the merchants are generally the people who advance money to government. By advancing it they do not mean to diminiſh; but, on the contrary, to increaſe their mercantile capitals; and unleſs they expected to ſell with ſome profit their ſhare in the ſubſcription for a new loan, they never would ſubſcribe. But if by advancing their money they were to purchaſe, inſtead of perpetual annuities, annuities for lives only, whether their own or thoſe of other people, they would not always be ſo likely to ſell them with a profit. Annuities upon their own lives they would always ſell with loſs; becauſe no man will give for an annuity upon the life of another whoſe age and ſtate are nearly the ſame with their own, the ſame price which he would give for one upon his own. An annuity upon the life of a third perſon, indeed, is, no doubt, of equal value to the buyer and the ſeller; but its real value begins to diminiſh from the moment it is granted, and continues to do ſo more and more as long as it ſubſiſts. It can never, therefore, make ſo convenient a transferable ſtock as a perpetual annuity, of which the real value may be ſuppoſed always the ſame, or very nearly the ſame.

In France, the ſeat of government not being in a great mercantile city, merchants do not make ſo great a proportion of the people who advance money to government. The people concerned in the finances, the farmers-general, the receivers of the taxes which are not in farm, the court-bankers, &c. make the greater part of thoſe who advance their money in all public exigencies. Such people are commonly men of mean birth, but of great wealth, and frequently of great pride. They are too proud to marry their equals, and women of quality diſdain to marry them. They frequently reſolve, therefore, to live bachelors; and having neither any families of their own, nor much regard for thoſe of their relations, whom they are not always very fond of acknowledging, they deſire only to live in ſplendour during their own time, and are not unwilling that their fortune ſhould end with themſelves. The number of rich people, beſides, who are either averſe to marry, or whoſe condition of life renders it either improper or inconvenient for them to do ſo, is much greater in France than in England. To ſuch people, who have little or no care for poſterity, nothing can be more convenient than to exchange their capital for a revenue, which is to laſt juſt as long, and no longer than they wiſh it to do.

ANNUITY OF TIENDS, in Scots law, a certain proportion of the tiends of erected benefices formerly payable to the crown, but now gone into diſuſe.

ANNULAR, in a general ſenſe, ſomething in the form of, or reſembling, a ring. It is alſo a peculiar denomination of the fourth finger, commonly called the *ring-finger*.

ANNULET, in architecture, a ſmall ſquare member in the Doric capital, under the quarter-round.

Annulet is alſo a narrow flat moulding, which is common to divers places of the columns, as in the baſes, capitals, &c. It is the ſame member which Vitruvius calls a *fillet;* Palladio, a *liſtil* or *cincture;* Scamozzi, and Mr Brown, a *ſupercilium, liſt, timea, eye-brow, ſquare rabbit.* See ARCHITECTURE.

Annulet, a little circle, borne as a charge in coats-of-arms, as alſo added to them as a *difference.* Among the Romans it repreſented liberty and nobility. It alſo denotes ſtrength and eternity, by reaſon of its circular form.

When this figure is added as a difference, ſome authors aſſert, that it ſerves to remind the bearer to atchieve great actions.

ANNULLING, a term ſometimes uſed for cancelling or making void a deed, ſentence, or the like.

ANNUNCIADA, ANNUNTIADA, or ANNUNTIATA, an order of knighthood in Savoy, firſt inſtituted by Amadeus I. in the year 1409: their collar was of 15 links, interwoven one with another, in form of a true-lover's knot; and the motto, F. E. R. T. ſignifying, *Fortitudo ejus Rhodum tenuit.* Amadeus VIII. gave the name *Annunciada* to this order, which was formerly known by that of *the knot of love;* changing at the ſame time the image of St Maurice patron of Savoy, which hung at the collar, for that of the Virgin Mary; and, inſtead of the motto above-mentioned, ſubſtituting the words of the angel's ſalutation.

Annunciada is alſo the title of ſeveral religious orders, inſtituted at different times, and at different places, in honour of the annunciation. See the next article.

ANNUNCIATION, the tidings brought by the angel Gabriel to the Virgin Mary of the incarnation of Chriſt.

Annunciation is alſo a feſtival kept by the church on the 25th of March, in commemoration of theſe tidings. This feſtival appears to be of very great antiquity. There is mention made of it in a ſermon which goes under the name of *Athanaſius.* Others carry it up to the time of Gregory Thaumaturgus, becauſe there is a ſermon likewiſe attributed to him upon the ſame ſubject. But the beſt critics reject both theſe writings as ſpurious. However, it is certain this feſtival was obſerved before the time of the council of Trullo, in which there is a canon forbidding the celebration of all feſtivals in lent, excepting the Lord's day, and the feaſt of the annunciation: ſo that we may date its original from the ſeventh century.

In the Romiſh church, on this feaſt, the pope performs the ceremony of marrying or cloyſtering a certain number of maidens, who are preſented to him in the church, clothed in white ſerge, and muffled up from head to foot: An officer ſtands by, with purſes containing notes of fifty crowns for thoſe who make choice of marriage, and notes of a hundred for thoſe who chooſe to veil.

Annunciation is likewiſe a title given by the Jews to part of the ceremony of the paſſover.

ANNUNCIATOR, the name of an officer in the church of Conſtantinople. It was his buſineſs to inform the people of the feſtivals that were to be celebrated.

ANODYNE (from α privative, and οδυνω, *doleo;* or α neg. and ωδυνη, *pain);* a term applied to medicines which eaſe pain, and procure ſleep. They are divided into three ſorts, *viz.* 1. Paregorics, or ſuch as aſſuage pain. 2. Hypnotics, or ſuch as relieve by procuring ſleep. 3. Narcotics, or ſuch as eaſe the patient by ſtupifying him.

Opiates and Narcotics deſtroy ſenſation. Some hypnotics annd paregorics, as nitre, camphor, &c. procure eaſe and ſleep by removing the offending cauſe. Camphor is ſaid to be the beſt anodyne in nervous caſes and at the decline of fevers. The doſes of theſe medicines are generally regulated by the pulſe.

ANNOINTERS, a religious ſect in ſome parts of England, ſo called from the ceremony they uſed of anointing all perſons before they admitted them into their church. They founded their opinion of anointing upon the fifth of James, verſes 14 and 15.

ANOLYMPIADES, in antiquity, a name given by the Elians to thoſe Olympic games which had been celebrated under the direction of the Piſæans and Arcadians. The Elians claimed the ſole right of managing the Olympic games, in which they ſometimes met with competitors. The hundred and fourth Olympiad was celebrated by order of the Arcadians, by whom the Elians were at that time reduced very low: this, as well as thoſe managed by the inhabitants of Piſa, they called ανολυμπιαδας, that is, "unlawful Olympiads;" and left them out of their annals, wherein the names of their victors and other occurrences were regiſtered.

ANOMALISTICAL year, in aſtronomy, the time that the earth takes to paſs through her orbit: it is alſo called the *Periodical Year.* The ſpace of time belonging to this year is greater than the tropical year, on account of the proceſſion of the equinoxes. See Astronomy.

ANOMALOUS, a term applied to whatever is irregular, or deviates from the rule obſerved by other things of the like nature.

Anomalous *Verbs,* in grammar, ſuch as are not conjugated conformably to the paradigm of their conjugation. They are found in all languages. In Latin, the verb *lego* is the paradigm of the third conjugation; and runs thus, *lego, legis, legit:* By the ſame rule it ſhould be *fero, feris, ferit;* but we ſay *fero, fers, fert: fero,* then, is an anomalous verb. In Engliſh the irregularity relates often to the preter tenſe and paſſive participle: for example, *give,* were it formed according to rule, would make *gived* in the preter tenſe and paſſive participle: whereas in the former, it makes *gave,* and in the latter *given.*

ANOMALY, in aſtronomy, an irregularity in the motion of the planets, whereby they deviate from the aphelion or apogee.

ANOMIA, in zoology, a genus of inſects belonging to the order of vermes teſtacea. The ſhell is bivalve, and the valves are unequal. One valve is perforated near the hinge; affixed by that perforation to ſome other body. There are 25 ſpecies of the anomia; of which only two are natives of the Britiſh ſeas, *viz.* 1. The ephippium, with the habit of an oyſter; the one ſide convex, the other flat; perforated; adherent to other bodies, often to oyſter-ſhells, by a ſtrong tendinous ligature; colour of the inſide perlaceous. Size near two inches diameter. 2. The ſquammula, with ſhells reſembling the ſcales of fiſh; very delicate, and ſilvery; much flatted; perforated; very ſmall. Adheres to oyſters, crabs, lobſters, and ſhells. The ſpecies of this genus are commonly called *Beaked cockles.* No name has been given to the fiſh that inhabit it; for the recent ſhells of this kind are ſo very rare, that there is ſcarcely one to be found perfect. They are perhaps, as well as that which has given its form to the *cornu amonis,* inhabitants of the deepeſt parts of the ocean; conſequently it muſt be ſome extraordinary agitation of that great body of water that can bring them at all to our knowledge in their recent ſtate.

The foſſile ſpecies of the *Anomia* genus are uncommonly numerous in this iſland, in our chalk-pits and limeſtone quarries; and, in Glouceſterſhire, they are as common on the ploughed land as pebbles in other places.

ANOMOEANS, in eccleſiaſtical hiſtory, the name by which the pure Arians were called in the fourth century, in contradiſtinction to the Semi-Arians. The word is formed from the Greek, ανομοιος, *different, diſſimilar:* For the pure Arians aſſerted, that the Son was of a nature different from, and in nothing like

Anomorhomboidia || Anorexia.

that of the Father: whereas the Semi-Arians acknowledged a likeneſs of nature in the Son; at the ſame time that they denied, with the pure Arians, the conſubſtantiality of the World.—The Semi-Arians condemned the Anomœans in the council of Seleucia; and the Anomœans in their turn condemned the Semi-Arians in the councils of Conſtantinople and Antioch, eraſing the word ομοιος, *like*, out of the Formula of Rimini and that of Conſtantinople.

ANOMORHOMBOIDIA, in natural hiſtory, the name of a genus of ſpars; the word is derived from the Greek ανωμαλης *irregular*, and ρομβοιδης a *rhomboidal* figure. The bodies of this genus are pellucid cryſtalline ſpars of no determinate or regular external form, but always breaking into regularly rhomboidal maſſes; eaſily fiſſile, and compoſed of plates running both horizontally and perpendicularly thro' the maſſes, but cleaving more readily and evenly in an horizontal, than in a perpendicular direction: the plates being ever compoſed of irregular arrangements of rhomboidal concretions. Of this genus there are five known ſpecies. 1. A white, bright, and ſhattery one; found in great quantities in the lead-mines of Derbyſhire, Yorkſhire, and Wales. 2. A milk-white, opake, and ſhattery one, found in ſome parts of France, and very plentifully in Germany, and ſometimes in Wales and Scotland, and in the hills of Yorkſhire. 3. A hard, dull, and ſnow-white one, found in ſome of the mines in Derbyſhire, and in many of the northern countries. 4. A hard, grey and pellucid one, found in the lead-mines of Yorkſhire, and very common in Germany. And, 5. A pellucid and colourleſs one; this is found in the lead mines of Derbyſhire and Yorkſhire. All theſe in ſome degree have their double refraction of the iſland cryſtal. See Island-*Cryſtal*.

ANONIS, in botany. See Ononis.

ANONYMOUS, ſomething that is nameleſs, or of which the name is concealed. It is a term uſually applied to books that do not expreſs the author's name, or to authors whoſe names are unknown.

Anonymous, in Commerce.——Partnerſhips in trade in France are ſtyled anonymous, when they are not carried on under any particular name, but wherein each of the partners trades viſibly on his own account, and in his own name; after which all the partners give one another an account of their profit or loſs in trade. Theſe ſorts of partnerſhips are concealed, and known only to the parties themſelves.

Anonymous Partnerſhips in Trade, are alſo in France ſuch, wherein perſons of fortune and quality depoſit ſums of money, in order to ſhare of the profits and loſs. To this end thoſe who furniſh the capital have no trouble in carrying on the trade, nor do their names appear to be any way intereſted therein.

Anonymous, in law. The ſendiug anonymous letters demanding money, &c. is felony by the Black Act, 9. Geo. I. cap. 22.

ANOREXIA, anorexy, (from α neg. and ορεξις, *appetite*); a want of appetite, or a loathing of food. The diſorder is either original or ſymptomatic. When it is original, its cauſes are, bad diet, too free drinking, voraciouſneſs, &c.: In which caſes, a vomit or two of ipecacuanha may be taken; and temperance, a light but cordial nouriſhing diet, and daily exerciſe, perſiſted in, will generally effect a recovery. But it is more frequently a ſymptom of ſome other diſorder; and then the cure depends on the removal of the original one.

Anoſſi.

ANOSSI, a province of the iſland of Madagaſcar, lying between Lat. 23° 18 and 26° S. It is watered by many rivers, moſt of which run into the *Franchere*, *Ramevatte*, or *Immour*, the ſpring of which is in a mountain called *Manghage*, and diſcharges itſelf into the ſea in Lat. 25. 18 S. The mouth of this river is often ſtopped, and the courſe to the ſea interrupted, unleſs kept open by the overflowings of great rains and high tides. The water runs ſalt one league above the mouth, particularly in a free communication with the ſea. A lake, called *Ambou*, is formed at the mouth, half a league wide, with depth ſufficient for any ſhip if the mouth of the river was kept open. Next in bigneſs to the Franchere is the Manghaſia, which ſprings from a mountain called *Siliva*, and empties itſelf into the ſea, where large ſhips may ride at anchor. Crocodiles breed in theſe and all the other rivers of the iſland.

Between the two rivers above mentioned lies Cape St Romain, half a mile diſtant from the mouth of the Franchere, and which runs from the north-weſt ſix or ſeven leagues into the ſea. When the Cape is paſſed, the coaſt forms a great bay, in the ſhape of a croſs, which extends to the mouth of a river called *Dian Panouge*, or *Pitorah*. In the middle of this bay the land runs out, and almoſt forms a peninſula called *Tholangare*. Fort Dauphin lies to the north of this peninſula, and Port Dauphin over againſt it. This province has ſeveral other peninſulas and ſmall iſlands belonging to it. The country is beautiful; abounds in fruit-trees; is fertile in paſture for cattle; and, if carefully cultivated, would produce all the neceſſaries of life. It is ſurrounded by high mountains, which are covered with woods and ſhrubs; but, about four miles diſtant from Fort Dauphin, the adjacent hills are quite deſtitute of verdure. The French often dug in this neighbourhood, expecting to meet with mines of gold and ſilver, particularly in one mountain where ſeveral ſprings flow near each other and empty themſelves into a neighbouring river. In this river they found ſeveral ſtones and heaps intermixed with yellow clay, with a great quantity of black and white ſpangles ſhining like ſilver, which they carefully pounded and waſhed, but without effect. About 60 yards above theſe ſprings the graſs, and every ſort of vegetable, appears half dried and yellow, from a metalline ſulphur, which gives that aſpect; but the top of the mountain is covered with a freſh and beautiful verdure. It is ſaid that the Portugueſe found gold at the foot of this mountain on the north ſide, but that the place they had dug was filled up by the chiefs of the country after the Portugueſe had been driven out.

The province of Anoſſi is inhabited by three different ſorts of whites, and four ſorts of negroes. The whites are diſtinguiſhed by the names of *Rohandrians Anacandrians*, and *Ondzatſi*. The whites are diſtinguiſhed from the negroes by the general name of *Zaferamini*, or *Rahimini*; and the Rohandrians are diſtinguiſhed above the other whites. When they proceed to an election of a ſovereign, whom they call *Ompiandrian*, or *Dian Bahouache*; he is choſen from the Rohandrian race. Next to him the others hold the rank of princes, and are honoured as ſuch by all the reſt of the ſubjects. The Anacandrians are deſcendants of the chiefs, but who have degenerated, and are accounted the baſtards of princes, or thoſe who are deſcended from a Rohandrian and any inferior white or black woman. Theſe are likewiſe called by the name of *Ontempaſſemaca*, or people from the ſandy parts of Mecca, from whence, they ſay, came the Rohandrians. Both the Rohandrians and Anacandrians wear long hair, which hangs down in curls; and enjoy the privilege of killing beaſts. The Ondzatſi, or loweſt claſs of whites, are deſcended from the baſtards of the Anacandrians. Theſe are all fiſhermen, and are allowed to kill no land-animal except a chicken.

The four claſſes of negroes are named *Voadziri Lohavohits*, *Ontſoa*, and *Ondeves*. The Voadziri, the moſt powerful and the richeſt, are maſters of ſeveral vilages, and deſcended from the original lords of the country. They enjoy the privilege of killing beaſts, when at a diſtance from the whites, and no Rohandrian or Anacandrian in the village. The Lohavohits are deſcendants from the Voadziri, and alſo lords; but with this difference, that the one commands a whole diſtrict, and the juriſdiction of the others extends only to their own village and family. They are alſo permitted to kill thoſe beaſts they intend to eat, when at a diſtance from the whites. The Ontſoa are next to the Lohavohits, and are their near relations. The Ondeves are the loweſt of all, being originally ſlaves by father and mother. The Voadziri, Lohavohits, and Ontſoa, enjoy the privilege of ſubmitting themſelves, on the death of their lord or king, to any chief they pleaſe. In return for ſuch homage the new lord makes them a preſent, in conſequence of which he becomes heir to all their poſſeſſions. Hence the lower claſſes both of whites and blacks, when death approaches, are under the greateſt concern and anguiſh of mind, well knowing that their lords will not fail to deprive their children of every thing they poſſeſs. The Ondeves have not the ſame liberty with the others: but, in times of famine, the chiefs are obliged to ſupply them with neceſſaries; which if they fail to do, they have the liberty of ſubmitting themſelves to new maſters. The inhabitants of this province have no temples, and very little appearance of religion; only they keep up a cuſtom of immolating beaſts upon particular occaſions, as in ſickneſs, planting yams or rice, on aſſemblies, &c. They offer the firſt-born beaſt to the devil and to God, naming the devil firſt, in this manner, *Dianbilis Aminhanhabare*, or "Lord Devil and God."—There are ſeveral towns on the river Franchere; and near this river the Portugueſe had a fort built upon a ſteep rock, and ſeveral buildings below, with incloſures, which furniſhed all ſorts of neceſſaries for their ſubſiſtence; but they were all maſſacred by the natives.

This province ſeems originally to have been inhabited by negroes. The whites or Zaferamini ſettled in it about 200 years ago, and conquered the negroes. But they themſelves were conquered by the French, though under the government of a king whom they honoured as a god. In 1642, Captain Rivault obtained a permiſſion to eſtabliſh a colony in this part of the iſland; and accordingly he took poſſeſſion of it in the name of the king of France, in the month of September, that ſame year. The French landed 200 men well armed and provided with ſtore of ammunition and other neceſſaries for building a fort, which they immediately ſet about; but no ſooner did the natives obſerve their intention, than they uſed their utmoſt art to prevent their deſign from taking effect. This created a war, in which the French were victors; and, the natives becoming in time much better reconciled to them, they intermarried, and lived up and down in ſeveral towns at ſome diſtance from one another, not above five or ſix in a place. This tranquillity laſted for ſome years; but at laſt the natives, growing jealous, reſolved to free themſelves from a foreign yoke, and accordingly formed a conſpiracy to cut off all the French in one day; which they ſoon after effected, not leaving a ſingle perſon alive. In 1644 the above-mentioned Fort Dauphin was erected in Lat. 25. 6. S. Many buildings were erected, behind the Fort, adjoining to the governor's houſe, with great incloſures that produced every ſort of fruit and kitchen herb. In 1656 this fort was accidentally deſtroyed by fire; but was ſoon after repaired, and ſtill continues, notwithſtanding the cataſtrophe above mentioned, and its garriſon carries on frequent wars with the natives.

ANOTTA, or ARNOTTA, in dyeing, an elegant red colour, formed from the pellicles or pulp of the ſeeds of the BIXA, a tree common in South America. It is alſo called *Terra Orleana*, and *Roucou*.

The manner of making anotta is as follows: The red ſeeds cleared from the pods, are ſteeped in water for ſeven or eight days or longer, till the liquor begins to ferment; then ſtrongly ſtirred, ſtamped with wooden paddles and beaters, to promote the ſeparation of the red ſkins: this proceſs is repeated ſeveral times till the ſeeds are left white. The liquor, paſſed through cloſe cane-ſieves, is pretty thick, of a deep red colour, and a very ill ſmell; in boiling, it throws up its colouring matter to the ſurface in form of ſcum, which is afterwards boiled down by itſelf to a due conſiſtence, and made up while ſoft into balls. The anotta commonly met with among us, is moderately hard and dry, of a brown colour on the outſide, and a dull red within. It is difficultly acted upon by water, and tinges the liquor only of a pale browniſh-yellow colour. In rectified ſpirit of wine, it very readily diſſolves, and communicates a high orange or yellowiſh red. Hence it is uſed as an ingredient in varniſhes, for giving more or leſs of an orange-caſt to the ſimple yellows. Alkaline ſalts render it perfectly ſoluble in boiling water, without altering its colour. Wool or ſilk boiled in the ſolution acquire a deep, but not a very durable, orange-dye. Its colour is not changed by alum or by acids, any more than by alkalis: but when imbibed in cloth, it is diſcharged by ſoap, and deſtroyed by expoſure to the air. It is ſaid to be an antidote to the poiſonous juice of manioc or caſſava.—Labat informs us, that the Indians prepare an anotta greatly ſuperior to that which is brought to us, of a bright ſhining red colour, almoſt equal to carmine: that, for this purpoſe, inſtead of ſteeping and fermenting the ſeeds in water, they rub them with the hands, previouſly dipt in oil, till the pellicles came off, and are reduced into a clear paſte; which is ſcraped off from the hands with a knife, and laid on a clean leaf in the ſhade to dry. De Laet, in his notes on Margrave's natural hiſtory of Brazil, mentions alſo two kinds of anotta; one of a permanent crimſon colour, uſed as a fucus or paint for the face; and another which gives a colour inclining more to that of ſaffron. This laſt, which is our anotta, he ſuppoſes to be a mixture of the firſt ſort with certain reſinous matters, and with the juice of the root of the tree. The wax or pulp in which the ſeeds are incloſed is a cool agreeable rich cordial, and has been long in uſe among the Indians and Spaniards in America, who ſtill mix it with their chocolate, both to heighten the flavour and raiſe the colour. It is ſaid to be a ſucceſsful remedy in bloody-fluxes. The roots have much the ſame properties with the wax; but theſe are obſerved to work more powerfully by the urinary paſſages: they are uſed by ſome people in their broths, and ſeem to anſwer all the purpoſes of the pulp, but in a more faint degree. See Bixa.

ANOUT, a ſmall iſland in the Schagerrack, or that part of the ſea of Denmark which has Norway on the north, Jutland on the weſt, and the iſle of Zealand on the ſouth; it lies in 13° E. Long. and 56° 36′ N. Lat.

ANSÆ, in aſtronomy, implies the parts of Saturn's ring projecting beyond the diſk of the planet.—The word is Latin, and properly ſignifies *handles*; theſe parts of the ring appearing like handles to the body of the planet.

ANSARIANS, a people of Syria, ſo called in the country, but ſtyled in Deliſle's maps *Enſarians*, and thoſe of Danville, *Naſſaris*. The territory occupied by theſe Anſaria is that chain of mountains which extends from Antakia to the rivulet called *Nahr-el-Kabir*, or the Great River. The hiſtory of their origin, though little known, is yet inſtructive. The following account is from the *Bibliotheque Orientale* of Aſſemani, a writer who has drawn his materials from the beſt authorities.

"In the year of the Greeks 1202 (A. D. 891), there lived at the village of Naſar, in the environs of Koufa, an old man, who, from his faſtings, his continual prayers, and his poverty, paſſed for a ſaint: ſeveral of the common people declaring themſelves his partizans, he ſelected from among them twelve diſciples to propagate his doctrine. But the commandant of the place, alarmed at his proceedings, ſeized the old man, and confined him in priſon. In this reverſe of fortune, his ſituation excited the pity of a girl who was ſlave to the goaler, and ſhe determined to give him his liberty: an opportunity ſoon offered to effect her deſign. One day when the goaler was gone to bed intoxicated, and in a profound ſleep, ſhe gently took the keys from under his pillow, and after opening the door to the old man, returned them to their place unperceived by her maſter: the next day when the goaler went to viſit his priſoner, he was extremely aſtoniſhed at finding he had made his eſcape, and the more ſo ſince he could perceive no marks of violence. He therefore judiciouſly concluded he had been delivered by an angel, and eagerly ſpread the report, to avoid the reprehenſion he merited; the old man, on the other hand, aſſerted the ſame thing to his diſciples, and preached his doctrines with more earneſtneſs than ever. He even wrote a book, in which, among other things, he ſays, 'I, ſuch a one, of the village of Naſar, have ſeen Chriſt who is the word of God, who is Ahmad, ſon of Mohammad, ſon of Hanafa, of the race of Ali; who alſo is Gabriel: and he ſaid to me, Thou art he who readeth (with underſtanding); thou art the man who ſpeaketh truth; thou art the camel which preſerveth the faithful from wrath; thou art the beaſt which carrieth their burden; thou art the (Holy) Spirit, and John, the ſon of Zachary. Go, and preach to men that they make four genuflections in praying; two before the riſing of the ſun, and two before his ſetting, turning their faces towards Jeruſalem: and let them ſay, three times, God Almighty! God Moſt High! God Moſt Great! Let them obſerve only the ſecond and third feſtival; let them faſt but two days annually; let them not waſh the prepuce, nor drink beer, but as much wine as they think proper; and laſtly, let them abſtain from the fleſh of carnivorous animals.' This old man paſſing into Syria, propagated his opinions among the lower orders of the country people, numbers of whom believed in him: And after a few years he went away, and nobody ever knew what became of him."

Such was the origin of theſe Anſarians, who are, for the moſt part, inhabitants of the mountains before mentioned.

The Anſaria are divided into ſeveral tribes or ſects; among which are diſtinguiſhed the Shamſia, or adorers of the ſun; the Kelbia, or worſhippers of the dog; and the Kadmouſia, who are ſaid to pay a particular homage to that part in women which correſponds to the priapus.

Many of the Anſaria believe in the metempſychoſis; others reject the immortality of the ſoul; and in general, in that civil and religious anarchy, that ignorance and rudeneſs which prevail among them, theſe peaſants adopt what opinions they think proper, following the ſect they like beſt, and frequently attaching themſelves to none.

Their country is divided into three principal diſtricts farmed by the chiefs called *Mokaddamim*. Their tribute is paid to the Pacha of Tripoli, from whom they annually receive their title. Their mountains are in general not ſo ſteep as thoſe of Lebanon, and conſequently are better adapted to cultivation; but they are alſo more expoſed to the Turks, and hence doubtleſs, it happens, that with great plenty of corn, tobacco, wines, and olives, they are more thinly inhabited than thoſe of their neighbours the Maronites and the Druzes.

ANSE, an ancient town of France, in the Lyonois, ten miles north of Lyons, Long. 6. 55. N. Lat. 45. 55.

ANSELM, archbiſhop of Canterbury, in the reigns of William Rufus and Henry I. He was born in the year 1033, at Aoſt, a town in Savoy at the foot of the Alps. He became a monk in the abbey of Bec in Normandy; of which he was afterwards choſen prior, and then abbot. In the year 1092, he was invited over to England by Hugh Earl of Cheſter; and in the year following was prevailed on, as we are told, with great difficulty, to accept the archbiſhopric of Canterbury. He enjoined celibacy on the clergy; for which he was baniſhed by king Rufus, but recalled by Henry at his coming to the crown: He refuſed to conſecrate ſuch biſhops as were inveſted by the king, according to pope Urban's decree; flatly denying it to be the king's prerogative: for this he was outed again; till, the pope and king agreeing, he was recalled in 1107. In ſhort, from the day of his conſecration to that of his death, he was continually employed in fighting the prerogative of the church againſt that of the crown; and for that purpoſe ſpent much of his time in travelling backwards and forwards between England and Rome, for the advice and direction of his Holineſs. At the council of Bari, in the kingdom of Naples, the pope being puzzled by the arguments of the Greeks againſt the Holy Ghoſt's proceeding from the Father, he called upon Anſelm, who was preſent, and he diſcuſſed their objections with great applauſe. Prieſts call him a reſolute ſaint; to other people he appears to have been an obſtinate and inſolent prieſt. He wrought many miracles, if we believe the author of his life, both before and after his death, which happened at Canterbury, in the 76th year of his age, anno 1109. He was canoniſed in the reign of Henry VII. Anſelm, though we may diſregard him as a ſaint, deſerves to be remembered as one of the principal revivers of literature, after three centuries of profound ignorance.

His works have been printed in different years, and at different places, viz. Nuremb. 1491. Paris 1544 and 1549. Venice 1549. Cologn 1573 and 1612. Lyons 1630. But the beſt is that of father Gerberon, printed at Paris 1675. It is divided into three parts; the firſt contains dogmatical tracts, and is intitled *Monologia*; the ſecond contains practical and devotional tracts; the third part conſiſts of letters, in four books.

ANSER, in ornithology, the trival name of a ſpecies of anas. See Anas.

Anser, in aſtronomy, a ſmall ſtar, of the fifth or ſixth magnitude, in the milky way, between the ſwan and eagle, firſt brought into order by Hevelius.

ANSERES, the name which Linnæus gives to his third order of birds. See Zoology, nº 8.

ANSIBARII, or Ansivarii, an ancient people of Germany, ſituated ſomewhere in the neighbourhood of the Chauci. All we know of their hiſtory is, that in the reign of the Emperor Nero, they were driven from their own poſſeſſions by the Chauci. Being then in a forlorn condition, they took poſſeſſion of ſome uninhabited lands, which had been uſed as paſture for the horſes of the Roman ſoldiers. They were led by one Boiocalus, a man of great valour, and of known fidelity to the Romans. He remonſtrated to the Romans, who objected to their taking poſſeſſion of theſe lands, That the territory in diſpute was large; and requeſted, that it might be allowed to an unhappy people, driven from their own habitations: that, at the ſame time, wide tracts might be retained for the horſes and cattle of the ſoldiers to graze in: that it was inconſiſtent with humanity to famiſh men in order to feed beaſts. &c. and at laſt, lifting up his eyes to heaven, he aſked the celeſtial luminaries how they could behold a deſolate ſoil, and if they would not more juſtly let looſe the ſea to ſwallow up uſurpers, who had engroſſed the whole earth? To this the Roman commander, Avitus, replied, that the weakeſt muſt ſubmit to the ſtrongeſt; and that ſince the gods, to whom they had appealed, had left the ſovereign judgment to the Romans, they were reſolved to ſuffer no other judges than themſelves. To Boiocalus himſelf, however, he privately offered lands as a reward for his long attachment to the Romans: but this offer the brave German rejected, as a price for betraying his people; adding, "A place to live in we may want, but a place to die in we cannot." The Anſibarii now invited the neighbouring nations to join them againſt the Romans; but they, dreading the power of that nation, refuſed to give them any aſſiſtance: upon which they applied to the neighbouring nations, begging leave to ſettle in their territories; but being every where driven out as enemies and intruders, theſe unhappy people were reduced to wander up and down till every one of them periſhed.

ANSIKO, a kingdom of Africa, bounded on the weſt by the river Umbre which runs into the Zaire, the kingdom of Wangua, and the Amboes who border on Loango; on the north, by ſome deſarts of Nubia; and on the ſouth, by Songo and Sonda, provinces of Congo. Here are great numbers of wild beaſts, as lions, rhinoceroſes, &c. and many copper mines. The king of Anſiko, or the great Macoco, commands 13 kingdoms, and is eſteemed the moſt powerful monarch in Africa. The inhabitants of Angola have a tradition, that this is the proper country of the Giagas, who came originally from Sierra Leona, and over-ran like a torrent the whole coaſt as far as Benguela; that, being weakened by numerous battles, and unable to force the defiles in order to return to Sierra Leona, they arrived on the borders of Monomotapa, where being defeated, they were forced to remain in the provinces of Anſiko. Be this as it will, the Anſikans yield not in the leaſt to the Giagas in fierceneſs and barbarity. They are ſo accuſtomed to the eating of human fleſh, that it is aſſerted they have markets where it is publicly ſold, and that there are no other graves for the dead than the bellies of the living. They try the courage of their priſoners of war by ſhooting at them as at marks, directing their arrows above or around their heads; and whoever diſcovers the leaſt ſigns of fear, is immediately devoured without remedy. Thoſe who appear intrepid and reſolute, have their noſes and ears bored, and two fore-teeth of the upper jaw drawn. They are then improved in barbarity, by accuſtoming them to the moſt horrid cruelties.

The Anſikans are neat, well-proportioned, and ſtrong; wandering about from place to place, without either ſowing or reaping. They are dreaded for their extreme brutality, and never traded with by the Europeans. Their language is barbarious, and difficult to be learned, even by the inhabitants of Congo. The moſt diſtinguiſhed among them wear red and black caps of Portugueſe velvet: the lower ranks go naked from the waiſt upwards; and, to preſerve their health, anoint their bodies with a compoſition of pounded white ſandal-wood and palm-oil. Their arms are battle-axes, and ſmall but very ſtrong bows adorned with ſerpents ſkins. Their ſtrings are made of ſupple and tender ſhoots of trees, that will not break, and their arrows of hard and light wood. Theſe people, who kill birds flying, ſhoot with ſuch ſurpriſing ſwiftneſs, that they can diſcharge 28 arrows from the bow before the firſt falls to the ground. With equal dexterity they manage their battle-axes; one end of which is ſharpened and cuts like a wedge, and the other flattened like a mallet, with a handle ſet between, about half the length of the iron, rounded at the end like an apple, and covered with the ſkin of a ſerpent.—The current money in this country is the zimbis or ſhell, which is fiſhed for, and paſſes among ſeveral African nations.—they worſhip the ſun as their chief deity; whom they repreſent by the figure of a man, and the moon by that of a woman. They have alſo an infinite number of inferior deities, each individual having a particular idol whom he addreſſes on certain occaſions.

ANSLO, a ſea-port town of Norway, in the province of Aggerhuys, with a biſhop's ſee. The ſupreme court of juſtice is held here for Norway. It is ſeated on a bay of the ſame name. E. Long. 10. 14. N. Lat. 50. 24.

ANSON (George), a gentleman whoſe merit and good fortune, as a naval commander, exalted him to the rank of Nobility. He was the ſon of William Anſon, Eſq; of Huckborough, in Staffordſhire; and ſhowing an early inclination for the ſea, received a ſuitable education. The firſt command he enjoyed was that of the Weazle ſloop in 1722; but the moſt memorable action of his life, and the foundation of his future good fortune, took place on his receiving the command of five ſhips, a ſloop, and two victuallers, equipped to annoy the Spaniards in the South Seas, and to co-operate with admiral Vernon acroſs the iſthmus of Darien: an expedition, the principal object of which failed by the unaccountable delay in fitting him out. He ſailed, however, in Sept. 1740; doubled Cape Horn in a dangerous ſeaſon; loſt moſt of his men by the ſcurvy; and with one only remaining ſhip, the Centurion, croſſed the great Pacific Ocean. If no conſiderable national advantage reſulted from this voyage, Commodore Anſon made his own fortune, and enriched his ſurviving companions, by the capture of a rich galleon on her paſſage from Acapulco to Manilla; with which he returned home round the Cape of Good Hope. If he was lucky in meeting this galleon, he was no leſs fortunate in eſcaping a French fleet then cruiſing in the Channel, by ſailing through it during a fog. He arrived at Spithead in June 1744. In a ſhort time after his return, he was appointed rear-admiral of the blue, and one of the lords of the admiralty. In April 1745, he was made rear-admiral of the white, and the following year, vice-admiral of the blue; at which time he was choſen to repreſent the borough of Heydon in parliament. In 1747, being on board the Prince George of 90 guns, in company with Admiral Warren, and 12 other ſhips, he intercepted off Cape Finiſterre, a powerful fleet, bound from France to the Eaſt and Weſt Indies; when, by his valour and conduct he again enriched himſelf and his officers, and at the ſame time ſtrengthened the Britiſh navy, by taking ſix men of war and four Eaſt-Indiamen, not one of them eſcaping. The French admiral, M. Jonquiere, on preſenting his ſword to the conqueror, ſaid, *Monſieur, vous avez vaincu l'Invincible, et la Glorie vous ſuit:* “ Sir, you have conquered the Invincible, and Glory follows you; pointing to the ſhips named the *Invincible* and the *Glory*, he had taken. For his ſignal ſervices, King George the IId. created him Baron of Soberton in Hants. The ſame year he was appointed vice-admiral of the red; and, on the death of Sir John Norris, was made vice-admiral of England. In 1748 he was made admiral of the blue: he was afterwards appointed firſt lord of the admiralty, and was at length made admiral and commander in chief, in which rank he continued, with a very ſhort interval, until his death; and the laſt ſervice he performed was to convoy Queen Charlotte to England. He died in June 1762. No performance ever met with a more favourable reception, than the account of Anſon's voyage round the world. Though it is printed under the name of his chaplain, it was compoſed under his lordſhip's own inſpection, and from the the materials he himſelf furniſhed, by the ingenious Mr Benjamin Robins.

ANSPACH (the marquiſate of), a ſmall territory of Franconia, in Germany; bounded on the north by the biſhoprics of Wartſburg and Bamberg, which laſt likewiſe lies to the weſt; by the earldoms of Holach and Oeting, with the biſhopric of Aichſtet, on the ſouth; and the palatinate of Bavaria and the territory of Nuremberg on the eaſt. The country is fruitful, and interſperſed with woods, which render it agreeable for hunting. Beſides the city Anſpach, which is the capital, the chief towns are Kreglin, Swaſbach, Kreilſheim, Rot, and Waſſer-Truding.

Anspach is a ſmall but pretty town, very well built, and has ſeveral churches. It is walled round, but has no other fortifications. In the palace there is a remarkable cabinet of curioſities. It is ſeated on a river of the ſame name, and belongs to the houſe of Brandenburg. E. Long. 10. 42. N. Lat. 49. 14.

ANSPESSADES, in the French armies, a kind of inferior officers in the foot, below the corporals, but above the common centinels. There are uſually four or five of them in a company.

ANSTRUTHER *Eaſter* and *Weſter*, two royal boroughs of Scotland, ſituated on the ſouth-eaſt coaſt of the county of Fife, in W. Long. 2. 25. N. Lat. 56. 20.

ANT, in zoology. See Formica and Termes.

Ant-Bear, or *Ant-eater*, in zoology. See Myrmecophaga.

Ant-Eggs, a name popularly given to a kind of little white balls found in the banks or neſts of ants ordinarily ſuppoſed to be the ova of this inſect.

Late naturaliſts have obſerved, that theſe are not properly the ants eggs, but the young brood themſelves in their firſt ſtate; they are ſo many little vermiculi wrapped up in a film, or ſkin, compoſed of a ſort of ſilk, which they ſpin out of themſelves as ſilk-worms and caterpillars do. At firſt they are hardly obſerved to ſtir: but, after a few days continuance they exhibit a feeble motion of flexion and extenſion; and begin to look yellowiſh and hairy, ſhaped like ſmall maggots, in which ſhape they grow up, till they are almoſt as large as ants. When they paſs their metamorphoſis, and appear in their proper ſhape, they have a ſmall black ſpeck on them cloſe to the anus of the included ant, which M. Liewenhoeck probably enough imagines to be the feces voided by it. Dr Ed. King opened ſeveral of theſe vulgarly reputed eggs; in ſome of which he found only a maggot in the circumſtances as above deſcribed; while in another the maggot had begun to put on the ſhape of an ant about the head, having two little yellow ſpecks, where the eyes were to be. In others, a further progreſs was obſerved, the included maggots being furniſhed with every thing to complete the ſhape of an ant, but wholly tranſparent, the eyes only excepted, which were as black as bugles. Laſtly, in others, he took out every way perfect and complete ants, which immediately crept about among the reſt. Theſe ſuppoſed ants eggs are brought up every morning in ſummer, near the top of the bank, where they are lodged all the warm part of the day, within reach of the ſun's influence. At night, or if it be cool, or like to rain, they carry them down to a greater depth; ſo that you may dig a foot depth e'er you come at them. The true ants eggs are the white ſubſtance which, upon opening their banks, appears to the eye like the ſcatterings of fine white ſugar, or ſalt, but very ſoft and tender. Examined by a microſcope, it is found to conſiſt of ſeveral pure, white appearances, in diſtinct membranes, all figured like the leſſer ſort of birds eggs, and as clear as a fiſhes bladder. The ſame ſubſtance is found in the bodies of the ants themſelves. On this ſpawn, when emitted, they lie in multitudes to brood, till in ſome time it is turned into little vermicles as ſmall as mites, commonly called *ants-eggs*.

Ant-Hills, are little hillocks of earth, which the ants throw up for their habitation and the breeding of their young. They are a very great miſchief to dry paſtures, not only by waſting ſo much land as they cover, but by hindering the ſcythe in mowing the graſs, and yielding a poor hungry food pernicious to cattle. The manner of deſtroying them is to cut them into four parts from the top, and then dig into them ſo deeep as to take out the core below, ſo that, when the turf is laid down again, it may lie ſomewhat lower than the level of the reſt of the land: by this means it will be wetter than the reſt of the land: and this will prevent the ants from returning to the ſame place, which otherwiſe they would certainly do. The earth that is taken out muſt be ſcattered to as great a diſtance every way as may be, otherwiſe they will collect it together and make another hill juſt by. The proper time for doing this is winter; and if the places be left open, the froſt and rains of that time of the year will deſtroy the reſt: but in this caſe care muſt be taken that they are covered up early enough in the ſpring, otherwiſe they will be leſs fertile in graſs than the other places. In Hertfordſhire they uſe a particular kind of ſpade for this purpoſe. It is very ſharp, and formed at the top into the ſhape of a creſcent, ſo that the whole edge makes up more than three-fourths of a circle; this cuts in every part, and does the buſineſs very quickly and effectually. Others uſe the ſame inſtruments that they do for mole-hills. Human dung is a better remedy than all theſe, as is proved by experiment; for it will kill great numbers of them and drive all the reſt away, if only a ſmall quantity of it be put into their hills.

Acid of Ants, and acid produced by diſtilling millions of theſe inſects, either without addition, or with water. It reſembles vinegar in many reſpects; but differs from it in forming cryſtals with magneſia, iron, and zinc. Its attractions are not yet determined, but are ſuppoſed to coincide with thoſe of vinegar.

ANTA, in the ancient architecture, a ſquare pilaſter, placed at the corners of buildings.

Anta, or *Ante*, a ſmall kingdom on the gold-coaſt of Africa, extending about ten leagues in length.—The country is covered with large trees, among which ſtand a number of fine villages. The ſoil is exceedingly rich, and the face of the country beautiful. The air is alſo much more ſalubrious than in other places of the gold-coaſt; it being obſerved by all writers, that the number of deaths here bears no proportion to that on any other part on the coaſts of Guinea. This country contains the following villages, which deſerve a particular deſcription on account of the commerce they drive; viz. *Bourtrey, Tokorari, Sukoda,* and *Sama*; for which, ſee thoſe articles.—Formerly Anta was potent and populous, inhabited by a bold and rapacious people, who greatly annoyed the Europeans by their frequent incurſions; but by continual wars with their neighbours they are now greatly enfeebled, and the country in a manner depopulated. The ſpirit of the few remaining inhabitants is fled: they are deſponding, diſpirited, and abject, ſeeking protection from the Dutch and other Europeans who have forts on this coaſt, and looking upon them as their beſt friends.

ANTACIDS, in pharmacy, an appellation given to all medicines proper to correct acid or ſour humours.

Under the claſs of antacids come, 1. Abſorbents; as chalk, coral, ſea-ſhells, hæmatites, and ſteel-filings. 2. Obtundents; as oils and fats. 3. Immutants; as lixivious ſalts, and ſoaps.

ANTÆUS, in fabulous hiſtory, a giant of Libya, ſon of Neptune and Terra. Deſigning to build a temple to his father, of men's ſculls, he ſlew all he met; but Hercules fighting him, and perceiving the aſſiſtance he received from his mother (for by a touch of the earth he refreſhed himſelf when weary), lifted him up from the ground, and ſqueezed him to death.

Antæus was king of Mauritania; and from ſeveral circumſtances, with which we are ſupplied by various authors, it appears extremely probable that he was the ſame perſon with Atlas; they were both of them the ſons of Neptune, who reigned over Mauritania, Numidia, and a great part of Libya; as may be naturally inferred from his having ſuch particular marks of diſtinction conferred upon him by the inhabitants of thoſe regions. They both ruled with abſolute power over a great part of Africa, particularly Tingitania. Hercules defeated and ſlew Antæus in the ſame war wherein he took the Libyan world from Atlas: both Atlas and Antæus invaded Egypt, and contended with Hercules in the wars with the gods, and were both vanquiſhed by him. Antæus, as well as Atlas, was famed for his knowledge in the celeſtial ſciences: from whence we may fairly conclude them to have been the ſame king of Mauritania.

Antæus, in his wars with Hercules, who commanded an army of Egyptians and Ethiopians, behaved with great bravery and reſolution. Receiving large reinforcements of Libyan troops, he cut off vaſt numbers of Hercules's men: but that celebrated commander having at laſt intercepted a ſtrong body of Mauritanian or Libyan forces ſent to the relief of Antæus, gave him a total overthrow, wherein both he and the beſt part of his forces were put to the ſword. This deciſive action put Hercules in poſſeſſion of Libya and Mauritania, and conſequently of all the riches in thoſe kingdoms: hence aroſe the fable, that Hercules finding Antæus, a giant of an enormous ſize, with whom he was engaged in ſingle combat, to receive freſh ſtrength as often as he touched his mother earth when thrown upon her, at laſt lifted him up in the air and ſqueezed him to death. Hence likewiſe may be deduced the fable, intimating, that Hercules took Atlas's globe upon his own ſhoulders, overcame the dragon that guarded the orchards of the Heſperides, and made himſelf maſter of all the golden fruit. The golden apples, ſo frequently mentioned by the old mythologiſts, were the treaſures that fell into Hercules's hands

Antagoniſt. Ante.

hands upon Antæus's defeat, the Greeks giving the Oriental word מאל, *riches*, the ſignification affixed to their own term, μηλα, *apples*. After the moſt diligent and impartial examination of all the different hypotheſes of hiſtorians and chronologers, relating to Atlas and Antæus, we find none ſo little clogged with difficulties as that of Sir Iſaac Newton. According to that illuſtrious author, Ammon, the father of Seſac, was the firſt king of Libya, or that vaſt tract extending from the borders of Egypt to the Atlantic ocean; the conqueſt of which country was effected by Seſac in his father's life-time. Neptune afterwards excited the Libyans to a rebellion againſt Seſac; ſlew him; and then invaded Egypt under the command of Atlas or Antæus, the ſon of Neptune, Seſac's brother and admiral. Not long after, Hercules, the general of Thebais and Ethiopia for the gods or great men of Egypt, reduced a ſecond time the whole continent of Libya, having overthrown and ſlain Antæus near a town in Thebais, from that event called Antæa or Antæopolis: this, we ſay, is the notion advanced by Sir Iſaac Newton, who endeavours to prove, that the firſt reduction of Libya by Seſac happened a little above a thouſand years before the birth of Chriſt, as the laſt by Hercules did ſome few years after.

ANTAGONIST, denotes an adverſary, eſpecially in ſpeaking of combats and games.

ANTAGONIST muſcles, in anatomy, thoſe which have oppoſite functions; as flexors and extenſors, abductors and adductors, &c.

ANTANACLASIS, in rhetoric, a figure which repeats the ſame word, but in a different ſenſe; as, *dum vivimus, vivamus*.

ANTAGOGE, in rhetoric, a figure by which, when the accuſation of the adverſary is unanſwerable, we load him with the ſame or other crimes.

ANTANDROS, (anc. geog.) a town of Myſia, on the ſea-coaſt, at the foot of mount Alexandrea, a part of mount Ida. (Strabo, Ptolemy): it was a town of the Leleges, (Strabo); anciently called *Edonis*, then *Cimmeris*, (Pliny, Stephanus.) It takes its name from Antandros, a general of the Aeolians: it is now called *S. Dimitri*.

ANTAPHRODISIACS, in pharmacy, medicines proper to diminiſh the ſemen, and conſequently extinguiſh or leſſen all deſires of venery.

ANTARCTIC, in a general ſenſe, denotes ſomething oppoſite to the arctic or northern pole. Hence antarctic circle is one of the leſſer circles of the ſpheres, and diſtant only 23° 30′ from the ſouth pole, which is likewiſe called antarctic for the ſame reaſon.

ANTARES, in aſtronomy, the name of a ſtar of the firſt magnitude, called alſo the ſcorpion's heart. Its longitude is 60° 13′ 14″ of Sagittarius; and its latitude 4° 31′ 26″ S.

ANTAVARE, a province of the iſland of Madagaſcar, lying about 21° 30′ S. Lat. and bounded by the province and cape of Manouſi. The greateſt part of it is watered by the river Mananzari, whoſe ſource is in the red mountains of Ambohitſmene.

ANTE′, in heraldry, denotes that the pieces are let into one another in ſuch form as there is expreſſed; for inſtance, by dove-tails, rounds, ſwallow-tails, or the like.

Anteambulones ‖ Antediluvian.

ANTEAMBULONES, in Roman antiquity, ſervants who went before perſons of diſtinction to clear the way before them. They uſed this formula, *Date locum domino meo*, i. e. Make room or way for my maſter.

ANTECEDENT, in general, ſomething that goes before another, either in order of time or place.

ANTECEDENT, in grammar, the words to which a relative refers.

ANTECEDENT, in logic, is the firſt of the two propoſitions in an enthymeme.

ANTECEDENT, in mathematics, is the firſt of two terms of a ratio, or that which is compared with the other.

ANTECEDENCE, in aſtronomy, an apparent motion of a planet towards the weſt, or contrary to the order of the ſigns.

ANTECESSOR, one that goes before. It was an appellation given to thoſe who excelled in any ſcience. Juſtinian applied it particularly to profeſſors of civil law; and, in the univerſities of France, the teachers of law take the title *anteceſſors* in all their theſes.

ANTECURSORES, in the Roman armies, a party of horſe detached before, partly to get intelligence, proviſions, &c. and partly to chooſe a proper place to encamp in. Theſe were otherwiſe called *anteceſſores*, and by the Greeks *prodromi*.

ANTEDATE, among lawyers, a ſpurious or falſe date prior to the true date of a bond, bill, or the like.

ANTEDILUVIAN, in a general ſenſe, implies ſomething that exiſted before the flood.

ANTEDILUVIAN World; the earth as it exiſted before the flood. See EARTH.

ANTEDILUVIANS, a general name for all mankind who lived before the flood, and ſo includes the whole of the human race from Adam to Noah and his family.

Chronology of the firſt ages.

As Moſes had not ſet down the particular time of any tranſaction before the flood, except only the years of the fathers age wherein the ſeveral deſcendants of Adam in the line of Seth were begotten, and the length of their ſeveral lives; it has been the buſineſs of chronologers to endeavour to fix the years of the lives and deaths of thoſe patriarchs, and the diſtance of time from the creation to the deluge. In this there could be little difficulty were there no varieties in the ſeveral copies we now have of Moſes's writings; which are, the Hebrew, the Samaritan, and the Greek verſions of the Septuagint: but as theſe differ very conſiderably from one another, learned men are much divided in their opinions concerning the chronology of the firſt ages of the world; ſome preferring one copy and ſome another.

That the reader may the better judge of the variations in the three copies in this period, they are exhibited in the following table, with the addition of thoſe of Joſephus as corrected by Dr Wells and Mr Whiſton.

A TABLE of the Years of the Antediluvian Patriarchs.

	Their ages at their ſons birth.				Years they lived after their ſons birth.			Length of their lives.		
	Heb.	Sam.	Sept.	Joſ.	Heb.	Sam.	Sept.	Heb.	Sam.	Sept.
Adam, -	130	130	230	130	800	800	700	930	930	930
Seth, -	105	105	205	105	807	807	707	912	912	912
Enos, -	90	90	190	90	815	815	715	905	905	905
Cainan, -	70	70	170	70	840	840	740	910	910	910
Mahalaleel, -	65	65	165	65	830	830	730	895	895	895
Jared, -	162	62	162	62	800	785	800	962	847	962
Enoch, -	65	65	165	65	300	300	200	365	365	365
Methuſelah, -	187	67	167	187	782	653	802	969	720	969
Lamech, -	182	53	188	182	595	600	565	777	653	753
Noah was aged at the Flood,	600	600	600	600						
To the Flood,	1656	1307	2262	1556						

To this table it will be neceſſary, in order to explain the conſequences of theſe variations, to add ſeparate chronological tables, ſhowing in what year of his contemporaries the birth and death of each patriarch happened, according to the computation of each of the ſaid three copies.

A Chronological TABLE of the Years of the Patriarchs according to the Computation of the Hebrew.

	Years of the world.	Years of Seth.	Years of Enos.	Years of Cainan.	Years of Mahalaleel.	Years of Jared.	Years of Enoch.	Years of Methuſelah.	Years of Lamech.	Years of Noah.
Adam created,	1									
Seth born, -	130									
Enos born, -	235	105								
Cainan born, -	325	195	90							
Mahalaleel born,	395	265	160	70						
Jared born, -	460	330	225	135	65					
Enoch born, -	622	492	387	297	227	162				
Methuſelah born,	687	557	452	362	292	227	65			
Lamech born, -	874	744	639	549	479	414	252	187		
Adam dies, -	930	800	695	605	535	470	308	243	56	
Enoch tranſlated,	987	857	752	662	592	527	365	300	113	
Seth dies, -	1042	912	807	717	647	582		355	168	
Noah born, -	1056		821	731	661	596		369	182	
Enos dies, -	1140		905	817	745	680		453	266	84
Cainan dies, -	1235			910	840	775		548	361	179
Mahalaleel dies,	1290				895	830		603	416	234
Jared dies, -	1422					962		735	548	366
Japhet born, -	1556							869	682	500
Shem born, -	1558							871	684	502
Lamech dies, -	1651							964	777	595
Methuſelah dies,	1656			The Flood, -				969		600

A Chronological TABLE *of the Years of the Patriarchs according to the Computation of the Septuagint.*

	Years of the world.	Years of Seth.	Years of Enos.	Years of Cainan.	Years of Mahalaleel.	Years of Jared.	Years of Enoch.	Years of Methuſelah.	Years of Lamech.	Years of Noah.
Adam created,	1									
Seth born, -	230									
Enos born, -	435	205								
Cainan born, -	625	395	190							
Mahalaleel born,	795	565	360	170						
Adam dies, -	930	700	495	305	135					
Jarad born, -	960	730	525	335	165					
Enoch born, -	1122	892	687	497	327	162				
Seth dies, -	1142	912	707	517	347	182				
Methuſelah born,	1387		852	662	492	327	165			
Enos dies, -	1340		905	715	545	380	218			
Lamech born, -	1474			849	679	514	352	187		
Enoch tranſlated,	1487			862	692	527	365	200		
Cainan dies, -	1535			910	740	575		248	61	
Noah born, -	1662				867	702		375	188	
Mahalaleel dies,	1690				895	730		403	216	28
Jared dies, -	1922					962		635	448	260
Japhet born, -	2162							875	688	500
Shem born, -	2164							877	690	502
Lamech dies, -	2227							940	753	565
Methuſelah dies,	2256							696		595
The Flood, -	2262									600

A Chronological TABLE *of the Years of the Patriarchs, according to the Computation of the Samaritan Pentateuch.*

	Years of the world.	Years of Seth.	Years of Enos.	Years of Cainan.	Yearsof Mahalaleel.	Years of Jared.	Years of Enoch.	Years of Methuſelah.	Years of Lamech.	Years of Noah.
Adam created,	1									
Seth born,	130									
Enos born,	235	105								
Cainan born,	325	195	90							
Mahalaleel born,	395	265	160	70						
Jared born,	460	330	225	135	65					
Enoch born,	522	392	287	197	127	62				
Methuſelah born,	587	457	352	262	192	127	65			
Lamech born,	654	524	419	329	259	194	132	67		
Noah born,	707	577	472	382	312	247	185	120	53	
Enoch traſlated,	887	757	652	562	497	427	365	300	233	180
Adam dies,	930	800	695	605	535	470		343	276	323
Seth dies,	1042	912	807	717	647	582		462	388	335
Enos dies,	1140		905	815	745	680		553	486	433
Japhet born,	1207			882	812	747		620	553	500
Shem born,	1209			884	814	749		622	555	502
Cainan dies,	1235			910	840	775		648	581	528
Mahalaleel dies,	1290				895	830		703	636	583
Jared, Methuſelah, and Lamech, die,	1307		The Flood,			847		720	653	600

To the varieties exhibited in the two laſt tables, others might be added, by admitting the various readings of ſome numbers in the Samaritan and Septuagint: for as to the Hebrew copies, there is here a conſtant agreement among them.

The manuſcript from which the Samaritan Pentateuch was publiſhed, agrees exactly with the Samaritan numbers given by Euſebius. But St Jerom tells us, that, in his time, there were ſome Samaritan copies which make Methuſelah 187 years old at the birth of Lamech, and Lamech 182 at the birth of Noah, juſt as the Hebrew does. Now if theſe numbers be approved as the true original numbers, the interval from the creation to the flood will be 1556 years; differing from the Hebrew computation but 100 years in the age of Jared at the birth of Enoch: and if this laſt be allowed to be a miſtake of the tranſcriber, by his dropping a number, and writing 62 inſtead of 162, as has been ſuſpected, the Samaritan will be perfectly reconciled with the Hebrew, and all difference between them vaniſh.

Scaliger, on the authority of an old Samaritan chronicle, having at the end a table of the years of the patriarchs to the time of Moſes, would correct two of the Samaritan numbers in Euſebius; viz. inſtead of 65 the age of Mahalaleel when he begat Jared, he thinks it ſhould be 75; and inſtead of 67, the age of Methuſelah when he begat Lamech, he would have it 77. By which alterations he reckons 20 years more to the flood than Euſebius and the manuſcript; that is, 1327. But as he acknowledges the table, whereon he grounds theſe corrections, contains ſome great abſurdities, it ſeems unreaſonable to oppoſe it to the joint authority of Euſebius and the Samaritan manuſcript.

As to the Septuagint, in the common editions of that verſion, the age of Methuſelah at the birth of Lamech is 167; and conſequently the ſum of this period, according to them, is no more than 2242. But in this caſe Methuſelah will outlive the flood 14 years; and we may well wonder, with Euſebius, where he was preſerved. To obviate this objection, we are told, that, in ſome copies, Methuſelah is ſaid to have lived but 782 (not 802) years after the birth of Lamech, and no more than 949 in all. But the Alexandrian manuſcrip entirely takes away the the difficulty, by giving the ſame number in this place with the Hebrew.

Pezron is of opinion, that the age of Lamech at the birth of Noah ſhould be but 182, as it is both in the Hebrew and in Joſephus, ſuppoſing, with St Auſtin, that the preſent number is the error of the ſcribe who firſt copied the original Septuagint manuſcript in Ptolemy's library. So that he computes 2256 years to the flood. And, if this correction be admitted, and one more mentioned alſo by St Auſtin, viz. that Lamech lived 595 years after the birth of Noah, and not 161, as in the preſent copies, there will then remain no other difference between the Septuagint and the Hebrew than 600 years added to the ages of the ſix patriarchs when they begat their ſons, and Methuſaleh will, conformably to the Hebrew and Samaritan, die in the year of the flood.

Having premiſed this chronological view, we ſhall proceed to the hiſtory of the antediluvian patriarchs.

2
Of Adam in Paradiſe.

Of the great progenitor we are told, that "the Lord God took the man and put him into the garden." Theſe words plainly indicate, that Adam was not created within the precincts of Paradiſe; and it is afterwards ſaid, upon his being turned out of the garden, "He was ſent to till the ground whence he was taken."—As to the ſituation of this garden, concerning which there has been ſo much learned but uncertain enquiry, ſee the article PARADISE.

Adam was doubtleſs created in the prime of his life, with all his powers and faculties in the higheſt degree of ſtrength and vigour. His body would be graceful, and well proportioned; while his countenance was comely, and glowed with all the luſtre of youthful innocence. The poet thus deſcribes our firſt parents:

Adam the goodlieſt man, of men ſince born
His ſons; the faireſt of her daughters Eve.
——for in their looks divine
The image of their glorious Maker ſhone. *Milton.*

Many have entertained an opinion (as mentioned under the article ADAM), that our firſt parent was created an adept in knowledge and in ſcience, a conſummate philoſopher, and an accompliſhed divine. But the very reverſe of this muſt be true, providing we give credit to the account which Moſes gives of him. If Adam was created with intuitive knowledge, for what end was he endowed with the ſenſes of a man, through which ideas might be conveyed to his mind, and make him capable of ſuch improvements as ariſe from experience and obſervation? And if he originally poſſeſſed ſuch a fund of valuable knowledge, why had he ſuch an ardent thirſt for an unwarrantable portion of more, and for the ſake of this additional pittance forfeited his happineſs and life? Beſides, if Adam was at firſt all light and knowledge, and was ſoon after reduced to a ſtate of ignorance and error, this tranſition would make a retrograde in the ſyſtem of nature, quite diſſimilar to that uniformity which obtains throughout the whole of the divine government and œconomy. Moſes introduces our firſt parents into life in the moſt natural manner, as having capacities to acquire knowledge, ſenſes to receive impreſſions from objects around them, and a ſufficient degree of reaſon to form a judgment of the things perceived: yet all theſe faculties can only be conſidered as ſo many inſtruments, by the exerciſe of which they might be enabled to diſcharge the duties of their future life.

Smellie's Tranſlation, vol. iii. p. 50. &c. (the paſſage here abridged).

The following portrait of our firſt progenitor when he firſt came into life, drawn by the inimitable pencil of Buffon, is extremely beautiful, while it is diſſonant from no part of the Moſaic hiſtory. "Let us ſuppoſe a man in the ſame ſituation with him who firſt received exiſtence; a man whoſe organs were perfectly formed, but who was equally new to himſelf, and to every object which ſurrounded him. Were he to give a hiſtory of his thoughts, and of the manner in which he received impreſſions, he might give ſome ſuch information at this. I remember the moment when my exiſtence commenced. It was a moment replete with joy, with amazement and anxiety. I neither knew what I was, where I was, nor whence I came. I opened my eyes. But what an amazing increaſe of ſenſation! The light, the celeſtial vault, the verdure of the earth, the tranſparency of the waters, gave animation to my ſpirits, and conveyed pleaſures which exceed the powers of expreſſion. At firſt I believed that all theſe objects exiſted within me, and formed a part of myſelf. When, turning mine eyes to the ſun, his ſplendor overpowered me. I voluntarily ſhut out the light, and felt a ſmall degree of pain. During this moment of darkneſs, I imagined that I had loſt the greateſt part of my being. I was then rouſed with a variety of ſounds. The ſinging of birds and the murmuring breezes formed a concert, which excited the moſt ſweet and enchanting emotions. I liſtened, and was convinced that theſe harmonious ſounds exiſted within me.—I made a ſtep forwards; and afterwards renewing my motion, I walked with my face turned towards the Heavens, till I ſtruck againſt a palm tree, and felt ſome degree of pain. Seized with terror, I ventured to lay my hand upon the object, and perceived it to be a being deſtinct from myſelf, becauſe it did not, like touching my own body, give me a double ſenſation. I reſolved then to feel every object I ſaw, and had a ſtrong deſire to touch the ſun; but ſtretching out my hands to embrace the Heavens, they met without any intermediate object. All objects appeared to me equally near, and it was not till after many trials that I learned to uſe my eyes as a guide to my hand. At laſt the train of my ideas was interrupted, and I loſt the conſciouſneſs of my exiſtence. My ſleep was profound; but having no mode of meaſuring time, I knew nothing of its duration. When I awakened, I was aſtoniſhed to find by my ſide another form, perfectly ſimilar to my own. I conceived it to be another ſelf; and inſtead of loſing by my ſleep, I imagined myſelf to be doubled. I ventured to lay my hand upon this new being. With rapture and aſtoniſhment, I perceived that it was not myſelf, but ſomething much more glorious and deſirable."

This philoſophical detail coincides with the opinion, that excepting what portions of knowledge Adam might acquire by the exerciſe of his ſenſes, his Maker taught him every thing that was neceſſary for his comfort and ſubſiſtence. But before the Almighty gave any inſtructions to our firſt parents, we muſt ſuppoſe he inſpired them with the knowledge of the meaning of every word which they heard him ſpeak; otherwiſe it would have been impoſſible that he could have had any ſuch communication with them. The words which they heard, and were made to underſtand, being imprinted upon their memories, would ſerve as the foundation of a language, which they would afterwards increaſe and enlarge as new objects began to multiply, and hence give riſe to new terms and definitions.

One of the firſt leſſons taught to Adam by his infallible Director, would be the neceſſity of food for the ſupport of his life. Accordingly Moſes informs us, that for this purpoſe a grant was made him to eat of every tree of the garden excepting one. At the ſame time it was made known to him, in what manner he was to repair the decays of nature; namely, by eating of *the tree of life*. Then, in order to qualify him for ſocial intercourſe, he was ordered to exerciſe his faculty of ſpeech, by giving names to different creatures. The author of the book of Eccleſiaſticus ſays of our firſt parents, "They received the uſe of the five operations of the Lord; and in the ſixth, he imparted to them underſtanding; and in the ſeventh, ſpeech to interprete the cogitations thereof." The meaning cannot be, that he gave them every word they were to pronounce, more than every idea which their ſenſes were to convey to their underſtanding. Our talents, and the exerciſe of them, may be both ſaid to be given us of God; but whatever capacities we receive from him, it is ſuppoſed that we ourſelves muſt improve them, before we can attain to any acquirements whatever. Although Adam had heard and underſtood the words of God, yet Moſes does not give the leaſt hint that he ever attempted to ſpeak before this time. For if he had, as ſome imagine, innate knowledge and proper terms for every thing preſented to him, what occaſion was there to bring animals before him to ſee what names he would impoſe upon them? Some writers have endeavoured to turn into ridicule the whole of this tranſaction, and have aſked, how could all creatures upon earth appear at one time before Adam? not only one, but many days would have elapſed before he could give each a name. But this objection ariſes from not underſtanding the words of Moſes. What our tranſlators render to ſee what he would call THEM, is in the original to ſee what name he would call IT. "And whatſoever Adam called IT (viz. the living creature), that was the name of IT." The meaning ſeems to be no more than this: God brought a few creatures to Adam, to make him try to name them; and whatever he called any of them, that continued to be its name. And no doubt he would denominate every animal before him, from its external appearances, from its ſize, its colour, or its voice: And in proceſs of time, he would give names to all thoſe creatures which providence brought within his view, or with which he became afterwards acquainted.

The next thing in which God inſtructed Adam, tho' probably in a trance or viſion, was his near relation to Eve, as being part of his own body. This piece of knowledge was imparted to him, in order to cement the greater love and affection between the two during the remaining period of their lives.

Theſe, according to Moſes, are all the tranſactions in which our firſt parents were intereſted during their abode in Paradiſe, till they loſt their innocence, and forfeited the enjoyments of their happy ſituation. And nothing can be more evident, than that the inſtructions which they received, beſpoke the infantile ſtate of their minds; tho' there is no doubt but further and higher diſpenſations of knowledge would have been communicated to them, as they became able to bear them, and had their minds matured by experience and reflection.

3 **How long our firſt parents retained their innocence.**

How long our firſt parents retained their innocence, we are no where told. Many aſſert that they fell on the very firſt day of their creation. But Moſes mentions ſo many tranſactions on that day, as muſt have ingroſſed the whole of their attention, and prevented them from falling into ſuch temptations as ariſe from indolence and want of reflection. Beſides, if in ſuch circumſtances as they were placed, they could not refrain from an open violation of the Divine law for the ſpace of one day, it would beſpeak a deceitfulneſs of heart in them greater than in moſt of their poſterity. It is ſomewhat ſingular, that many of the great trials recorded in ſacred writing were limited to 40 days; which in prophetic ſtyle is ſometimes equivalent to 40 years. This appears from the hiſtory of Moſes, of Elijah, of Nineveh, and of the Jewiſh nation after the death of Chriſt. And what is very remarkable, he, of whom Adam was a type, was tempted 40 days in the wilderneſs. Agreeable to this part of the Divine œconomy, perhaps the trial of our firſt parents laſted ſo long. However, that they remained for a conſiderable time in the garden, appears highly probable from this conſideration, that their indulgent Creator, who had manifeſted his tender concern for them while innocent, and extended his mercy to them when fallen, would never have turned them out of paradiſe, and

Antediluvians.

ſent them into an uncultivated world, before they had acquired the arts of living, and were capable of providing againſt the viciſſitudes of their future lot. The particulars of this memorable tranſaction are conſidered under the article FALL.

Moſes gives us no further account of Adam's life after leaving the garden, but that he begat ſome children, and died at ſuch an age. Yet we have no reaſon to doubt, but the venerable patriarch ever after led a life of penitence and of the ſtricteſt piety. The various communications which he had enjoyed with his Maker in paradiſe, and which were probably renewed to him after his fall, could not fail to make the deepeſt impreſſions upon his mind. The gracious reſpite he had met with, from the execution of the ſentence denounced againſt him, would make him cautious of offending for the time to come; leſt the next violation of the Divine authority ſhould put an end to his exiſtence. The *cherubim and flaming ſword*, or the devouring flame, on the *eaſt of Eden* (which might continue burning all his life), would be to him what the veſtiges of the ark were to Noah and his ſons, an awful memorial of the danger of incurring the Divine diſpleaſure. Beſides, his worldly comforts being in a great meaſure withdrawn, his mind would be naturally diſpoſed for reliſhing thoſe pleaſures which flow from piety and religion.

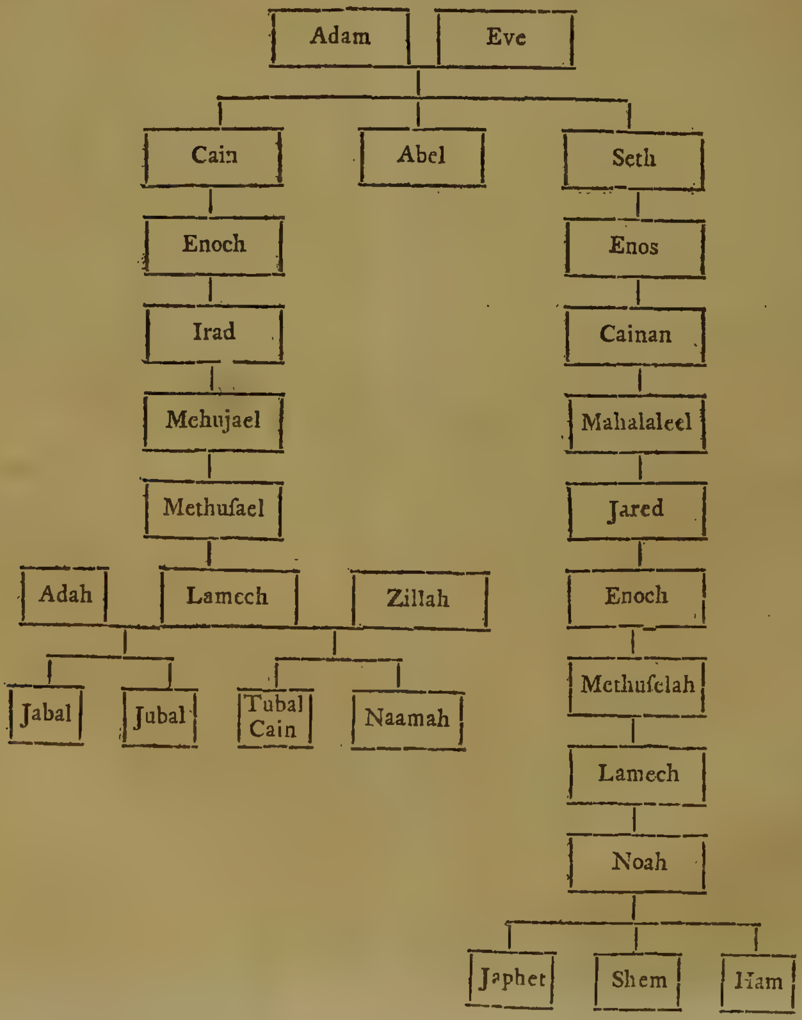
4
Of their progeny.

The firſt thing which we hear of Adam in his new ſituation was, that *he knew Eve his wife, and ſhe conceived and bare Cain.* Afterwards, we are told, ſhe bare Abel. When the brothers were grown up, they betook themſelves to diſtinct employments; the former to huſbandry, and the latter to the keeping of ſheep. Their inward diſpoſitions were ſtill more different; Cain being wicked and avaricious, but Abel juſt and virtuous.

In proceſs of time they brought their reſpective offerings to God. Cain of the fruit of the ground, and Abel of the firſtlings of his flock; but they met with very different ſucceſs: for God accepted the offering of Abel, but Cain's he did not accept; the conſequences of which are related under the articles ABEL and CAIN.

Soon after the murder of Abel, his loſs was made up to his parents in another ſon they had, whom Eve named *Seth*, that is, "appointed;" becauſe he was appointed inſtead of Abel, whom Cain ſlew.

As the whole progeny of Adam, of whom we have any mention in Scripture, were the deſcendants of Cain and Seth, it may be proper to give the following genealogical table of the Antediluvians.



The ſacred hiſtorian, confining himſelf chiefly to the line of Seth, from whence Noah was deſcended, has acquainted us with very few particulars relating to

5
Of the line of Cain.

that of Cain: nor can we thus form any conjectures how long he or any of his deſcendents lived. All we know is, that Lamech, the fifth in deſcent from him, married two wives, Adah and Zillah, the firſt known inſtance of polygamy: that by the former he had two ſons, Jabal, who was the firſt that dwelt in tents, and fed cattle; and Jubal, the inventor of muſic; and by the other, a ſon named Tubal-Cain, who found out the art of forging and working metals. Zillah likewiſe brought him a daughter named Naamah, ſuppoſed to have invented ſpinning and weaving: and we are told that, on ſome occaſion or other, Lamech made a ſpeech to his wives, the explication of which has greatly puzzled the interpreters. See LAMECH.

6
The line of Seth.
Miln's Phyſico-theolog. Lectures, p. 242, &c.

Moſes proceeds to tell us, that Seth had a ſon born to him called *Enos*, and that *then began men to call upon the name of the Lord*. Commentators give us three different ſenſes of theſe words. Some think the words ſhould be rendered, *Then men profaned in calling on the name of the Lord;* and that even Enos arrogated to himſelf a power, as if he had been a god. But this ſenſe ſeems harſh and unnatural. There is nothing more unlikely, than that Adam's grandchildren, who lived under his own eye, would ſo ſoon ſhake off parental authority, and apoſtatiſe from the belief and worſhip of the one true God. Others think, that though men had hitherto worſhipped God in private, yet they now inſtituted public aſſemblies, met in larger ſocieties for ſolemn and ſocial worſhip, and introduced liturgies and forms for more effectually paying their homage to the Almighty. This indeed is a very natural comment from thoſe who place religion in modes and ſet forms of worſhip. But it is ſcarcely credible, that Adam and his family had never met together to worſhip God till now, when we are told that Cain and Abel, and probably both their families along with them, brought their offerings to the Lord: this they no doubt did every ſabbath-day. Others, therefore, put a more conſiſtent interpretation upon the words, namely, that *men now called themſelves by the name of the Lord.* The meaning of which is, that about this period, the family of Seth, who adhered to God and his worſhip, began to give themſelves a denomination, expreſſive of their relation and regards to him. They diſtinguiſhed themſelves from the irreligious family of Cain, and aſſumed the title of the *ſons* or *children* of God; which deſignation was afterwards applied to them by Moſes; it was even uſed after the flood, and adopted by the writers of the New Teſtament.

Of the three next deſcendents of Seth, Cainan, Mahalaleel, and Jared, and of Methuſelah and Lamech, the grandfather and father of Noah, Moſes has recorded no more than their ſeveral ages. The oriental authors commend them, as they do Seth and Enos, for their piety, and the ſalutary injunctions they left behind them, forbidding their children all intercourſe with the race of curſed Cain.

Enoch, the ſon of Jared and father of Methuſelah, was a perſon of moſt extraordinary piety, *walking with God*, as the Scripture expreſſes it, for at leaſt the laſt three hundred years of his life: as a reward for which exemplary behaviour in ſo corrupt an age, he was taken up by God into heaven, without taſting death. See ENOCH.

7
Corruption of the human race.

Moſes afterwards informs us, *When men began to multiply*, i. e. when the earth was filled with inhabitants, and tribes formerly living remote, began to approach nearer to one another, *Daughters were born unto them;* meaning, in greater abundance than formerly: which ſeems to hint, that at this period there were conſiderably more females than males born into the world. Some think that Moſes, being now about to mention the wickedneſs of the Antediluvians, introduces the poſterity of Cain as being the chief cauſe of their corruption; and that he ſtyles them *men* and *daughters of men*, becauſe they were ſenſual and earthly; in which ſenſe the word *men* is ſometimes uſed in the ſcriptures.

The ſons of God ſaw the daughters of men that they were fair; and they took them wives of all that they choſe. Theſe words have given riſe to many abſurd and ridiculous comments both of Jews and Chriſtians. There are two meanings affixed to them, which may be mentioned as the moſt probable. Whenever the name of God is added to any thing, it not only denotes God's being the efficient cauſe, but it heightens and increaſes its uſual meaning. For which reaſon any thing that is excellent in its kind, or uncommonly lofty and magnificent, was by the Jews ſaid to be of God, or of the Lord. Thus the angels are called the *ſons of God*. And Adam being created with a nobler image than any other creature, is ſaid to be made in the *image of God*. The cedars of Lebanon are called the *cedars of the Lord;* and great mountains, the *mountains of God*. Therefore by the *ſons of God* in this place are meant men of great opulence, power, and authority. And by way of contraſt, the hiſtorian introduces thoſe of poor and mean circumſtances in life, and calls them the *daughters of men*. The words thus explained are not an unlikely deſcription of that diſſolute age. The great and mighty in this world are commonly moſt addicted to ſenſual gratifications, becauſe they have ſo many incentives to inflame their paſſions, and ſo few reſtraints to curb them; and, inſtead of uſing their power to puniſh and diſcountenance vice, are too often the greateſt examples and promoters of laſciviouſneſs and debauchery. Thus, theſe *ſons of God*, theſe great men, when they happened to meet with the daughters of their inferiors, gazed upon them as fit objects to gratify their luſt; and from among theſe they *took to themſelves*, in a forcible manner *wives*, or (as it may be rendered) *concubines*, *of all that they choſe*, whether married or unmarried, without ever aſking their conſent. No wonder then that the earth ſhould be *filled with violence*, when the higheſt rank of men were above the reſtraint of law, of reaſon and religion, and not only oppreſſed the poor, but with impunity treated them and their children in ſuch a baſe and cruel manner.

But there are other writers who cannot reliſh the above opinion; becauſe they think it a harſh and unnatural conſtruction, to call great and powerful perſons the *ſons of God*, and all mean and plebeian women the *daughters of men*. Beſides, the text does not ſay, that the *ſons of God* offered any violence to theſe inferior women; but that they ſaw that they were *fair*, and made choice of them for wives. And wherein is the heinouſneſs of the offence, if men of a ſuperior rank marry their inferiors, eſpecially when an exceſs of beauty apologiſes for their choice? Or why ſhould a few unequal matches be reckoned among the cauſes of bringing upon the world an univerſal deſtruction? For theſe reaſons many are of opinion, that the deſcendants of Seth, who were ſtyled the *ſons of God* on account of their near relation to him, ſaw the *daughters of men*, i. e. the impious progeny of Cain, and by intermarriages became aſſociated with them; and ſurrendering to thoſe inchantreſſes their hearts and their freedom, they ſurrendered at the ſame time their virtue and their religion. From this union proceeded effects ſimilar to what has happened ever ſince. When a pure ſociety mixes with a profane, the better principles of the one become ſoon tainted by the evil practices of the other; which verifies the old adage, *Evil communication corrupts good manners*. Thus it appears, that the great ſource of univerſal degeneracy, was owing to the poſterity of Seth mingling with the progeny of Cain, in oppoſition to what their pious fathers had ſtrictly charged them.

Miln. p. 265.

It is afterwards ſaid, *There were giants in the earth in thoſe days: and alſo after that, when the ſons of God came in unto the daughters of men, and they bare children to them, the ſame became mighty men, which were of old, men of renown.* Tranſlators are not agreed about the meaning of the word *giants*. Some render the word, *violent and cruel men;* others, men who *fall upon* and *ruſh forward*, as a robber does upon his prey: the meaning then is, that they were not more remarkable for their ſtrength and ſtature than for their violence and cruelty. It is generally agreed, that in the firſt ages of the world, men were of a gigantic ſtature; though Moſes does not mention them as giants till after the union of the families of Seth and Cain, when men uſed their ſuperiority in bodily ſtrength for the purpoſes of gratifying their unhallowed paſſions.

At this period of the world, and long after, political power and bodily ſtrength went hand in hand together. Whoever was able to encounter and kill a fierce and dangerous wild beaſt and clear the country of noxious animals, or who was able in the day of batttle to deſtroy moſt of his enemies, was looked up to by the reſt of his companions as the fitteſt to be their leader and commander. Thus, Nimrod, from being a *mighty hunter*, became a great king, and graſping at power, was never ſatisfied till every obſtacle to his ambition was removed. And it appears from hiſtory, that all his ſucceſſors have pretty nearly trodden in the ſame path. Theſe *giants* then, or *ſons of God*, might be the chief warriors, who formed themſelves into choſen bands, and living among a cowardly and effeminate people had no curb to their cruelty and luſt. From them might ſpring an illegitimate race, reſembling their fathers in body and mind, who, when they grew up, having no inheritance, would be turned looſe upon the world, and follow no other employment but theft, rapine, and plunder. Thus they became *mighty men* and *men of renown, and procured themſelves a name:* but this was owing to the miſchief they did, and the feats of ſavage cruelty which they performed.

8
God's forbearance.

Mankind running thus headlong into all manner of vice, were admoniſhed to repent; and God, out of his great mercy was pleaſed to grant them a convenient time for that purpoſe; no leſs than 120 years, during which ſpace, but no longer, he declared his Spirit ſhould "ſtrive with man," or endeavour to awaken and reclaim them from their wicked courſe of life.

9
Preaching of Noah.

Amidſt this general corruption, one man, however, was found to be juſt and perfect in his generation, walking with God. This extraordinary perſon was Noah, the ſon of Lamech; who, not thinking it ſufficient to be righteous himſelf unleſs he did his utmoſt to turn others likewiſe to righteouſneſs by admonition as well as example, became a preacher to the abandoned race among which he lived, employing both his counſel and authority to bring them to a reformation of their manners, and to reſtore the true religion among them. But all he could do was to no purpoſe; for they continued incorrigibly obſtinate: ſo that at length (as Joſephus tells us), finding himſelf and family in imminent danger of ſome violence in return for his good will, he departed from among them, with his wife and children.

10
Mankind incorrigible.

On his departure, it is probable they fell into greater diſorders than before; having now none to control or even to trouble them with unwelcome advice. Moſes aſſures us, "that the wickedneſs of man was great in the earth, and that every imagination of the thoughts of his heart was continually evil;" and that "the earth was corrupt and filled with violence, all fleſh having corrupted his way upon the earth." Theſe words leave no room to inquire into the particular crimes of the antediluvian world, which ſeems to have been over-run with a complication of all manner of debauchery and wickedneſs, and above all with violence and injuſtice towards one another.

11
The whole world deſtroyed by a flood, except Noah and his family.

Things being in this ſtate, God, as the ſacred hiſtorian pathetically expreſſes it, "repented that he had made man on earth, and it grieved him at his heart." And the time of forbearance being elapſed, he paſſed the ſentence of their utter deſtruction by a flood of waters; a ſentence which likewiſe included the beaſts of the earth and every creeping thing, and the fowls of the air. But "Noah found grace in the eyes of the Lord;" who had before acquainted him with his deſign of bringing a deluge on the earth, and directed him to make an ark, or veſſel, of a certain form and ſize, capable of containing not only himſelf and family, but ſuch numbers of animals of all ſorts as would be ſufficient to preſerve the ſeveral ſpecies and again repleniſh the earth, together with all neceſſary proviſions for them. All theſe injunctions Noah performed; and, by God's peculiar favour and providence, he and thoſe that were with him ſurvived this tremendous calamity. See the article DELUGE.

12
Traditional hiſtory of the Antediluvians

As to any further tranſactions before the flood, we are left entirely in the dark by the ſacred hiſtorian. The Jews and eaſtern nations, however, have made ample amends for the ſilence of Moſes, by the abundance of their traditions. The only part of theſe, which can be connected in any thing like hiſtory, is what follows.———After the death of Adam, Seth with his family ſeparated themſelves from the profligate race of Cain, and choſe for their habitation the mountain where Adam was buried, the Cainites remaining below in the plain where Abel was killed; and, according to our hiſtorians, this mountain was ſo high, that

that the inhabitants could hear the angels ſinging the praiſes of God, and even join them in that ſervice. Here they lived in great purity and ſanctity of manners. Their conſtant employment was praiſing God, from which they had few or no avocations; for their only food was the fruits of the trees which grew on the mountain, ſo that they had no occaſion to undergo any ſervile labours, nor the trouble of ſowing and gathering their harveſt. They were utter ſtrangers to envy, injuſtice, or deceit. Their only oath was, "By the blood of Abel; and they every day went up to the top of the mountain to worſhip God, and to viſit the body of Adam, as a mean of procuring the Divine bleſſing. Here, by contemplation of the heavenly bodies, they laid the foundations of the ſcience of aſtronomy; and leſt their inventions ſhould be forgotten, or loſt before they were publicly known, underſtanding, from a prediction of Adams, that there would be a general deſtruction of all things, once by fire, and once by water, they built two pillars, one of brick, and the other of ſtone, that if the brick one happened to be overthrown by the flood or otherwiſe deſtroyed, that of ſtone might remain. This laſt, Joſephus ſays, was to be ſeen in his time in the land of Siriad, (thought to be in Upper Egypt).

The deſcendants of Seth continued in the practice of virtue till the 40th year of Jared, when an hundred of them hearing the noiſe of the muſic and the riotous mirth of the Cainites, agreed to go down to them from the holy mountain. On their arrival in the plain, they were immediately captivated by the beauty of the women; who were naked, and with whom they defiled themſelves; and this is what is meant by the intermarriage of the ſons of God with the daughters of men, mentioned by Moſes. The example of theſe apoſtate ſons of Seth was ſoon followed by others; and from time to time great numbers continued to deſcend from the mountain, who, in like manner, took wives from the abandoned race of Cain. From theſe marriages ſprung the giants (who, however, according to Moſes exiſted before); and, theſe being as remarkable for their impiety as for their ſtrength of body, tyrannized in a cruel manner, and polluted the earth with wickedneſs of every kind. This defection became at laſt ſo univerſal, that none were left in the holy mountain, except Noah, his wife, his three ſons and their wives.

13
Profane hiſtory. *Beroſus's Babylonian Antiquities.*

Beroſus, a Chaldæan hiſtorian, who flouriſhed in the time of Alexander the Great, enumerates ten kings who reigned in Chaldea before the flood; of whom the firſt, called *Alorus*, is ſuppoſed to be Adam, and Xiſuthrus, the laſt, to be Noah.—This Alorus declared that he held his kingdom by divine right, and that God himſelf had appointed him to be the paſtor of the people. According to our hiſtorian, in the firſt year of the world, there appeared out of the Red Sea, at a place near the confines of Babylonia, a certain *irational* animal called *Oannes*. He had his whole body like that of a fiſh; but beneath his fiſh's head grew another of a different ſort, (probably a human one). He had alſo feet like a man, which proceeded from his fiſh's tail, and a human voice, the picture of him being preſerved ever after. This animal converſed with mankind in the day-time, without eating any thing: he delivered to them the knowledge of letters, ſciences, and various arts: he taught them to dwell together in cities, to erect temples, to introduce laws, and inſtructed them in geometry; he likewiſe ſhowed them how to gather ſeeds and fruits, and imparted to them whatever was neceſſary for a convenient and civilized life; but after this time there was nothing excellent invented. When the ſun ſet, Oannes retired into the ſea, and continued there all night. He not only delivered his inſtructions by word of mouth, but, as our author aſſures us, wrote of the origin of things, and of political œconomy. This, or a ſimilar animal, is alſo mentioned by other authors.

Of Alaſporus, the ſecond king, nothing remarkable is related. His ſucceſſor, Amelon, or Amillarus, was of a city called *Pantabibla*. In his time another animal reſembling the former appeared 260 years after the beginning of this monarchy. Amelon was ſucceeded by Metalarus; and he by Doanus, all of whom were of the ſame city. In the time of the latter, four animals of a double form, half man and half fiſh, made their appearance. Their names were *Euedocus*, *Eneugamus*, *Eneubulus*, and *Anementus*. Under the next prince, who was likewiſe of Pantabibla, appeared another animal of the ſame kind, whoſe name was *Odacon*. All theſe explained more particularly what had been conciſely delivered by Oannes.

In the reign of the tenth king, Xiſuthrus, happened the great deluge, of which our author gives the following account: Cronus, or Saturn, appeared to Xiſuthrus in a dream, and warned him, that on the fifteenth of the month Dæſius mankind would be deſtroyed by a flood; and therefore commanded him to write down the original, intermediate ſtate, and end of all things, and bury the writings under ground in Sippara, the city of the ſun; that he ſhould alſo build a ſhip, and go into it with his relations and deareſt friends, having firſt furniſhed it with proviſions, and taken into it fowls and four-footed beaſts; and that, when he had provided every thing, and was aſked whither he was ſailing, he ſhould anſwer, *To the gods, to pray for happineſs to mankind.* Xiſuthrus did not diſobey; but built a veſſel, whoſe length was five furlongs, and breadth two furlongs. He put on board all he was directed; and went into it with his wife, children, and friends. The flood being come, and ſoon ceaſing, Xiſuthrus let out certain birds, which finding no food, nor place to reſt upon, returned again to the ſhip. Xiſuthrus, after ſome days, let out the birds again; but they returned to the ſhip, having their feet daubed with mud: but when they were let go the third time, they came no more to the ſhip, whereby Xiſuthrus underſtood that the earth appeared again; and thereupon he made an opening between the planks of the ſhip, and ſeeing that it reſted on a certain mountain, he came out with his wife, and his daughter, and his pilot; and having worſhipped the earth, and raiſed an altar, and ſacrificed to the gods, he and thoſe who went out with him diſappeared. They who were left behind in the ſhip, finding that Xiſuthrus and the perſons that accompanied him did not return, went out themſelves to ſeek for him, calling him aloud by his name; but Xiſuthrus was no more ſeen by them: only a voice came out of the air, which enjoined them, as their duty was, to be religious; and informed them, that on account of his own piety he was gone to dwell with the gods, and that his wife and daughter and pilot, were partakers of the ſame honour. It alſo directed them to return to Babylon, and that, as the fates had ordained, they ſhould take the writings from Sippara, and communicate them to mankind; and told them, that the place where they were was the country of Armenia. When they had heard this, they offered ſacrifice to the gods, and unanimouſly went to Babylon; and when they came thither, they dug up the writings at Sippara, built many cities raiſed temples, and rebuilt Babylon.

14 Antediluvian kings of Egypt.

The Egyptians who would give place to no nation in point of antiquity, have alſo a ſeries of kings, who, as is pretended, reigned in Egypt before the flood; and to be even with the Chaldeans, began their account the very ſame year that theirs does according to Beroſus.

There was an ancient chronicle extant among the Egyptians, not many centuries ago, which contained 30 dynaſties of princes who ruled in that country, by a ſeries of 113 generations, through an immenſe ſpace of 36,525 years, during which Egypt was ſucceſſively governed by three different races; of whom the firſt were the Auritæ, the ſecond the Meſtræi, and the third the Egyptians.

But this extravagant number of years Manetho (to whoſe remains we muſt chiefly have recourſe for the ancient Egyptian hiſtory) has not adopted, however, in other reſpects he is ſuppoſed to have been led into errors in chronology by this old chronicle, which yet ſeems to have been a compoſition ſince Manetho's time.

15 Sanchoniatho's Phœnician hiſtory.

The account given by Beroſus is manifeſtly taken from the writings of Moſes; but we have another account of the firſt ages of mankind, in which no mention is made of the flood at all. This is contained in ſome fragments of a Phœnician author called *Sanchoniatho*, who is by ſome ſaid to have been cotemporary with Gideon, by others to have lived in the days of king David; while ſome boldly aſſert there never was ſuch a perſon, and that the whole is a fiction of Philo-Biblius, in oppoſition to the books of Joſephus written againſt Apion. To gratify the reader's curioſity, however, we have ſubjoined an account of the firſt ten generations mentioned by him, which are ſuppoſed by the compilers of the Univerſal Hiſtory to correſpond to the generations mentioned by Moſes before the flood.

Sanchoniatho having delivered his coſmogony, or generation of the other parts of the world, begins his hiſtory of mankind with the production of the firſt pair of mortals, whom Philo, his tranſlator, calls *Protogonus* and *Æon;* the latter of whom found out the food which was gathered from trees.

Their iſſue were called *Genus* and *Genea*, and dwelt in Phœnicia: but when the great droughts came, they ſtretched forth their hands to heaven towards the ſun; for him they thought the only God and Lord of heaven, calling him *Beelſamen*, which in Phœnician is *Lord of heaven*, and in Greek *Zeus*.

Afterwards from Genus, the ſon of Protogonus and Æon, other mortal iſſue was begotten, whoſe names were *Phos, Pur, and Phlox;* that is, *Light, Fire*, and *Flame*. Theſe found out the way of generating fire, by the rubbing of pieces of wood againſt each other, and taught men the uſe thereof. They begat ſons of vaſt bulk and height, whoſe names were given to the mountains on which they ſeized: ſo from them were named mount *Caſſius Libanus, Antilibanus*, and *Brathys*.

Of theſe laſt were begotten Memrumus, and Hypſuranius; but they were ſo named by their mothers, the women of thoſe times, who without ſhame lay with any man they could light upon. Hypſuranius inhabited Tyre, and he invented the making of huts of reeds and ruſhes, and the papyrus. He alſo fell into enmity with his brother Uſous, who firſt invented a covering for his body out of the ſkins of the wild beaſts which he could catch. And when violent tempeſts of winds and rains came, the boughs in Tyre being rubbed againſt each other, took fire, and burnt the wood there. And Uſous, having taken a tree, and broke off its boughs, was ſo bold as to venture upon it into the ſea. He alſo conſecrated two rude ſtones, or pillars, to fire and wind; and he worſhipped them, and poured out to them the blood of ſuch wild beaſts as had been caught in hunting. But when theſe were dead, thoſe that remained conſecrated to them ſtumps of wood and pillars, worſhipping them, and kept anniverſary feaſts unto them.

Many years after this generation came Agreus and Halicus, the inventors of the arts of hunting and fiſhing, from whom huntſmen and fiſhermen are named.

Of theſe were begotten two brothers, the inventors of iron and of the forging thereof: one of theſe, called *Chryſor*, the ſame with Hepheſtus or Vulcan, exerciſed himſelf in words and charms and divinations; found out the hook, bait, and fiſhing-line, and boats ſlightly built; and was the firſt of all men that ſailed. Wherefore he alſo was worſhipped after his death for a god; and they called him *Zeus Michius*, or Jupiter the engineer; and ſome ſay his brothers invented the way of making walls of brick.

Afterwards from this generation came two brothers; one of whom was called *Technites*, or the Artiſt; the other, *Geinus, Autochthon*, [the home-born man of the earth.] Theſe found out to mingle ſtubble, or ſmall twigs, with the brick earth, and to dry them in the ſun, and ſo made tyling.

By theſe were begotten others; of which one was called *Agrus* [Field]; and the other *Agrouerus*, or *Agrotes*, [Huſbandmen], who had a ſtatue much worſhipped, and a temple carried about by one or more yoke of oxen, in Phœnicia, and among thoſe of Byblus he is eminently called the *greateſt of the gods*. Theſe found out how to make courts about mens houſes, and fences and caves, or cellars. Huſbandmen, and ſuch as uſe dogs in hunting, derive from theſe; and they are alſo called *Aletæ* and *Titans*.

Of theſe were begotten Amynus and Magus, who ſhowed men to conſtitute villages and flocks.

In theſe mens age there was one Eliun, which imports in Greek *Hypſiſtus* [the moſt high], and his wife was named *Beruth*, who dwelt about Byblus: and by him was begot one Epigerus, or Autochton, whom they afterwards called *Uranus* [heaven]; ſo that from him that element which is over us, by reaſon of its excellent beauty, is called *heaven:* and he had a ſiſter of the ſame parents called *Ge*, [the earth]; and by reaſon of her beauty, the earth had her name given to it.

Hypſiſtus, the father of theſe, dying in fight with wild beaſts, was conſecrated, and his children offered ſacrifices and libations to him.—But Uranus taking the kingdom of his father, married his ſiſter Ge, and had by her four ſons; Ilus, who is called *Cronus* [or Saturn]; Betylus; Dagon, who is Siton or the god of corn; and Atlas: but by other wives Uranus had much iſſue.

As to the cuſtoms, policy, and other general circumſtances of the Antediluvians, we can only form conjectures.

The only thing we know as to their religious rites is, that they offered ſacrifices, and that very early, both of the fruits of the earth, and of animals; but whether the blood and fleſh of the animals, or only their milk and wool, were offered, is a diſputed point.—

16 **Arts, &c. of the Antediluvians.**

Of their arts and ſciences, we have not much more to ſay. The antediluvians ſeem to have ſpent their time rather in luxury and wantonneſs, to which the abundant fertility of the firſt earth invited them, than in diſcoveries or improvements, which probably they ſtood much leſs in need of than their ſucceſſors. The art of working metals was found out by the laſt generation of Cain's line; and muſic, which they might be ſuppoſed to practice for their pleaſure, was not brought to any perfection, if invented, before the ſame generation. Some authors have ſuppoſed aſtronomy to have been cultivated by the Antediluvians, though this is probably owing to a miſtake of Joſephus; but it is to be preſumed, the progreſs they made therein, or in any other ſcience, was not extraordinary; it being even very doubtful whether letters were ſo much as known before the flood. See ALPHABET, n° 13.

As to their politics and civil conſtitutions, we have not ſo much as any circumſtances whereon to build conjecture. It is probable, the patriarchal form of government, which certainly was the firſt, was ſet aſide when tyranny and oppreſſion began to take place, and much ſooner among the race of Cain than that of Seth. It ſeems alſo, that their communities were but few, and conſiſted of vaſtly larger numbers of people than any form ſince the flood: or rather, it is a queſtion, whether, after the union of the two great families of Seth and Cain, there were any diſtinction of civil ſocieties, or diverſity of regular governments, at all. It is more likely, that all mankind then made but one great nation, though living in a kind of anarchy, divided into ſeveral diſorderly aſſociations; which, as it was almoſt the natural conſequence of their having, in all probability, but one common language, ſo it was a circumſtance which greatly contributed to that general corruption, which otherwiſe perhaps could not have ſo univerſally overſpread the Antediluvian world. And for this reaſon chiefly, as it ſeems, ſo ſoon as the poſterity of Noah were ſufficiently increaſed, a plurality of tongues was miraculouſly introduced, in order to divide them into diſtinct ſocieties, and thereby prevent any ſuch total depravation for the future. See *CONFUSION of Tongues*.

Of the condition of the Antediluvians, Mr Whitehurſt, in his *Inquiry into the original ſtate and formation of the earth*,* has given us the following picture: "Under a mild and ſerene ſky, and when the ſpontaneous productions of the earth were more than ſufficient for the calls of nature without art or labour, mankind had no need of any other protection from the inclemency of the ſeaſons, nor of barns for winter's ſtore, than the benevolent Author of nature had plentifully provided for them. Conſequently, in a ſtate of nature like this, there was no temptation to acts of violence, injuſtice, fraud, &c. every one having plenty and enough, each equally partook of the numerous bleſſings thus amply provided for him. Power and property being equally diffuſed, men lived together in perfect peace and harmony, without law, and without fear; therefore it may be truly ſaid of the Antediluvians, that they ſlept away their time in ſweet repoſe on the ever verdant turf. Such apparently was the ſtate of nature in the firſt ages of the world, or from the creation to the firſt convulſion in nature, whereby the world was not only univerſally deluged, but reduced to a heap of ruins." But our ingenious author, whoſe *Inquiry* is not profeſſedly repugnant to revelation, ſeems here to have loſt himſelf in a pleaſing reverie. At leaſt he has forgot to inform us, For what purpoſe, under ſuch circumſtances, he ſuppoſes the deluge to have been ſent upon the earth: and, How we are to underſtand the account given by Moſes, who repreſents the Antediluvians, not as an innocent race, quietly repoſing on the ever-verdant turf; but as a corrupt generation, by whom "the earth was filled with violence."

17 **Of the longevity of the Antediluvians.**

One of the moſt extraordinary circumſtances, which occurs in the antediluvian hiſtory, is the vaſt length of human lives in thoſe firſt ages, in compariſon with our own. Few perſons now arrive to eighty or an hundred years; whereas, before the flood, they frequently lived to near a thouſand: a diſproportion almoſt incredible, though ſupported by the joint teſtimonies of ſacred and prophane writers. Some, to reconcile the matter with probability, have imagined that the ages of thoſe firſt men might poſſibly be computed, not by ſolar years, but months; an expedient which reduces the length of their lives rather to a ſhorter period than our own. But for this there is not the leaſt foundation; beſides the many abſurdities that would thence follow, ſuch as their begetting children at about ſix years of age, as ſome of them in that caſe muſt have done, and the contraction of the whole interval between the creation and the deluge to conſiderably leſs than two hundred years, even according to the larger computation of the Septuagint.

Again: Joſephus the Jewiſh hiſtorian, and ſome Chriſtian divines, are of opinion, that before the flood, and ſome time after, mankind in general did not live to ſuch a remarkable age, but only a few beloved of God, ſuch as the patriarchs mentioned by Moſes. They reaſon in this manner: Though the hiſtorian records the names of ſome men whoſe longevity was ſingular, yet that is no proof that the reſt of mankind attained to the ſame period of life, more than that every man was then of a gigantic ſtature, becauſe he ſays *in thoſe days there were giants upon the earth.* Beſides, had the whole of the Antediluvians lived ſo very long, and increaſed in numbers in proportion to their age, before the flood of Noah, the earth could not have contained its inhabitants, even ſupppoſing no part of it had been ſea. And had animals lived as long, and multiplied in the ſame manner as they have done afterwards, they would have conſumed the whole produce of the globe, and the ſtronger would have extinguiſhed many ſpecies of the weaker. Hence they conclude, that, for wiſe and good ends, God extended only the lives of the patriarchs, and a few beſide, to ſuch an extraordinary length.

But moſt writers maintain the longeviiy of mankind in general in the early world, not only upon the authority of ſacred, but likewiſe of profane hiſtory. And for ſuch a conſtitution, the moral reaſons are abundantly obvious.

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* P. 282, 283.

18 Moral reaſons for this longevity.

When the earth was wholly unpeopled, except by one pair, it was neceſſary to endow men with a ſtronger frame, and to allow them a longer continuance upon earth for peopling it with inhabitants. In the infant ſtate of every mechanical art, relating to tillage, building, clothing, &c. it would require many years experience to invent proper tools and inſtruments to eaſe men of their labour, and by multiplied eſſays and experiments to bring their inventions to any degree of maturity and perfection. Every part of their work muſt have been exceedingly arduous from ſuch a penury and coarſeneſs of tools, and muſt have required longer time and more ſtrength of body than afterwards, when mechanical knowledge was introduced into the world. If parents at this period had not continued long with their children, to have taught them the arts of providing for themſelves, and have defended them from the attacks of wild beaſts, and from other injuries to which they were expoſed, many families would have been totally extinguiſhed. But one of the beſt and moſt valuable ends which longevity would anſwer was, the tranſmitting of knowledge, particularly of religious knowledge, to mankind. And thus, before writing was invented, or any ſuch eaſy and durable mode of conveyance was found out, a very few men ſerved for many generations to inſtruct their poſterity, who would not be at a loſs to conſult living and authentic records.

19 Natural cauſes of it.

The natural cauſes of this longevity are variouſly aſſigned. Some have imputed it to the ſobriety of the Antediluvians, and the ſimplicity of their diet; alleging that they had none of thoſe provocations to gluttony, which wit and vice have ſince invented. Temperance might undoubtedly have ſome effect, but not poſſibly to ſuch a degree. There have been many temperate and abſtemious perſons in later ages, who yet ſeldom have exceeded the uſual period.—Others have thought, that the long lives of thoſe inhabitants of the old world proceeded from the ſtrength of their ſtamina, or firſt principles of their bodily conſtitutions: which might, indeed, be a concurrent, but not the ſole and adequate cauſe of their longevity; for Shem, who was born before the deluge, and had all the virtue of the antediluvian conſtitution, fell three hundred years ſhort of the age of his forefathers, becauſe the greateſt part of his life was paſſed after the flood.—Others have imputed the longevity of the Antediluvians to the excellency of theſe fruits, and ſome peculiar virtue in the herbs and plants of thoſe days. But to this ſuppoſition it has been objected, that as the earth was curſed immediately after the fall, its productions we may ſuppoſe gradually decreaſed in their virtue and goodneſs till the flood; and yet we do not ſee the length of mens lives decreaſed conſiderably, if at all, during that interval. Waving this objection, as the import of the curſe is variouſly interpreted, it appears certain that the productions of the earth were at firſt, and probably continued till after the deluge, of a different nature from what they were in future times. Buffon ſuppoſes this difference may have continued gradually to diminiſh for many ages ſubſequent to that cataſtrophe. The ſurface of the globe (according to his theory) was in the firſt ages of the world leſs ſolid and compact; becauſe, gravity having acted only for a ſhort time, terreſtrial bodies had not acquired their preſent denſity and conſiſtence. The produce of the earth, therefore, muſt have been analogous to its condition. The ſurface being more looſe and moiſt, its productions would of courſe be more ductile and capable of extenſion: Their growth, therefore, and even that of the human body, would require a longer time of being completed. The ſoftneſs and ductility of the bones, muſcles, &c. would probably remain for a longer period, becauſe every ſpecies of food was more ſoft and ſucculent. Hence, the full expanſion of the human body, or when it was capable of generating, muſt have required 120 or 130 years; and the duration of life would be in proportion to the time of growth, as is uniformly the caſe at preſent: For if we ſuppoſe the age of puberty, among the firſt races of men, to have been 130 years, as they now arrive at that age in 14 years, the age of the Antediluvians will be in exact proportion to that of the preſent race; ſince by multiplying theſe two numbers by ſeven, for example, the age of the preſent race will be 90, and that of the Antediluvians will be 910. The period of man's exiſtence, therefore, may have gradually diminiſhed in proportion as the ſurface of the earth acquired more ſolidity by the conſtant action of gravity: and it is probable, that the period from the creation, to the days of David, was ſufficient to give the earth all the denſity it was capable of receiving from the influence of gravitation; and conſequently that the ſurface of the earth has ever ſince remained in the ſame ſtate, and that the terms of growth in the productions of the earth, as well as the duration of life, have been invariably fixed from that period.

It has been further ſuppoſed, that a principal cauſe of the longevity under conſideration was the wholeſome conſtitution of the Antediluvian air, which, after the deluge, became corrupted and unwholeſome, breaking, by degrees, the priſtine craſis of the body, and ſhortening men's lives, in a very few ages, to near the preſent ſtandard.

The temperature of the air and ſeaſons before that cataſtrophe are, upon very probable grounds, ſuppoſed to have been conſtantly uniform and mild: the burning heats of ſummer and the ſeverities of winter's cold were not then come forth, but ſpring and autumn reigned perpetually together: And indeed, the circumſtances above all others moſt conducive to the prolongation of human life in the poſtdiluvian world appears to be an equal and benign temperature of climate (ſee the article LONGEVITY); whence it ſeems reaſonable to infer, that the ſame cauſe might have produced the ſame effect in the Antediluvian world.

20 Whether any fleſh might be eaten before the flood.

Whether fleſh was permitted to be eaten before the deluge, is a queſtion which has been much debated. By the permiſſion expreſsly given to Noah for that purpoſe, after the flood, and God's aſſigning vegetables only for food to man, as well as beaſt, at the creation, one would imagine it was not lawful before: yet others have ſuppoſed, that it was included in the general grant of power and dominion given to Adam by God over the animal creation; and the diſtinction of beaſts into clean and unclean, which was well known before the flood, is inſiſted on as a ſtrong argument on this ſide.

But in anſwer to this it has been obſerved, that if ſo, it doth not appear what occaſion there was to renew this grant after the flood, and to add, "Every moving thing that liveth ſhall be meat for you, even as the green herb have I given you all things." This ſurely implies that the green herb and fruits of the trees were all that was granted to man at firſt; but now, over and above that, was added the grant of animal food: for in a deed or gift, all is ſpecified that is given or granted, and whatever is not expreſsly mentioned is excluded or not given. Here man's food is appointed and ſpecified, what is not expreſsly mentioned is therefore reſerved and not granted. Beſides, this grant or appointment of man's food reſpected, not Adam only, but all his poſterity, till an additional grant was made.

To the animals no further grant was made than at firſt; but to man another was made immediately after his fall and expulſion from Paradiſe, implied in theſe words; "In the ſweat of thy face ſhalt thou eat bread, till thou return unto the ground." This was in truth a puniſhment for his tranſgreſſion, as well as a grant of other food, but yet what was now become neceſſary to him. Paradiſe was no doubt planted with the moſt excellent fruits, ſufficient to have ſuſtained his life in health and vigour in his innocent ſtate: but after his tranſgreſſion, being thruſt out from that happy abode, and having then only the fruits of the common earth to feed on, which were not ſo nutritious as thoſe of Paradiſe, he ſtood in need of ſomething elſe to ſuſtain life; and therefore bread produced by culture and other preparations for his food was now added, which before was not neceſſary, and thence called *the ſtaff of life*. This ſeems a plain reaſon why bread was added after he came to live on the common earth; though perhaps another reaſon alſo for that addition may be given from the change that happened in man's body after his fall. Bread being now become the ſtaff of life, Cain, the firſt man born, became a tiller of the ground, or an huſbandman; as the next in birth, Abel, became a keeper or feeder of ſheep.

As to the diſtinction between clean and unclean, this ſolely reſpected animals offered in ſacrifice in the Antediluvian world: as is evident from hence, that Noah, upon his coming out of the ark, "took of every clean beaſt and of every clean fowl, and offered burnt-offerings unto the Lord;" and that upon the grant of animal food to him and his poſterity, which was poſterior in time to the ſacrifice, there is not the leaſt mention of any diſtinction between clean and unclean with reſpect to food, but the very contrary, ſince the grant runneth, "Every moving thing that liveth ſhall be meat for you, even as the green herb have I given you all things." That diſtinction of clean and unclean as to food, came in with the law of Moſes, and was different from that of ſacrifices, there being ſeveral creatures clean for food which were not to be offered in ſacrifice.

But another objection here occurs. What occaſion was there for keeping ſheep, when none of them could be eaten? In anſwer to this, it has been obſerved, that ſheep and other animals might at this period be of great uſe to men beſides yielding them food. Their flocks, no doubt, conſiſted of ſuch creatures as were of the domeſtic kind, and ſuch as by the divine law were pronounced clean and fit for being offered in ſacrifice; therefore numbers would be kept for this very purpoſe. Their ſkins, beſides ſerving men as garments; might anſwer many other valuable intentions. Veſtments of hair and wool ſoon ſucceeded the ruder covering of ſkins; conſequently great profit would be derived from ſuch animals as could be ſhorn, eſpecially in countries where the inhabitants led a paſtoral life and dwelt in tents. And we afterwards find that Abel's ſacrifice was of this kind. They might uſe ſeveral of theſe animals, as they ſtill do in ſome parts of the world, for bearing of burdens and drawing of carriages: for we may take for granted that the firſt inventions for eaſing men of labour, would be of the ſimpleſt kind, and ſuch as came eaſieſt to hand. But keeping flocks of ſheep, goats, and ſuch like, would be of great utility, by affording quantities of milk, which is found to be the moſt nouriſhing diet both to the young and the old; and their carcaſes, though not uſed as food, might anſwer ſome uſeful purpoſes, perhaps in manuring the ſoil.

21
Increaſe of mankind before the flood.

The Antediluvian world was, in all probability, ſtocked with a much greater number of inhabitants than the preſent earth either actually does, or perhaps is capable of containing or ſupplying. This ſeems naturally to follow from the great length of their lives, which exceeding the preſent ſtandard of life in the proportion, at leaſt, of ten to one, the Antediluvians muſt accordingly in any long ſpace of time double themſelves, at leaſt in about the tenth part of the time in which mankind do now double themſelves. It has been ſuppoſed that they began to beget children as early, and left off as late, in proportion, as men do now; and that the ſeveral children of the ſame father ſucceeded as quickly one after another as they uſually do at this day; and as many generations, which are but ſucceſſive with us, were contemporary before the flood, the number of people living on the earth at once would be by that means ſufficiently increaſed to anſwer any defect which might ariſe from other circumſtances not conſidered. So that, if we make a computation on theſe principles, we ſhall find, that there was a conſiderable number of people in the world at the death of Abel though their father Adam was not then 130 years old; and that the number of mankind before the deluge would eaſily amount to above one hundred thouſand millions (even according to the Samaritan chronology), that is, to twenty times as many as our preſent earth has, in all probability, now upon it, or can well be ſuppoſed capable of maintaining in its preſent conſtitution.

The following table, made upon the abovementioned principles by Mr Whiſton, ſhows at leaſt what number of people might have been in the Antediluvian world.

Number of mankind.	Year of the world.	Year of doubling.	Series.
4	2	[illegible]	1
8	6	4	[illegible]
16	12	6	3
32	20	8	4
64	30	10	5
128	42	12	6
256	56	14	7

512

Number of mankind.	Year of the world.	Year of doubling.	Series.
512	72	16	8
1024	90	18	9
2048	110	20	10
4096	132	22	11
8192	156	24	12
16,384	182	26	13
32,768	210	28	14
65,536	240	30	15
131,072	272	32	16
262,144	306	34	17
524,288	342	36	18
1,048,576	380	38	19
2,097,152	420	40	20
4,194,304	462	42	21
8,388,608	506	44	22
16,777,216	552	46	23
33,554,432	600	48	24
67,108,864	650	50	25
134,217,728	702	52	26
268,435,456	756	54	27
536,870,912	812	56	28
1,073,741,824	170	58	29
2,147,483,648	930	60	30
4,294,967,296	992	62	31
8,589,934,592	1056	64	32
17,179,869,184	1122	66	33
34,359,738,368	1190	68	34
68,719,476,736	1260	70	35
137,438,953,472	1332	72	36
274,877,906,944	1406	74	37
549,755,813,888	1482	76	38

But according to a later* writer upon the ſubject, the above table, though the numbers there may be thought ſufficient for the peopling of the earth, we could by no means depend upon, for ſeveral reaſons; particularly,

22 Objections to Mr Whiſton's table.

1. It is laid down there as a foundation, that the Antediluvians would double themſelves every 40 years; as indeed they would, and in leſs time, after there came to be 100 marriages. Now, had the author obſerved this regular progreſſion in his computation, by adding 40 years to every former period of the age of the world, the amount, inſtead of two millions of millions, &c. would have been above five millions of millions at the year 1656, the age of the world at the deluge, according to the Hebrew numbers which he contends for. What would the ſum then have been, had we carried on the computation for 600 years more according to the Septuagint?

2. He ſuppoſes the period of doubling muſt have been much ſhorter in the earlieſt ages, and much longer in the later, contrary to reaſon and fact. For mankind being ſprung from one pair only, the increaſe at firſt muſt have been very ſlow, but come on very faſt when a conſiderable number were married. His table therefore is made not regularly, but according to fancy, by unequal ſtarts or chaſms, at great intervals in the later part, where it ſhould have been moſt regular; it would ſeem with no other view than to raiſe ſuch a number, upon the whole, as might be thought ſufficient to people the earth,

3. In that calculation the two material points, the time of nurſing and the age of puberty, are quite overlooked, by which all computations of the numbers in the antediluvian world muſt be regulated. What unavoidable miſtakes this omiſſion muſt occaſion, will be ſeen by examining the firſt ten numbers of the ſaid table.

Years of the world and intervals of doubling.	Nember of increaſe according to the intervals.	
1	2	Adam and Eve.
2	4	Cain and Abel.
6	8	
12	16	
20	32	
30	64	
42	128	
56	256	
72	512	
90	1024	
110	2048	

On this table it may be obſerved, 1. That though there were but two perſons created at firſt, this computation makes four perſons in the ſecond year of the world. This could not poſſibly be, except Cain had been born within 12 months after the creation, which is highly improbable, and Abel in the ſecond year, yet far more improbable; for in that caſe Eve could not have ſuckled Cain.

2. In the ſixth year of the world we have eight perſons, that is, ſix children of Eve's in ſix years. "But (our author adds) what ſhall Eve do with ſix infants in ſix years? Where could ſhe find ſo many wet nurſes for them? Or would the mother of all living deny her children that nouriſhment which the Creator had appointed for their firſt food, the milk in her breaſts? Do they conſider that there was but one women in the world to do for herſelf, her huſband and her children, what belongs to women to do? We ſhould ſurely have more reſpect and compaſſion for the mother of all mankind, than to lay ſuch an intolerable burden upon her, whoſe ſorrow for her own deception, and thereby ruining both herſelf and her huſband, muſt have been very great for many years. In puniſhment of which, though God had ſaid *he would greatly multiply her ſorrow and conception*, the meaning was not, that ſhe ſhould have a child every year, which could not be, becauſe the nature of that food and nouriſhment appointed by himſelf for her children would not permit it. Nor yet when he commanded them to *increaſe and multiply and repleniſh the earth*, could the command be obeyed in ſuch a manner as was contrary to the order of nature and providence. But the method intended to anſwer the deſign of the command was to prolong their lives to above 800 and 900 years, and their prolific powers for 340 or 360 years of that term of life, that by ſlow and ſure and long continuance of increaſe they might people the earth in due time." *Cockburn, p. 108.*

3. The ſame exception lies to all the following periods of doubling, where the number far exceeds what it could poſſibly be in fact; but we ſhall paſs them over, and come to the laſt of them in the year 110, in which the nember of mankind is made 2048. Now in the year 110 not one of Adam's children were mar-

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* *Cockburn upon the Deluge.*

ried, becauſe not yet come to the age of puberty. In that year of the world there could be no more than 18 or 20 perſons, at ſingle births, beſides Adam and Eve. It is a great miſtake therefore to imagine, that the periods of doubling were much ſhorter in the earlier times than in the latter; the contrary of which is evident to reaſon.

Id. p. 81.

According to our author, two errors have been fallen into in treating of this point; namely, 1. That in the firſt ages of the world, both before and after the Flood, men began to propagate their kind as early as they commonly do at preſent. 2. That the children of the ſame father ſucceeded one after another as faſt as they do now, that is, that the women brought forth children every year.

23 Of the ages of puberty among the Antediluvians.

The firſt of theſe errors he confutes, by ſhowing that the ſeveral periods or ſtages of man's life bear a juſt proportion to one another, and to the whole term of life; and that the period of puberty or maturity has not been the ſame at all times, but is according to the length or brevity of life in the different ages of the world, according to that remark of St Auguſtine, *Tanto ſerior fuit proportione pubertas, quanto vitæ totius major annoſitas.* Moſes, he obſerves, gives the age of the world from the creation to the deluge, and from that period to his own time chiefly by generations. A generation is the interval of years between the births of father and ſon. This the Latins call *ætas*, and the Greeks γενεα. Now, a generation, or the interval of years between father and ſon, has not been, neither poſſibly could be, the ſame in all ages from the beginning, as Voſſius juſtly obſerves; but has varied greatly according to the length or brevity of man's life in the ſeveral periods of the world. Since the ordinary term of man's life has been reduced to 70 and 80 years, the time of puberty is in proportion to this brevity of life, and reckoned at 20 or 21, which is the fourth-part of a life of fourſcore. The ſeveral ſtages of human life are infancy, childhood, youth, manhood, full age, declenſion, old or decrepit age; all which commonly bear a proportion to the whole term of life. Now the bounds and limits of theſe ſeveral ſtages cannot be preciſely the ſame in all, but vary in reſpect of the diſpoſition of men's bodies, their courſe of life, and alſo the places and ages in which they live. In the Antediluvian world then, when men lived to upwards of 800 and 900 years, can it be thought that they paſſed through the ſeveral ſtages of life in as ſhort a time as men do now, who ſeldom exceed 80, and not one in ten arrives at that age? But if the Antediluvians arrived at puberty or manhood as ſoon as men do now, then would the ſeveral ſtages of human life have been loſt or confounded, and men would have ſtarted from childhood to manhood at once, without any due or regular intervals, contrary to the order of nature: But if, according to the preſent œconomy of nature, man is but a youth at 20, which is a fourth part of our term of life, we may reaſonably conclude, there would be a ſuitable proportion of years in a much longer term of life, ſince nature is conſtant and uniform in her operations. And though in ſo long a life as the Antediluvians enjoyed, the time of puberty might be a fifth or a ſixth part of their term of life, yet would they be but youths at 150 or 160; which bears much the ſame proportion to the whole of their life as 20 is to that of ours.

The other is an error, he thinks, which could never have been fallen into, had it been conſidered, that every mother ſuckled her own children in thoſe early days; and indeed where could ſhe have found another to have done it for her?

Taking it for granted, then, that it was an univerſal cuſtom for women to ſuckle their children as well before as after the food, the next queſtion is, for how long time they continued nurſes? He ſhows various inſtances, that when man's life was reduced to 130 or 140 years, the ordinary time of nurſing was two years: he thence infers, that for three or four generations after the flood, when men lived to above 400 years, the time would be ſo much longer in proportion, and would not be leſs than three or four years; and conſequently, that before the flood, when life was protracted to 800 or 900 years, it would be ſtill longer in proportion to their longevity; ſo that five years might be the ordinary time of nurſing in the Old World; and therefore that we cannot reckon leſs than ſix years between the births.

24 Of the time allotted for nurſing in thoſe early days.

For man's life being prolonged to ſo many hundred years at firſt for the more ſpeedy peopling of the earth, he came by ſlow degrees to mature age, there being a long time required to rear up a body that was to laſt near 1000 years. The intervals therefore of infancy, childhood, youth, and mature age, were ſo much longer in proportion to ours as the difference is between our term of life and theirs; and 150 or 160 years, with reſpect to their longivity, was no more in proportion than 20 is to the brevity of our life. As the Antediluvians therefore were ſo very long in growing up to mature age, he concludes that the time of nurſing could not be ſhorter than five years, and that the diſtance between the births in a regular way muſt be ſet at ſix years.

25 Diſtance between the births.

Upon the whole, he thinks it evident that there could be no ſuch ſpeedy increaſe of mankind at the beginning as is imagined; that the time of nurſing above ſpecified was no more than neceſſary for that ſtrength of conſtitution which was to laſt for 800 and 900 years; and that women who were to continue bearing children for 340 or 360 years of their life, ſhould have them but ſlowly, and at the diſtance of ſeveral years, that their ſtrength might hold out, and that they might not be overburthened with too many cares at once; and therefore, when Eve's firſt child was ſix years old, it was time enough for her to have another, and ſo on, though poſſibly ſometimes twins.

25 Cockburn's calculation of the increaſe of mankind.

Theſe points being diſcuſſed, he proceeds, 1. To compute what number upon the whole might be born into the world from the creation to near the time of the deluge; and then, 2. To ſtate the needful deductions for deaths and other deficiencies.

I. 1. How long the parents of mankind continued in paradiſe, we know not; though longer perhaps than is commonly imagined. We ſhall even ſuppoſe two or three years, in which time there was no child born, nor any attempt towards it. We ſhall allow them two or three years more to lament their fall, and the miſerable eſtate their want of faith and diſobedience had brought them to, from a moſt happy condition; and ſuppoſe Cain to be born ſix years after the creation (in which ſuppoſition few, probably, will be apt to think us too haſty), and Abel again ſix years after him, and ſo every ſixth year Eve to have had a child, the firſt ſeven, eight or nine whereof were probably all males (the males being longer in coming to maturity than the females); and this diſtance between the births will alſo be thought a ſufficient allowance. At this rate of increaſe Adam would have in 100 years 16 children, in 200 years 32, and in 400 years 64 children; when we will ſuppoſe Eve to have left off child-bearing. Nor need this number of Adam's children be thought too great, when there are inſtances in theſe later ages, and this ſhort period of man's life, of thoſe who have had 40 children at ſingle births by two ſucceſſive wives, and of many others who have had 20, 25, and 30, by one wife; though in ſuch caſes it is not to be ſuppoſed that the women ſuckled their children.

2. Though it is reaſonable to think that the Antediluvians, notwithſtanding their longevity, came to mature age at 150; yet as we are not ſure that they all married ſo ſoon as they were ripe for marriage, and that the earlieſt in the genealogies is born in the 162d year of his father, who might probably be a firſt-born, our author does not ſuppoſe Cain, Abel, or any of the ſucceeding children or grandchildren of Adam to have married till they were 160, but to have had children from 161 or 162 till they were of the age of 500, at the fore-named diſtance or interval between the births; though Noah we know had three ſons after he was 500, at the due intervals. And to all the Antediluvians we may allow, without fear of exceeding, 50 or 54 children in general, according to the courſe of nature, and the longevity of thoſe firſt ages of the world.

3. Let us next inquire in what number of years the men of that world might double themſelves, notwithſtanding the long interval between the births. The increaſe indeed will be found very ſmall for the firſt 300 or 400 years, as they were late in coming to maturity; but the ſucceeding ages will ſwell the account exceedingly. Let us ſuppoſe at preſent (what ſhall be proved afterwards) that in the year of the world 500, there were 200 perſons only, male and female, of full age to marry, the men at 160, the women at 120 or thereabout. The firſt or ſecond year after the marriage will probably produce 100 births from 100 couple, and every ſixth year after 100 more. At this ſlow progreſſion the 200 married perſons will, in 19 or 20 years, be increaſed to 600: ſo that the number of mankind would be trebled in 20 years, after there came 100 pair to be married. And in this manner they would increaſe and multiply every 20 years, or in that ſpace treble themſelves.

It may perhaps be objected, that though it appears that ſuch an increaſe might be at firſt from the firſt 100 marriages, yet they could not continue thus to multiply at ſuch periods; becauſe, according to the rule we have laid down, none of the iſſue of theſe 100 firſt marriages could increaſe the number of mankind till the men had attained the age of 160. It is true they could not: but then it muſt be remembred, that the firſt 100 pair are ſtill adding every ſixth year 100 more to the number of mankind, even till after the 400 born in the firſt 20 years are married, and begin a new ſtock for increaſe; ſo that when there came to be ſome hundred couples married, the increaſe and multiplication would come on very faſt, and in 1000 years mankind would be prodigiouſly increaſed.

But though there be nothing in this ſuppoſition contrary to reaſon, viz. That after the year of the World 500, they might treble themſelves in 20 years; yet we will not reckon upon ſo ſhort an interval, but will allow a much longer time even to their doubling themſelves, and ſhall exhibit two tables of doubling; the firſt at the interval of 50 years (much too long indeed), the other at the interval of 40 years, and both beginning at the year 500, when there could not be fewer (whatever more there might be) than 100 married or marriageable perſons deſcended from Adam and Eve.

Years of the World.	Number of Mankind.
500	200
550	400
600	800
650	1,600
700	3,200
750	6,400
800	12,800
850	25,600
900	51,200
950	102,400
1,000	204,800
1,050	409,600
1,100	819,200
1,150	1,638,400
1,200	3,276,800
1,250	6,553,600
1,300	13,107,200
1,350	26,214,400
1,400	52,428,800
1,450	104,857,600
1,500	209,715,200
1,550	419,430,400
1,600	838,860,800
1,650	1,677,721,600
1,700	3,355,443,200
1,750	6,710,886,400
1,800	13,421,772,800
1,850	26,843,545,600
1,900	53,687,091,200
1,950	107,374,182,400
2,000	214,748,364,800
2,050	429,496,729,600

This table is calculated at the long interval of 50 years, that it may appear that even by under-rating the number of mankind, there would be ſo many millions born into the world before the deluge came, that they would be obliged to ſpread themſelves over the face of the earth, though but one half of the ſum total of 429,496 millions had been alive at the time of the deluge; but as the interval here allowed may appear to be too long for the time of doubling, the ſecond is calculated at the interval of 40 years, which comes nearer to the truth of the caſe, though even this may exceed the time of doubling.

Years of the World.	Number of Mankind.
500	200
540	400
580	800
620	1,600
660	3,200
700	6,400

Antediluvians.

Years of the World.	Numbers of Mankind.
740	12,800
780	25,600
820	51,200
860	102,400
900	204,800
940	409,600
980	819,200
1,020	1,638,400
1,060	3,276,800
1,100	6,553,600
1,149	13,107,200
1,180	26,214,400
1,220	52,428,800
1,260	104,857,600
1,300	209,715,200
1,340	419,430,400
1,380	838,860,800
1,420	1,677,721,600
1,460	3,355,443,200
1,500	6,710,886,400
1,540	13,421,772,800
1,580	26,843,545,600
1,620	53,687,091,200
1,660	107,374,182,400
1,700	214,748,364,800
1,740	429,496,729,600
1,780	858,993,459,200
1,820	1,717,986,918,400
1,860	3,435,973,836,800
1,900	6,871,947,673,600
1,940	13,743,895,347,200
1,980	27,487,790,694,400
2,020	54,975,581,388,800

The firſt table is brought down no lower than to the year 2050, and the ſecond to the year 2020, though there remain by the firſt 206, and by the ſecond 236 years to the flood: the reaſon is, that in thoſe laſt 200 years of the world, mankind would not increaſe in any meaſure equal to what they had done in the preceeding years (though regularly the increaſe ſhould have been much greater): becauſe that violence was then great in the earth, and thouſands, yea, millions, might have been cut off by untimely deaths; for which cauſe the worlds deſtruction was determined 120 years before the flood came.

27 Objection anſwered.

II. But now againſt this immenſe number of mankind that might in a regular and ordinary way have been born in the world between the creation and the deluge in 2056 years, it will no doubt be objected by ſome (as it has been done to far leſs numbers,) that all ſuch calculations are mere gueſs-work, the product of fruitful imaginations.

But it ſhould be conſidered, that in calculations of this nature ſome regular order or method muſt be obſerved: and though, according to the courſe of nature, ſuch an increaſe and multiplication of mankind there might have been periodically, eſpecially at the beginning, when the command was *to increaſe and multiply and repleniſh the earth;* yet we will not ſuppoſe that all things went on thus regularly, without difference or interruption. We do not know what extraordinary obſtructions or interruptions there might be to ſuch a regular increaſe. Though every married pair might by the courſe of nature have had ſuch a number of children as has been mentioned, yet the Divine Providence might order it otherwiſe in manifold inſtances, and it might poſſibly be in the Old World as it has been ſince the flood, viz. that ſome marriages have produced many children, others few, and ſome none at all. Allowing therefore for all ſuch obſtructions and deficiencies, and likewiſe for all caſualties and accidents (to which men might be liable in that world as well as in the preſent), in as ample a manner as can be deſired, let the former number be reduced to one half, viz. to 27,487,790,694,400, that is, 27 billions, or millions of millions, four hundred and eighty-ſeven thouſand ſeven hundred and ninety millions, ſix hundred and ninety-four thouſand and four hundred. And this we ſhall now ſuppoſe to be the whole number of thoſe who were born into the world before the deluge. But from this ſum is to be ſubtracted the number of thoſe who died before that time.

Of thoſe in the genealogies from Adam by Seth, Enoch was tranſlated at the age of 365, and Lamech the father of Noah died juſt before the flood at 753, Mahalaleel at 895. Adam and the other five patriarchs lived to above 900. Before the year 900 therefore, we may ſuppoſe there were no deaths except that of Abel, who was ſlain, a young man, but that all born within that period were alive together. But in the tenth century death began to reign, and Adam and Eve we may preſume were the firſt over whom death had power in a natural way, as their diſobedience was the cauſe of it. The children alſo born of them in the firſt hundred years would alſo die in this 10th century, thoſe born in the ſecond hundred would die in the 11th, thoſe born in the third century would die in the 12th, and ſo on. But though we are far from thinking that after the beginning of the 10th century (till which time few or none died), the deaths would be equal to the births; yet as we have made large conceſſions all along, we ſhall do the ſame in this caſe, and ſuppoſe them upon the whole to have been equal, eſpecially ſince we cannot preciſely ſay how ſoon that violence or blood-ſhed, which was their crying ſin, came to prevail; and therefore will reduce the laſt ſum mentioned to one half again, to allow for the deaths and prevailing violence, and ſuppoſe the total number of mankind alive upon earth at the time of the deluge to have been no more than 13,743,895,347,200, that is, 13 billions, or millions of millions, ſeven hundred and forty-three thouſand eight hundred and ninety-five millions, three hundred and forty-ſeven thouſand and two hundred; a number vaſtly exceeding that of the preſent inhabitants of the whole earth.

28 Probability of the above calculation.

Notwithſtanding the very large allowances and abatements made to reduce the number of mankind, yet even the laſt reduction to 13 billions, or millions of millions, &c. ſeems ſo vaſtly great, that it will hardly be thought poſſible that ſuch a number of men could ever be at one time upon the earth. Now, though we pretend to no certainty in this point (which made it the more requiſite to allow largely for deaths and deficiencies), yet the calculation we have given muſt appear highly probable, ſince it is founded on grounds certain and undeniable: for inſtance,

1. It cannot be denied but that the Antediluvians were come to the age of puberty and marriage at 160 years, when we find a ſon born in 162. Nor,

2. Can it be ſaid, that they could not have children at the age of 500, when we have an inſtance of one that had three ſons at due diſtances after that age. Neither,

3. Can it be alleged that we have not allowed a due diſtance or interval between the births, viz. ſix years, when moſt will be opinion that it could not be ſo long. Nor yet,

4. Can it be judged that we have made the period of doubling far too ſhort, when we had before ſhowed that after 100 marriages conſummated, they would treble themſelves in half the time we have taken for their doubling. Nor,

5. Will any one make a doubt, but that there might be 200 perſons of mature age for marriage in the year of the world 500, the men at 160, the women younger. Nevertheleſs, as this is the foundation of our calculation, we ſhall now ſhow that there was at leaſt ſuch a number of perſons marriageable at that age of the world.

It may be obſerved, that as we take 160 for the year of maturity and marriage, according to that period all married or marriageable in the year 500 muſt have been born in or before the year 340; the males at leaſt, though the females coming ſooner to maturity, might ſome of them be born later or after the year 380. Now, according to this ſtated period of marriage,

1. In or before the year 340, Adam might have had 54 children, males and females, or 27 pair married or fit for marriage.

2. Cain, whom we ſuppoſe to be but ſix years younger than Adam (which by the by is more than others allow), and to have married in the year 166, might have in the year 340, 28 children, or 14 pair fit for marriage; which added to the former, makes 41 pair.

3. Abel married ſix years later, that is, in the year 172. and whom we ſhall ſuppoſe ſlain in the year 225 or 226, could in that caſe have no more than eight or nine children, or four pair, which with the former make 45 pair.

4. Adam's third ſon married in the year 178, will afford us in the year 340, 26 children, or 13 pair, which increaſe the number of marriageable perſons to 58 pair.

5. A fourth ſon of Adam's married in the year 184, will give us in the year 340, 25 children, or 12 pair; which makes the number of pairs 70.

6. A fifth ſon of Adam's married in the year 190, might in the year 340 have 24 children, or 12 pair again, which increaſe the former number to 82 pair.

7. A ſixth ſon of Adam's married in the year 196, would have in the year 340, 22 children, or 11 pair; which added to the former make up 93 pair.

8. A ſeventh ſon of Adam's married in the year 202, will, in the year 340, give us 20 children, or 10 pair; which makes in the whole 103 pair, already three pair more than we reckoned upon. I need therefore go no farther on to the eighth or ninth ſon; but the following eight or nine births I may reaſonably take to have been daughters, and married to the brothers that preceded them. Here are now no more than 14 children of Adam's married, who have given us the 100 pair we have reckoned upon, and three over. We might yet have 13 pair to bring into the account, all born before the year 340, and marriageable in the year 500, which would very much increaſe the number of mankind. And by this the reader may perceive that we have been far from building on uncertain or precarious foundations, ſince we have omitted 13 pair more, which we might have taken into the account. And if it be conſidered that the command given to Adam was to increaſe and multiply and repleniſh the earth, no doubt can be made, but that his own and his childrens marriages were fruitful in the procreation of children that the earth might be inhabited.

ANTEGO. See Antigua.

ANTEJURAMENTUM, by our anceſtors called *juramentum calumniæ*, an oath which anciently both accuſer and accuſed were to take before any trial or purgation.—The accuſer was to ſwear that he would proſecute the criminal; and the accuſed to make oath, on the day he was to undergo the ordeal, that he was innocent of the crime charged againſt him.

ANTELOPE, in zoology. See Capra.

ANTELUCAN, in eccleſiaſtical writers, is applied to things done in the night or before day. We find frequent mention of the antelucan aſſemblies *(Cœtus antelucani)* of the ancient Chriſtians in times of perſecution for religious worſhip.

ANTEMURALE, in the ancient military art, denotes much the ſame with what the moderns call an *out-work*.

ANTENATI, in modern Engliſh hiſtory, is chiefly underſtood of the ſubjects of Scotland, born before king James the Friſt's acceſſion to the Engliſh crown, and alive after it. In relation to theſe, thoſe who were born after the acceſſion were denominated *Poſtnati*. The antenati were conſidered as aliens in England, whereas the poſtnati claimed the privilege of natural ſubjects.

ANTENCLEMA, in oratory, is where the whole defence of the perſon accuſed turns on criminating the accuſer. Such is the defence of Oreſtes, or the oration for Milo: *Occiſus eſt, ſed latro. Exſectus, ſed raptor.*

ANTENICENE, in eccleſiaſtical writers, denotes a thing or perſon prior to the firſt council of Nice. We ſay the Antenicene faith, Antenicene creeds, Antenicene fathers.

ANTENNÆ, in the hiſtory of inſects, ſlender bodies with which nature has furniſhed the heads of theſe creatures, being the ſame with what in Engliſh are called *horns* or *feelers*. See Entomology.

ANTENOR, a Trojan prince, came into Italy, expelled the Enganians on the river Po, and built the city of Padua, where his tomb is ſaid to be ſtill extant.

ANTEPAGMENTA, in the ancient architecture, the jams of a door. They are alſo ornaments, or garniſhings, in carved work, of men, animals, &c. made either of wood or ſtone, and ſet on the architrave.

ANTEPENULTIMA, in grammar, the third ſyllable of a word from the end, or the laſt ſyllable but two.

ANTEPILANI, in the Roman armies, a name given to the haſtati and principes, becauſe they marched next before the triarii, who were called *pilani*.

ANTEPILEPTICS, among phyſicians, medicines eſteemed good in the epilepſy.

ANTEPOSITION, a grammatical figure, whereby a word, which by the ordinary rules of ſyntax ought to follow another, comes before it. As when, in the Latin, the adjective is put before the ſubſtantive, the verb before the nominative caſe, &c.

ANTEPREDICAMENTS, among logicians, certain preliminary queſtions which illuſtrate the doctrine of predicaments and categories.

ANTEQUIERA, a handſome town of Spain, in the kingdom of Granada, divided into two parts, the upper and the lower. The upper is ſeated on a hill, and has a caſtle: the lower ſtands in a fertile plain, and is watered with a great number of brooks. There is a large quantity of ſalt in the mountain; and five miles from the town, a ſpring famous for the cure of the gravel. W. Long. 4. 40. N. Lat. 36. 51.

ANTERIOR, denotes ſomething placed before another, either with reſpect to time or place.

ANTEROS, in mythology, one of the two Cupids who were the chief of the number. They are placed at the foot of the Venus of Medici; this is repreſented with a heavy and ſullen look, agreeably to the poetical deſcription of him, as the cauſe of love's ceaſing. The other was called Eros.

ANTESIGNANI, in the Roman armies, ſoldiers placed before the ſtandards, in order to defend them, according to Limpſius; but Cæſar and Livy mention the anteſignani as the firſt line, or firſt body, of heavy armed troops. The velites, who uſed to ſkirmiſh before the army, were likewiſe called *anteſignani*.

ANTESTATURE, in fortification, a ſmall retrenchment made of paliſadoes, or ſacs of earth, with a view to diſpute with an enemy the remainder of a piece of ground.

ANTESTARI, in Roman antiquity, ſignifies to bear witneſs againſt any one who refuſed to make his appearance in the Roman courts of judicature, on the day appointed, and according to the tenor of his bail. The plaintiff, finding the defendant after ſuch a breach of his engagement, was allowed to carry him into court by force, having firſt aſked any of the perſons preſent to bear witneſs. The perſon aſked to bear witneſs in this caſe, expreſſed his conſent by turning his right ear, which was inſtantly taken hold of by the plaintiff, and this was to anſwer the end of a ſubpœna. The ear was touched upon this occaſion, ſays Pliny, as being the ſeat of memory, and therefore the ceremony was a ſort of caution to the party to remember his engagement.

ANTEVIRGILIAN HUSBANDRY, an appellation given to Mr. Tull's new method of horſe-hoeing huſbandry. See AGRICULTURE.

ANTHELION, See CORONA and PARHELION.

ANTHELIX, in anatomy, the inward protuberance of the external ear, being a ſemicircle within, and almoſt parallel to the helix. See ANATOMY.

ANTHELMINTICS, among phyſicians, medicines proper to deſtroy worms.

ANTHEM, a church-ſong, performed in cathedral-ſervice by choriſters, who ſung alternately. It was uſed to denote both pſalms and hymns, when performed in this manner. But at preſent, anthem is uſed in a more confined ſenſe, being applied to certain paſſages taken out of the ſcriptures, and adapted to a particular ſolemnity. Anthems were firſt introduced in the reformed ſervice of the Engliſh church, in the beginning of the reign of Queen Elizabeth.

ANTHEMIS, CAMOMILE: A genus of the polygamia ſuperflua order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ diſcoides*. The eſſential characters are theſe: The receptaculum is chaffy; there is no pappus; the calyx is hemiſpheric and ſubequal; and the florets of the ray are more than five. Of this genus Linnæus enumerates 17.

Species; of which the moſt remarkable are the following. 1. The nobilis, or common camomile, grows in plenty upon commons, and other waſte land. It is a trailing perennial plant, which puts out roots from the branches, by which it ſpreads and multiplies greatly. Of this kind there is a variety with double leaves. —Formerly this plant was uſed for planting of walks; which, when mowed and rolled, looked well for ſome time; but as it was ſubject to decay in large patches, the walks became unſightly, and it was therefore diſuſed. 2. The pyrethrum, or pellitory of Spain, is a perennial plant, which grows naturally in Spain and Portugal, from whence the roots are brought to Britain. The branches trail upon the ground, and ſpread a foot or more each way; theſe are garniſhed with fine winged leaves like thoſe of the common camomile. At the extremity of each branch is produced one large ſingle flower, like a camomile, but much larger; the rays of which are of a pure white within, but purple on the outſide. After the flowers are paſt, the receptacle ſwells to a large ſcaly cone, having the ſeeds lodged between its ſcales; but unleſs the ſeaſon is dry, the ſeeds will not come to perfection in Britain. 3. The tinctoria, with ſawed winged leaves, is a perennial plant, which flowers from June to November, and makes a very pretty appearance, ſome of the flowers being of a white, others of a ſulphur, and ſome of a bright yellow colour. 4. The Arabica, with a branching empalement. The ſeeds of this ſpecies were brought from Africa by the late Dr Shaw, and diſtributed to many curious botaniſts in Britain and other countries of Europe. It grows near two feet high, with an upright ſtem, having a ſingle flower at the top, from whoſe empalement there are two or three footſtalks put out horizontally, about two inches long, each having a ſingle flower ſmaller than the firſt, like the childing marigold, or hen-and-chicken daiſy.

Culture. The firſt ſort may be very eaſily propagated by procuring a few ſlips in the ſpring, and planting them about a foot diſtant from one another, where they will ſoon cover the ground. The other ſorts may be propagated from ſeeds ſown in the ſpring, and will require no other care than to be kept free from weeds: only the third ſort muſt be tranſplanted when come up from the ſeeds into borders near ſhrubs, where they may have room to grow; for they ſpread very wide, and therefore require to be placed three feet diſtant from other plants.

Medicinal Uſes. The firſt and ſecond ſorts are uſed in medicine. The firſt have a ſtrong, not ungrateful, aromatic ſmell, and a very bitter nauſeous taſte. They are accounted carminative, aperient, emollient, and in ſome meaſure anodyne; and ſtand recommended in flatulent colics, for promoting the uterine purgations in ſpaſmodic pains, and the pains of child-bed-women: ſometimes they have been employed in intermittent fevers, and the nephritis. Theſe flowers are frequently alſo uſed externally in diſcutient and antiſeptic fomentations, and in emollient glyſters. They enter the *decoctum pro enemate* and *decoctum pro fomento* of our pharmacopœias. An eſſential oil was formerly directed to be prepared from them, but it is now omitted. A ſimple watery infuſion of them taken in a tepid ſtate, is at preſent frequently employed to promote the operation of emetics. The root of the pyrethrum is the only part endowed with medical virtue. It has no ſenſible ſmell; its taſte is very hot and acrid, but leſs ſo than that of arum or dracunculus: the juice expreſſed from it has ſcarce any acrimony, nor is the root itſelf ſo pungent when freſh as after it has been dried. Water, aſſiſted by heat, extracts ſome ſhare of its taſte, rectified ſpirit the whole; neither of them elevate any thing in diſtillation. The principal uſe of pyrethrum in the preſent practice is as a maſticatory, for promoting the ſalival flux, and evacuating viſcid humours from the head and neighbouring parts; by this means it often relieves the tooth-ach, ſome kinds of pains of the head, and lethargic complaints.

ANTHERA, among botaniſts, that part of the ſtamen which is fixed on the top of the filamentum, within the corolla: it contains the pollen or fine duſt, which, when mature, it emits for the impregnation of the plant, according to Linnæus. The APEX of Ray, Tournef. & Rivin.; *Capſula ſtaminis*, of Malpighi.

ANTHERICUM, SPIDER-WORT: A genus of the monogynia order, belonging to the hexandria claſs of plants; and in the natural method, ranking under the 10th order, *Coronariæ*. The characters are: There is no *calyx:* The *corolla* conſiſts of ſix oblong petals, which are expanding: The *ſtamina* conſiſt of ſix ſubulated erect filaments; the antheræ are ſmall and furrowed: The *piſtillum* has a three-cornered germen, a ſimple ſtylus, and obtuſe ſtigma: The *pericarpium* is an ovate triſulcated capſule, with three cells and three valves: The *ſeeds* are numerous and angular. Of this genus Linnæus reckons up nine.

Species. But only the three following ſeem to deſerve notice. 1. The ramoſum, with a branching ſtalk. 2. The iliago. Theſe are perennial plants, which are natives of Spain, Portugal, and other warm countries. They were formerly pretty common in the Engliſh gardens; but the ſevere winter of 1740 killed moſt of their roots. They flower in June and July, and the ſeeds are ripe in September. 3. The fruteſcens, with a ſhrubby ſtalk, was formerly known among the gardeners near London by the name of *onion-leaved aloe.* It produces many ligneous branches from the root, each ſupporting a plant with long taper leaves, in ſhape like thoſe of an onion, and full of a yellow pulp very juicy. Theſe plants ſend out roots, which run down and faſten themſelves into the earth, by which they multiply greatly. The flowers are produced on long looſe ſpikes, are yellow, and appear at different times, ſo that the plants are never long deſtitute of flowers. This ſpecies is a native of the Cape of Good Hope.

Culture. The two firſt are propagated by ſeeds, which ſhould be ſown in the autumn, in a warm ſituation, on a bed of light ſandy earth. When the plants come up they muſt be kept clear of weeds during the ſummer; and in autumn, when the leaves decay, they ſhould be carefully taken up and tranſplanted into a bed of light earth, at a foot diſtance from one another. If the winter prove ſevere, they ſhould be covered with ſtraw, peaſe-haulm, or old tan. The third likewiſe requires ſhelter in winter; though ſome of them will live in the open air, if planted cloſe to the warm wall.

ANTHESPHORIA, in antiquity, a Sicilian feſtival inſtituted in honour of Proſerpine. The word is derived from the Greek ανϑος, *flower*, and φιρω, *I carry;* becauſe that goddeſs was carried away by Pluto when ſhe was gathering flowers in the fields. Yet Feſtus does not aſcribe the feaſt to Proſerpine; but ſays it was thus called by reaſon ears of corn were carried on this day to the temples.—Antheſphoria ſeems to be the ſame thing with the *floriſertum* of the Latins, and anſwers to the harveſt-home among us.

ANTHESTERIA, in antiquity, was a feaſt celebrated by the Athenians in honour of Bacchus. The moſt natural derivation of the word is from the Greek ανϑος *(flos)*, a flower, it being the cuſtom at this feaſt to offer garlands of flowers to Bacchus.

The Antheſteria laſted three days, the 11th, 12th, and 13th of the month; each of which had a name ſuited to the proper office of the day. The firſt day of the feaſt was called πιϑοιγια, i. e. *opening of the veſſels:* becauſe on this day they tapped the veſſels, and taſted the wine. The ſecond day they called χοες, *congii*, the name of a meaſure containing the weight of 10 pounds; on this they drank the wine prepared the day before. The third day they called χυτροι, *kettles:* on this day they boiled all ſorts of pulſe in kettles; which however they were not allowed to taſte, as being offered to Mercury.

ANTHESTERION, in ancient chronology, the ſixth month of the Athenian year. It contained 29 days; and anſwered to the latter part of our November and beginning of December. The Macedonians called it *dæſion* or *deſion*. It had its name from the feſtival antherеſteria kept in it.

ANTHISTIRIA, in botany: A genus of the trigynia order, belonging to the triandria claſs of plants; and, in the natural method, ranking under the 4th order, *Gramina.* The characters are: The *calyx* is a four-valved glume equally cleft to the baſe: The *corolla* is a two-valved glume: The *ſtamina* conſiſt of three ſhort ſlender filaments, the antheræ oblong and erect: The *piſtillum* has an oblong germen; the ſtyli are two; and the ſtigmata are clavated and and hairy: There is no *pericarpium*, except a cloſed calyx: The *ſeed* is oblong and furrowed. There is only one ſpecies of this graſs, the ciliata or fringed anthiſtiria, a native of India.

ANTHOCEROS, or HORN-FLOWER: A genus of the order of algæ, belonginging to the cryptogamia claſs of plants; and, in the natural method, ranking under the 57th order, *Algæ*. The eſſential characters are: The calyx of the *male* is ſeſſile, cylindric, and entire; the antheræ (one) is ſubulated, very long, and two-valved: The calyx of the *female* is monophyllous, divided into ſix parts, and expanding: The ſeeds are about three, naked and roundiſh.—There are only three ſpecies of the anthoceros, viz. the punctatus or ſpotted anthoceros, a native of Britain; the lævis, a native of

Europe and America; and the multifides, a native of Germany. It is found in moiſt ſhady places, and on heaths.

ANTHOLOGION, the title of the ſervice-book uſed in the Greek church. It is divided into 12 months, containing the offices ſung throughout the year, on the feſtivals of our Saviour, the Virgin, and other remarkable ſaints.

ANTHOLOGY, a diſcourſe of flowers, or of beautiful paſſages from any authors.—It is alſo the name given to a collection of epigrams taken from ſeveral Greek poets.

ANTHOLYZA, MAD-FLOWER: A genus of the monogynia order, belonging to the triandria claſs of plants; and in the natural method ranking under the 6th order, *Enſatæ*. The eſſential characters are theſe: The calyx is tubular, irregular, and bent back; and the capſule is beneath the flower.

Species. 1. The ringens, whoſe flower-ſlips ſpread aſunder. This hath red, round, bulbous roots, from which ariſe ſeveral rough furrowed leaves, near a foot long, and half an inch broad: between theſe comes out the flower-ſtalk immediately from the root, which riſes two feet high, is hairy, and hath ſeveral red flowers coming out on each ſide. Theſe appear in June, and the ſeeds ripen in September. 2. The ſpicata, with narrow furrowed leaves, is in ſhape and ſize like the vernal crocus, but the outer ſkin is thin and white; from this ariſe five or ſix long narrow leaves, which are deeply furrowed. Between theſe ariſe the flower-ſtem, which is a foot and a half high, bending on one ſide towards the top, where the flowers come out on one ſide, ſtanding erect. They are of a white colour, appear in May, and the ſeeds ripen in Auguſt. Both theſe ſpecies are natives of Africa, from whence their ſeeds were firſt obtained, and raiſed in the Dutch gardens.

Culture. The antholyza may be propagated by offſets, which it ſends off in pretty great plenty; or by ſeeds, which are ſometimes perfected in Europe. Theſe ſhould be ſown ſoon after they are ripe, in pots of light earth; which, if plunged in old beds of tan which has loſt its heat, and ſhaded in the middle of the day in hot weather, they will come up the following winter: therefore they muſt be kept covered with glaſſes to ſcreen them from cold, otherwiſe the young plants will be deſtroyed. They may remain in the pots two years, if the plants are not too cloſe, when they will have acquired ſtrength enough to bear tranſplanting; the proper time for which is in July and Auguſt, when their leaves are decayed. In ſummer the pots may be placed in the open air, but in winter they muſt be placed under a hot-bed frame; or in the green-houſe, where they are a great ornament when in flower.

ANTHONY (St), was born in Egypt in 251, and inherited a large fortune, which he diſtributed among his neighbours and the poor, retired into ſolitude, founded a religious order, built many monaſteries, and died *anno* 356. Many ridiculous ſtories are told of his conflicts with the devil and of his miracles. There are ſeven epiſtles extant attributed to him.

St Anthony is ſometimes repreſented with a fire by his ſide, ſignifying that he relieves perſons from the inflammation called after his name; but always accompanied by a hog, on account of his having been a ſwineherd, and curing all diſorders in that animal. To do him the greater honour, the Romaniſts in ſeveral places keep at common charges a hog denominated *St Antony's hog*, for which they have great veneration. Some will have St Antony's picture on the walls of their houſes, hoping by that to be preſerved from the plague; and the Italians, who do not know the true ſignification of the fire painted at the ſide of their ſaint, concluding that he preſerves houſes from being burnt, invoke him on ſuch occaſions. Both painters and poets have made very free with this ſaint and his followers: the former by the many ludicrous pictures of his temptation; and the latter, by divers epigrams on his diſciples or friars; one of which is the following, printed in Stephens's World of Wonders:

Once fedd'ſt thou, Anthony, an herd of ſwine,
  And now an herd of monks thou feedeſt ſtill.
For wit and gut alike both charges bin;
  Both loven filth alike; both like to fill
Their greedy paunch alike: nor was that kind
More beaſtly, ſottiſh, ſwiniſh, than this laſt.
All elſe agrees: one fault I only find,
  Thou feedeſt not thy monks with oaken maſt.

ANTHONY, or *Knights of St ANTHONY*, a military order, inſtituted by Albert Duke of Bavaria, Holland, and Zealand, when he deſigned to make war againſt the Turks in 1382. The knights wore a collar of gold made in form of a hermit's girdle, from which hung a ſtick cut like a crutch, with a little bell, as they are repreſented in St Antony's pictures.

St ANTHONY alſo gives the denomination to an order of religious founded in France about the year 1095, to take care of thoſe afflicted with St Anthony's fire, (ſee the next article.)—It is ſaid, that, in ſome places, theſe monks aſſume to themſelves a power of giving, as well as removing, the *ignis ſacer*, or eryſipelas; a power which ſtands them in great ſtead for keeping the poor people in ſubjection, and extorting alms. To avoid the menaces of theſe monks, the country people preſent them every year with a fat hog a-piece. Some prelates endeavoured to perſuade Pope Paul III. to aboliſh the order; *quæſtuarios iſtos ſancti Anthonii, qui decipiunt ruſticos et ſimplices, eoſque innumeris ſuperſtitionibus implicent, de medio tollendos eſſe.* But they ſubſiſt notwithſtanding, to this day in ſeveral places.

St ANTHONY's Fire, a name popularly given to the eryſipelas. Apparently it took this denomination, as thoſe afflicted with it made their peculiar application to St Anthony of Padua for a cure. It is known, that anciently particular diſeaſes had their peculiar ſaints: thus, in the ophthalmia, perſons had recourſe to St Lucia; in the tooth-ach, to St Apollonia; in the hydrophobia, to St Hubert, &c.

ANTHORA, in botany, the trivial name of a ſpecies of Aconitum. See ACONITUM.

ANTHORISMUS, in rhetoric, denotes a contrary deſcription or definition of a thing from that given by the adverſe party.—Thus, if the plaintiff urge, that to take any think away from another without his knowledge or conſent, is a thief; this is called ορος, or definition. If the defendant reply, that to take a thing away from another without his knowledge or conſent, provided it be done with deſign to return it to him again, is not theft; this is an Ανθορισμος.

ANTHOSPERMUM, the AMBER-TREE: A genus of the diœcia order, belonging to the polygamia claſs of plants; and in the natural method ranking under the 47th order, *Stellatæ*. The eſſential characters are: The calyx of the hermaphrodite flower is divided into four parts; there is no corolla; the ſtamina are four, and the piſtilli two; the germen is beneath the flower. Male and female on the ſame and ſeparate plants.

Species. Of this genus Linnæus mentions three; the Æthiopica, ciliare, and herbacea; but the firſt is moſt generally known in the gardens of the curious. Its beauty conſiſts in its ſmall evergreen leaves, which grow as cloſe as heath. Theſe being bruiſed between the fingers, emit a very fragrant odour; whence the name amber-tree.

Culture. This plant is eaſily propagated by cuttings during any of the ſummer-months, in a border of light earth; where they will take root in ſix weeks time, provided they are watered or ſhaded as the ſeaſon may require; or if they are planted in pots plunged in a moderate hot-bed, they will take root the ſooner, and there will be a greater certainty of their growing. They muſt be frequently renewed by cuttings, as the old plants are very ſubject to decay, and ſeldom laſt above three or four years.

ANTHOXANTHUM, or VERNAL-GRASS: A genus of the digynia order, belonging to the diandria claſs of plants; and in the natural method ranking under the 4th order, *Gramina*. The eſſential characters are: The calyx is a bivalved gluma, with one flower; the corolla is bivalved, obtuſe, and without any awn.

There are three ſpecies of anthoxanthum; viz. the odoratum, or ſpring-graſs, a native of Britain; the indicum, a native of India; and the paniculatum, a native of the ſouthern parts of Europe. The odoratum is one of the earlieſt ſpring graſſes, and is extremely common in our fertile paſtures. The delightful ſmell of new-mown hay is chiefly from this plant. Cows, horſes, ſheep, and goats eat it.

ANTHRACIS, ANTHRACIAS, or ANTHRACITIS, names promiſcuouſly uſed by ancient naturaliſts for very different foſſils; viz. the carbuncle, hæmatites, and a kind of aſteria. See CARBUNCLE, &c.

ANTHRACOSIS, in medicine, a corroſive ſcaly ulcer either in the bulb of the eye or the eye-lids.

ANTHRAX, a Greek term, literally ſignifying a burning coal, uſed by the ancients to denote a gem, as well as a diſeaſe, more generally known by the name of *carbuncle*.

ANTHRAX is ſometimes alſo uſed for lithanthrax or pitcoal. See LITHRANTHRAX.

ANTHROPOGLOTTUS, among zoologiſts, an appellation given to ſuch animals as have tongues reſembling that of mankind, particularly to the parrot kind.

ANTHROPOGRAPHY, denotes the deſcription of the human body, its parts, ſtructure, &c. See ANATOMY.

ANTHROPOLATRÆ, in church-hiſtory, an appellation given to the Neſtorians, on account of their worſhipping Chriſt, notwithſtanding that they believed him to be a mere man.

ANTHROPOLATRIA, the paying divine honours to a man; ſuppoſed to be the moſt ancient kind of idolatry.

ANTHROPOLITES, a term denoting petrifactions of the human body, as thoſe of quadrupeds are called *zoolites*.

It has been doubted whether any real human petrifactions ever occur, and whether thoſe which have been ſuppoſed ſuch were not mere *luſus naturæ*. But the generality of naturaliſts beſt verſed in this branch aſſures us of real anthropolites being ſometimes found. And indeed, as it is univerſally admitted that the zoolites are frequently ſeen, what negative argument therefore can be brought againſt the exiſtence of the others? Are not the component parts of the human body nearly ſimilar to thoſe of the brute creation? Conſequently, correſpondent matter may be ſubject to, and acquire, the like accidental changes, wherever the ſame power or cauſes concur to act upon either object. If the former are not ſo common, it may be accounted for, in ſome meaſure, by reflecting that human bodies are generally depoſited in ſelect and appropriated places; whereas the bones of animals are diſperſed every where, and falling into various beds of earth, at a greater or leſs depth, there is more probability of their encountering the petrifying agent. Could we credit ſome authors who have treated on this ſubject, they will tell us of entire bodies and ſkeletons that were found petrified. One in particular, diſcovered at Aix in Provence *anno* 1583, in a rocky cliff, the cerebrum whereof, when ſtruck againſt a piece of ſteel, produced ſparks, the bones being at the ſame time friable. The reports of Happel and Kircher are too abſurd for belief. Van Helmont's ſtrange relations, together with thoſe of a Jean a Coſta, muſt alſo be rejected as fabulous. Scheuhzer has publiſhed an engraved figure, which he calls the *Antediluvian man*: how far it is authentic, it would be raſh to ſay. It is, however, aſſerted by many reſpectable writers on natural hiſtory, that whole ſkeletons petrified have been brought to light from certain old mines, which remained cloſed up and diſuſed for ſeveral centuries. Theſe indeed are acknowledged to be very rare. Yet it is a known fact, that detached parts, oſteolithi, are ſometimes found, eſpecially in ſituations where either the water, the ſoil, or both, have been obſerved to poſſeſs a ſtrong putreſcent quality. The human vertebræ, fragments or portions of the tibia, and even the whole cranium itſelf, have been ſeen in an abſolute ſtate of petrification. Some of theſe are ſaid to appear vitriolated or mineralized. As to the petrified bones of pretended giants, they are more probably real zoolites, the bones of the larger animals. All theſe bones are found in various ſtates, and under different appearances. Some are only indurated; others calcined, vitriolated, or mineralized; ſome, again, are ſimply incruſted; whilſt others have been proved completely petrified. Notwithſtanding what is here advanced, it may be granted that a poſitive *luſus naturæ*, in ſome hands, is repeatedly miſtaken for a real petrification. They are, however, diſtinguiſhable at all times by an experienced naturaliſt; particularly by the following rules: Firſt, We may determine that foſſil a *luſus naturæ* which, on a ſtrict examination, is obſerved to deviate in any material degree from the true *res analogica exiſtens*. Secondly, By the ſame parity of reaſoning, thoſe foſſil ſhells are to be eſteemed certain petrifactions, and genuine Antediluvian *reliquiæ*, in which, on a compariſon with their *analogues* collected from the ſea, there appears an exact conformity in ſize and figure. This comparative obſervation will hold good for all foſſils; that is, ſuch as preſent themſelves either under the animal or vegetable form. It is nevertheleſs worthy of notice, that all teſtaceous foſſils are not petrified; ſince ſome kinds of them have been found in beds of ſand, which retained their original perfect ſhape and quality, but at the ſame time they proved very brittle, indeed ſcarcely bearing the moſt gentle touch. Shells of this deſcription are always diſſoluble by acids, in contradiſtinction to the petrified or calcareous foſſil ſhells whoſe property it is to reſiſt the action of ſuch like *menſtrua*. See further the article PETRIFACTION.

ANTHROPOLOGY, a diſcourſe upon human nature.

ANTHROPOLOGY, among divines, denotes that manner of expreſſion by which the inſpired writers attribute human parts and paſſions to God.

ANTHROPOMANCY, a ſpecies of divination, performed by inſpecting the intrails of a human creature.

ANTHROPOMORPHA, a term formerly given to the primates of that claſs of animals which have the greateſt reſemblance to the human kind.

ANTHROPOMORPHISM, among eccleſiaſtical writers, denotes the hereſy or error of the Anthropomorphites. See the next article.

ANTHROPOMORPHITES, in church-hiſtory, a ſect of ancient heretics, who taking every thing ſpoken of God in Scripture in a literal ſenſe, particularly that paſſage of Geneſis in which it is ſaid *God made man after his own image*, maintained that God had a human ſhape. They are likewiſe called *Audens*, from Audeus their leader.

ANTHROPOMORPHOUS, ſomething that bears the figure of reſemblance of a man. Naturaliſts give inſtances of anthropomorphous plants, anthropomorphous minerals, &c. Theſe generally come under the claſs of what they call *luſus naturæ*, or monſters.

ANTHROPOPATHY, a figure or expreſſion by which ſome paſſion is aſcribed to God, which properly belongs only to man.

ANTHROPOPHAGI, (of ανθρωπος a *man*, and φαγω to *eat*), MEN-EATERS. That there have been, in almoſt all ages of the world, nations who have followed this barbarious practice, we have a bundance of teſtimonies.

The Cyclops, the Leſtrygons, and Scylla, are all repreſented in Homer as *anthropophagi*, or man-eaters; and the female phantoms, Circe and the Syrens, firſt bewitched with a ſhew of pleaſure, and then deſtroyed. This, like the other parts of Homer's poetry, had a foundation in the manner of the times preceding his own. It was ſtill, in many places, the age ſpoken of by Orpheus,

> When men devour'd each other like the beaſts,
> Gorging on human fleſh.——

According to Herodotus, among the Eſſedonian Scythians, when a man's father died, the neighbours brought ſeveral beaſts, which they killed, mixed up their fleſh with that of the deceaſed, and made a feaſt. Among the Maſſagetæ, when any perſon grew old, they killed him and eat his fleſh; but if he died of ſickneſs, they buried him, eſteeming him unhappy. The ſame author alſo aſſures us, that ſeveral nations in the Indies killed all their old people and the ſick, to feed on their fleſh: he adds, that perſons in health were ſometimes accuſed of being ſick, to afford a pretence for devouring them. According to Sextus Empiricus, the firſt laws that were made, were for the prevention of this barbarious practice, which the Greek writers repreſent as univerſal before the time of Orpheus.

Of the practice of anthropophagy in latter times, we have the teſtimonies of all the Romiſh miſſionaries who have viſited the internal parts of Africa, and even ſome parts of Aſia. Herrera ſpeaks of great markets in China, furniſhed wholly with human fleſh, for the better ſort of people Marcus Paulus ſpeaks of the like in his time, in the kingdom of Concha towards Quinſay, and the iſland of Zapengit; others, of the great Java; Barboſa, of the kingdom of Siam and iſland of Sumatra; others, of the iſlands in the Gulf of Bengal, of the country of the Samogitians, &c.

The philoſophers Diogenes, Chryſippus, and Zeno, followed by the whole ſect of Stoics, affirmed that there was nothing unnatural in the eating of human fleſh; and that it was very reaſonable to uſe dead bodies for food, rather than to give them a prey to worms and putrefaction. In order to make the trial, however, whether there was any real repugnancy in nature to the feeding of an animal with the fleſh of its own ſpecies, Leonardus Floroventius fed a hog with hog's fleſh, and a dog with dog's fleſh; upon which he found the briſtes of the hog to fall off, and the dog to become full of ulcers.

When America was diſcovered, this practice was found to be almoſt univerſal, inſomuch that ſeveral authors have ſuppoſed it to be occaſioned through a want of other food, or through the indolence of the people to ſeek for it; though others aſcribe its origin to a ſpirit of revenge.

It appears pretty certain from Dr Hawkeſworth's Account of the Voyages to the South Seas, that the inhabitants of the iſland of New Zealand, a country unfurniſhed with the neceſſaries of life, eat the bodies of their enemies. It appears alſo to be very probable, that both the wars and anthropophagy of theſe ſavages take their riſe and owe their continuance to irreſiſtible neceſſity, and the dreadful alternative of deſtroying each other by violence or of periſhing by hunger. See vol. iii. p. 447, & ſeq. and vol. ii. p. 389, &c.

Mr Marſden alſo informs us that this horrible cuſtom is practiſed by the Battas, a people in the iſland of Sumatra. "They do not eat human fleſh (ſays he) as a means of ſatiſfying the cravings of nature, owing to a deficiency of other food; nor is it ſought after as a glutonous delicacy, as it would ſeem among the New Zealanders. The Battas eat it as a ſpecies of ceremony; as a mode of ſhowing their deteſtation of crimes, by an ignominous puniſhment; and as a horrid indication of revenge and inſult to their unfortunate enemies. The objects of this barbarious repaſt are the priſoners taken in war, and offenders convicted and condemned for capital crimes. Perſons of the former deſcription may be ranſomed or exchanged, for which they often wait a conſiderable time; and the latter ſuffer only when their friends cannot redeem them by the cuſtomary fine of twenty beenchangs, or eighty dollars. Theſe are tried by the people of the tribe where the fact was committee, but cannot be executed till their own particular raja or chief has been acquainted with the ſentence; who, when he acknowledges the juſtice of the intended puniſhment, ſends a cloth to cover the delinquent's head, together with a large diſh of ſalt and lemons. The unhappy object, whether priſoner of war or malefactor, is then tied to a ſtake: the people aſſembled throw their lances at him from a certain diſtance; and when mortally wounded, they run up to him, as if in a tranſport of paſſion; cut pieces from the body with their knives; dip them in a diſh of ſalt and lemon juice; ſlightly broil them over a fire prepared for the purpoſe; and ſwallow the morſels with a degree of ſavage enthuſiaſm. Sometimes (I preſume according to the degree of their animoſity and reſentment) the whole is devoured; and inſtances have been known, where, with barbarity ſtill aggravated, they tear the fleſh from the carcaſe with their mouths. To ſuch a depth of depravity may man be plunged, when neither religion nor philoſophy enlighten his ſteps! All that can be ſaid in extenuation of the horror of this diabolical ceremony is, that no view appears to be entertained of torturing the ſufferers; of increaſing or lengthening out the pangs of death; the whole fury is directed againſt the corſe; warm indeed with the remans of life, but paſt the ſenſation of pain. I have found a difference of opinion in regard to their eating the bodies of their enemies ſlain in battle. Some perſons long reſident there, and acquainted with their proceeding, aſſert that it is not cuſtomary; but as one or two particular inſtances have been given by other people, it is juſt to conclude, that it ſometimes takes place, though not generally. It was ſuppoſed to be with this intent that raja Neabin maintained a long conflict for the body of Mr Nairne, a moſt reſpectable gentleman and valuable ſervant of the India Company, who fell in an attack upon the campong of that chief, in the year 1775."

It may be ſaid, that whether the dead body of an enemy be eaten or buried, is a matter perfectly indifferent. But whatever the practice of eating human fleſh may be in itſelf, it certainly is relatively, and in its conſequences, moſt pernicious. It manifeſtly tends to eradicate a principle, which is the chief ſecurity of human life, and more frequently reſtrains the hand of the murderer, than the ſenſe of duty or the dread of puniſhment. If even this horrid practice originates from hunger, ſtill it muſt be perpetuated from revenge. Death muſt loſe much of its horror among thoſe who are accuſtomed to eat the dead; and where there is little horror at the ſight of death, there muſt be leſs repugnance to murder. See ſome further obſervations on this ſubjects equally juſt and ingenious, by Dr Hawkeſworth, *ut ſupra*

ANTHROPOPHAGIA, the act or habit of eating human fleſh. This is pretended by ſome to be the effect of a diſeaſe, which leads people affected with it to eat every thing alike. Some chooſe only to conſider it as a ſpecies of PICA. The annals of Milan furniſh an extraordinary inſtance of anthropophagy. A Milaneſe woman, named Elizabeth, from a depraved appetite, like what women with child, and thoſe whoſe menſes are obſtructed, frequently experience, had an invincible inclination to human fleſh, of which ſhe made proviſion by enticing children into her houſe; where ſhe killed and ſalted them; a diſcovery of which having been made, ſhe was broken on the wheel and burnt in 1519.

ANTHROPOSCOPIA, from ανθρωπος, and σκοπεω, *I conſider*, the art of judging or diſcovering a man's character, diſpoſition, paſſions, and inclinations, from the lineaments of his body. In which ſenſe, anthropoſcopia ſeems of ſomewhat greater extent than phyſiognomy or metopoſcopy. Otto has publiſhed an Anthropoſcopia, *ſive judicium hominis de homine ex lineamentis externis*.

ANTHROPOTHYSIA, the in inhuman practice of offering human ſacrifices. See SACRIFICE.

ANTHUS, in ornithology, a ſynonime of a ſpecies of loxia. See LOXIA.

ANTHYLLIS, KIDNEY-VETCH, or *Lady's-finger*: A genus of the decandria order, belonging to the diadelphia claſs of plants; and in the natural method ranking under the 32d order, *Papilionaceæ*. The eſſential characters are: The calyx is ventricoſe, and the legumen is roundiſh and covered.

Species. Linnæus enumerates nine ſpecies; of which the following ſeem to be moſt worthy of attention. 1. The vulneraria, with unequal winged leaves, is a native of Spain and Portugal, as likewiſe of Wales. It is a biennial plant, having ſingle leaves at bottom, which are oval and hairy; but thoſe which grow out of the ſtalks are winged, each being compoſed of two or three pair of lobes terminated by an odd one. The flowers grow collected into heads at the top of the ſtalks, are of a bright ſcarlet colour, and make a pretty appearance. It flowers in June and July, and the ſeeds ripen in October. 2. The montana or herbaceous woundwort, with winged leaves, grows naturally in the mountains in the ſouth of France, and in Italy. It is garniſhed with winged leaves, which have an equal number of hairy lobes at the extremity of the branches. The flowers are produced in heads, and are of a purple colour and globular form. They appear in June and July, and the ſeeds ripen in October. 3. The barba jovis, or ſilver-buſh, has its name from the whiteneſs of its leaves. This is a ſhrub which often grows to the height of ten or twelve feet, dividing into many lateral branches, garniſhed with winged leaves compoſed of an equal number of narrow lobes, which are very white and hairy: the flowers are produced at the extremities of the branches, collected into ſmall heads; theſe are of a bright yellow colour, and appear in June; ſometimes they are ſucceeded by ſhort woolly pods, containing two or three kidney-ſhaped ſeeds: but unleſs the ſeaſon proves warm, they do not ripen in this country. 4. The cytiſoides, or ſhrubby woundwort, has long been known in the Engliſh gardens. It is a low ſhrub, ſeldom riſing above two feet high, but ſends out many ſlender branches, garniſhed with hoary leaves, which are ſometimes ſingle, but generally have three oval lobes, the middle being longer than the other two: the flowers are yellow, and come out from the ſides of the branches, three or four joined together, having woolly impalements; but theſe are rarely ſucceeded by ſeeds in England.

Culture. The firſt and ſecond ſorts require no particular management further than being kept free from weeds. The third and fourth may be propagated by cuttings planted during any of the ſummer months; obſerving to ſhade and water them till they have taken good root; when they are to be tranſplanted into pots, and muſt always be houſed in winter.

ANTHYPOPHORA, in rethoric, a figure of ſpeech; being the counter-part of an hypophora. See HYPOPHORA.

ANTI, a Greek prepoſition, which enters into the compoſition of ſeveral words, both Latin, French, and Engliſh, in different ſenſes. Sometimes it ſignifies *before*, as in anti-chamber; and ſometimes *oppoſite* or *contrary*, as in the names of theſe medicines, anti-ſcorbutic, anti-venereal.

ANTI, in matters of literature, is a title given to divers pieces written by way of anſwer to others, whoſe names are uſually annexed to the anti. See the *Anti* of M. Baillet; and the *Anti-Baillet* of M. Menage: there are alſo *Anti-Menagiani*, &c. Cæſar the dictator wrote two books by way of anſwer to what had been objected to him by Cato, which he callled *Anti-Catones*; theſe are mentioned by Juvenal, Cicero, &c. Vives aſſures us, he had ſeen Cæſar's *Anti-Catones* in an ancient library.

ANTIBACCHIUS, in ancient poetry, a foot conſiſting of three ſyllables, the two firſt long, and the laſt one ſhort: ſuch is the word āmbīrĕ.

ANTIBES, a ſea-port town of Provence in France, with a ſtrong caſtle. Its territory produces excellent fruit; and the town ſtands oppoſite to Nice, in the Mediterranean. E. Long. 7. 5. N. Lat. 43. 35.

ANTICHAMBER, an outer chamber for ſtrangers to wait in, till the perſon to be ſpoken with is at leiſure.

ANTICHORUS, in botany: a genus of the monogynia order, belonging to the octandria claſs; of which the eſſential characters are: The calyx is a four-leav'd perianthium: The corolla conſiſts of four expanding petals: The pericarpium is a capſule, above, ſubulated, with four cells and four valves: The ſeeds are very numerous. There is but one ſpecies, the depreſſus, a native of Arabia.

ANTICHRIST, among eccleſiaſtical writers, denotes a great adverſary of Chriſtianity, who is to appear upon the earth towards the end of the world.

We have demonſtrations, diſputations, and proofs, in great order and number, both that the pope is, and that he is not Antichriſt.

F. Calmet is very large in deſcribing the father and mother of Antichriſt, his tribe and pedigree, his wars and conqueſts, his atchievements againſt Gog, Magog, &c.

Some place his capital at Conſtantinople, others at Jeruſalem, others at Moſcow, and ſome few at London; but the generality at Rome, though theſe laſt are divided. Grotius and ſome others ſuppoſe Rome Pagan to have been the ſeat of Antichriſt: moſt of the Lutheran and reformed doctors contend earneſtly for Rome Chriſtian under the papal hierarchy. In fact, the point having been maturely debated at the council of Gap, held in 1603, a reſolution was taken thereupon, to inſert an article in the confeſſion of faith, whereby the pope is formally declared to be Antichriſt.—Pope Clement VIII. was ſtung to the quick with this deciſion; and even king Kenry IV. of France was not a little mortified, to be thus declared, as he ſaid, an imp of Antichriſt.

M. le Clerc holds, that the rebel Jews and their leader Simon, whoſe hiſtory is given by Joſephus, are to be reputed as the true Antichriſt. Lightfoot and Vanderhart rather apply this character to the Jewiſh Sanhedrim. Hippolitus and others held that the devil himſelf was the true Antichriſt; that he was to be incarnate, and make his appearance in human ſhape before the conſummation of all things. Others among the ancients held that Antichriſt was to be born of a virgin, by ſome prolific power imparted to her by the devil. A modern writer* of the female ſex, whom many hold for a ſaint, has improved on this ſentiment; maintaining that Antichriſt is to be begotten by the devil on the body of a witch, by means of the ſemen of a man caught in the commiſſion of a certain crime, and conveyed, &c.

Hunnius and ſome authors, to ſecure Antichriſt to the pope (notwithſtanding that this latter ſeemed excluded by not being of the tribe of Dan), have broke in upon the unity of Antichriſt, and aſſert there is to be both an eaſtern and a weſtern Antichriſt.

Father Malvenda, a Jeſuit, hath publiſhed a large work intitled *Antichriſto*, in which this ſubject is amply diſcuſſed. It conſiſts of thirteen books. In the firſt he relates all the opinions of the Fathers with regard to Antichriſt. In the ſecond, he ſpeaks of the times when he ſhall appear; and ſhows, that all the fathers who ſuppoſed Antichriſt to be near at hand, judged the world was near its period. In the third, he diſcourſes of his origin and nation; and ſhows that he is to be a Jew of the tribe of Dan: this he founds on the authority of the fathers; on the paſſage in Geneſis xlix. 17. *Dan ſhall be a ſerpent by the way*, &c.; on that of Jeremy viii. 10. where it is ſaid, *The armies of Dan ſhall devour the earth*; and on Rev. vii. where St. John enumerating all the tribes of Iſrael, makes no mention of that of Dan. In the fourth and fifth books, he treats of the ſigns of Antichriſt. In the ſixth, of his reign, and wars. In the ſeventh, of his vices. In the eighth, of his doctrine and miracles. In the ninth, of his perſecutions: and in the reſt of the coming of Enoch and Elias, the converſion of the Jews, the reign of Jeſus Chriſt, and the death of Antichriſt, after he has reigned three years and an half. See alſo *Lowman on the Revelation*.

How endleſs are conjectures! Some of the Jews, we are told, actually took Cromwell for the Chriſt: while ſome others have laboured to prove him Antichriſt himſelf. Pfaffius aſſures us he ſaw a folio book in the Bodleian library, written on purpoſe to demonſtrate this latter poſition.

Upon the whole, the Antichriſt mentioned by the apoſtle John, 1. Ep. ii. 18. and more particularly deſcribed in the book of Revelation, ſeems evidently to be the ſame with the *Man of Sin*, &c. characteriſed by St Paul in his ſecond Epiſtle to the Theſſalonians, ch. ii. And the entire deſcription literally applies to the exceſſes of papal power. Had the right of private judgment, ſays an excellent writer, been always adopted and maintained, Antichriſt could never have been; and when the ſacred right comes to be univerſally aſſerted,

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* Bayle's Dictionary, voce *Bourignon*.

ſerted, and men follow the voice of their own reaſon and conſciences, Antichriſt can be no more.

ANTICHRISTIANISM, a ſtate or quality in perſons or principles, which denominates them antichriſtian, or oppoſite to the kingdom of Chriſt.

M. Jurieu takes the idea of the unity of the church to have been the ſource of *Antichriſtianiſm*. Had not mankind been infatuated with this, they would never have ſtood in ſuch awe of the anathemas of Rome. It is on this the popes erected their monarchial power.

ANTICHRISTIANS properly denote the followers or worſhippers of Antichriſt.

ANTICHRISTIANS are more particularly underſtood of thoſe who ſet up or believe a falſe Chriſt, or Meſſiah.

ANTICHTHONES, in ancient geography, an appellation given to the inhabitants of oppoſite hemiſpheres.

ANTICOR, or ANTICOEUR, among farriers, an inflammation in a horſe's throat, being the ſame with the quinzy in mankind. See FARRIERY, xxxvii. 2.

ANTICOSTE, a barren iſland lying in the mouth of the river St Laurence, in North America. W. Long. 64. 16. N. Lat. from 49 to 53.

ANTICYRA (anc. geog.), a town in Phocis, on the Corinthian bay, oppoſite to Cirrha, lying to the weſt on the ſame bay. The Phoceans ſeizing the temple of Apollo at Delphi, a war, called the *ſacred*, commenced, and laſted ten years; when Philip, father of Alexander the great, avenged the god, by deſtroying many of the cities of the pillagers. Anticyra was one of the number. It was again taken and ſubverted by Atilius a Roman general in the war with the Macedonians. It afterwards became famous for its hellebore. That drug was the root of a plant, the chief produce of the rocky mountains above the city, and of two kinds; the black, which had a purgative quality; and the white, which was an emetic. Sick perſons reſorted to Anticyra to take the medicine, which was prepared there by a peculiar and very excellent recipe: Hence the adage, *Naviget Anticyram*, (Hor.) By the port in the ſecond century was a temple of Neptune, not large, built with ſelected ſtones, and the inſide white-waſhed; the ſtatue of braſs. The agora or market-place was adorned with images of the ſame metal; and above it was a well with a ſpring, ſheltered from the ſun by a roof ſupported by columns. A little higher was a monument formed with ſuch ſtones as occurred, and deſigned, it is ſaid, for the ſons of Iphitus. One of theſe, Schedius, was killed by Hector, while fighting for the body of Patroclus, but his bones were tranſported to Anticyra; where his brother died after his return from Troy. About two ſtadia or a quarter of a mile diſtant was a high rock, a portion of the mountain, on which a temple of Diana ſtood, the image bigger than a large woman, and made by Praxitelles. The walls and other edifices at Anticyra were probably erected like the temple of Neptune, with ſtones or pebbles. The ſite is now called *Aſproſpitia*, or *The White Houſes*; and ſome traces of the buildings from which it was ſo named remain. The port is land-locked, and frequented by veſſels for corn. Some paces up from the ſea is a fountain.

ANTIDESMA, in botany, a genus of the diœcia order, belonging to the pentandria claſs of plants. The *calyx* of the male is five-leav'd; there is no corolla; the *antheræ* are bifid: The female *calyx* is five-leav'd; the corolla is wanting; the *ſtigmata* are five; the *berry* is cylindric and one-ſeeded. There is but one ſpecies, the alexiteria, a native of India.

ANTIDICOMARIANITES, ancient heretics, who pretended that the holy virgin did not preſerve a perpetual virginity, but that ſhe had ſeveral children by Joſeph after our Saviour's birth.—Their opinion was grounded on ſome expreſſions of our Saviour, wherein he mentions his brothers and his ſiſters; and of St Matthew, where he ſays, that Joſeph knew not Mary till ſhe brought forth her firſt-born ſon. The Antidicomarianites were the diſciples of Helvidius and Jovinian, who appeared in Rome towards the cloſe of the fourth century.

ANTIDORON, in eccleſiaſtical writers, a name given by the Greeks to the conſecrated bread, out of which the middle part, marked with the croſs, wherein the conſecration reſides, being taken away by the prieſt, the remainder is diſtributed after maſs to the poor. On the ſides of the antidoron are impreſſed the words *Jeſus Chriſtus vicit*. The word is formed from δωρον, *donum*, "a gift," as being given away *loco muneris*, *or* in charity. The antidoron is alſo called *panis præſanctificatus*. Some ſuppoſe the antidoron to be diſtributed in lieu of the ſacrament, to ſuch as were prevented from attending in perſon at the celebration; and thence derived the origin of the word, the euchariſt being denominated *doron*, "gift," by way eminence.

ANTIDOSIS, in antiquity, denotes an exchange of eſtates, practiſed by the Greeks on certain occaſions with peculiar ceremonies, and firſt inſtituted by Solon.

When a perſon was nominated to an office, the expence of which he was not able to ſupport, he had recourſe to the antidoſis; that is, he was to ſeek ſome other citizen of better ſubſtance than himſelf, who was free from this, and other offices; in which caſe the former was excuſed. In caſe the perſon thus ſubſtituted denied himſelf to be the richeſt, they were to exchange eſtates after this manner; the doors of their houſes were cloſe ſhut up and ſealed, that nothing might be conveyed away; then both took an oath to make a faithful diſcovery of all their effects, except what lay in the ſilver-mines, which by the laws was excuſed from all impoſts; accordingly, within three days, a full diſcovery and exchange of eſtates was made.

ANTIDOTE, among phyſicians, a remedy taken to prevent, or to cure, the effects of poiſon, &c.

ANTIENT. See ANCIENT.

ANTIGONEA, or ANTIGONIA (anc. geog.), a town of Bithynia, ſo called from Antigonus, the ſon of Philip, and afterwards called *Nicæa* (Strabo, Stephanus.) Another of Epirus, to the north of the Montes Ceraunii, oppoſite to the city of Oricum (Polybius Ptolemy.) A third of Arcadia, namely *Mantinea*, ſo called in honour of king Antigonus (Plutarch, Pauſanias.) A fourth in Macedonia, in the territory of Mygdonia (Pliny, Ptolemy.) A fifth in the territory of Chalcidice, in Macedonia, on the eaſt ſide of the Sinus Thermaicus (Livy.) A ſixth of Syria, built by Antigonus, not far from Antioch, on the Orontes (Stephanus); but ſoon after deſtroyed by

Seleucus, who removed the inhabitants to Seleucia, a town built by him (Diodorus Siculus.) A ſeventh of Troas, called Alexandrea in Pliny's time.

ANTIGONUS, one of Alexander's commanders, to whom Aſia fell. He conquered Eumenes, and expelled Seleucus out of Syria; who flying to Ptolemy Lagus in Egypt, a bloody war commenced betwixt him, Caſſander, and Antigonus, wherein, by the help of his ſon Demetrius, Antigonus prevailed, and built the city Antigonia, anno Romæ 448. Afterward Caſſander, Seleucus, and Lyſimachus, uniting againſt him, routed him, in league with king Pyrrhus, and ſlew him near Epirus, 301 years before Chriſt.

ANTIGONUS, king of the Jews, was the ſon of Ariſtobulus. He entered into an alliance with the king of the Parthians, and beſieged Jeruſalem. He cut off his uncle Hircanus's ears, to incapacitate him for the high-prieſthood; and put Joſephus, Herod's brother, to death. At length, Herod took him and ſent him to M. Anthony; who, to gratify Herod, cut off his head, and thereby extinguiſhed the Aſmoneans, who had reigned 126 years. This happened 36 years before Chriſt.

ANTIGRAPHUS, in antiquity, an officer of Athens, who kept a counterpart of the apodecti, or chief treaſurer's account, to prevent miſtakes, and keep them from being falſified.

ANTIGRAPUS is alſo uſed, in middle-age writers, for a ſecretary or chancellor. He is thus called, according to the old gloſſariſts, on account of his writing anſwers to the letters ſent to his maſter. The antigraphus is ſometimes alſo called *archigraphus*; and his dignity *antigraphia* or *archigraphia*.

ANTIGRAPHUS is alſo uſed in Iſidorus for one of the notes of ſentences, which is placed with a dot to denote a diverſity of ſenſe in tranſlations.

ANTIGRAPHUS is alſo applied in eccleſiaſtical writers to an abbreviator of the papal letters. In which ſenſe the word is uſed by pope Gregory the Great in his regiſter. Of late days the office of antigraphus conſiſts in making minutes of bulls from the petitions agreed to by his holineſs, and renewing the bulls after engroſſing.

ANTIGUA, one of the Antilles or Caribbee iſlands, ſituated 20 leagues eaſt of St Chriſtopher's, in W. Long. 62. 5. and N. Lat. 17. 30. It is about 50 miles in circumference, and is reckoned the largeſt of all the Britiſh leeward iſlands.

This iſland having no rivers, and but few ſprings, or ſuch as are brackiſh, the inhabitants are obliged to preſerve the rain-water in ciſterns. The air here is not ſo wholeſome as in the neighbouring iſlands, and it is more ſubject to hurricanes; but it has excellent harbours, particularly Engliſh Harbour, which is capable of receiving the largeſt man of war in the navy. Here is alſo a dock-yard, ſupplied with all ſtores and conveniences for repairing and careening ſhips. The principal trade, however, is carried on in the harbour of St John's, the capital, ſituated in the north-weſt part of the iſland, and which has water ſufficiently deep for merchant veſſels. The town of St John's was once in a very flouriſhing condition, as may be judged by the loſs ſuſtained at the late fire, which was computed at the amazing ſum of L.400,000.

This iſland was firſt attempted to be ſettled by Sir Thomas Warner, about the ſame time with St Chriſtopher's and Nevis: but no eſtabliſhment then took place. It was afterwards granted by Charles II. to Lord Willoughby, then governor of Barbadoes, who ſettled a colony upon it in the ſpace of a few years. In a ſhort time, but by what means is not evident, it became again the public property. It raiſes at preſent about 16,000 hogſheads of ſugar, which was at firſt of a very bad quality, unfit for the Engliſh market; but the planters have greatly improved their ſtaple ſince, and it is now as good as in any of the other iſlands. It has continued unmoleſted in all the late wars with France. The number of white inhabitants is reckoned about 10,000. It is divided into five pariſhes; that of St John's-town, which is reckoned the capital of the north-weſt part, and conſiſts of above 200 houſes; thoſe of Falmouth, Porham, and Bridgetown, on the ſouth-ſide; and St Peters's, which is no town, but lies almoſt in the middle of the iſland.

ANTIGUGLER, is a crooked tube of metal, ſo bent, as eaſily to be introduced into the necks of bottles, and uſed in decanting liquors, without diſturbing them. For this purpoſe the bottle ſhould be a little inclined, and about half a ſpoonful of the liquor poured out, ſo as to admit an equal quantity of air; let one end of the bent tube be ſtopped with the finger, whilſt the other is thruſt into the body of the liquor near to the bubble of air already admitted. When the finger is taken off, the bottle will have vent, and the liquor will run out ſteadily and undiſturbed.

ANTIHECTICS, in pharmacy, medicines good in hectical diſorders.

ANTIHECTICUM POTERII, the name of a medicine formerly much celebrated, but now laid aſide in common practice.

ANTILIBANUS (anc. geog.), a mountain of Cœloſyria, which bounds it on the ſouth, running parallel with Libanus: they both begin a little above the ſea, Libanus near Tripolis, Antilibanus at Sidon; and both terminate near the mountains of Arabia, which run to the north of Damaſcus, and the mountains of Traconitis, and there end in other mountains (Strabo.) The Scripture making no diſtinction between Libanus and Antilibanus, calls them by the common name *Lebanon*.

ANTILLES, the French name for the CARIBBEE iſlands.

ANTILOGARITHM, the complement of the logarithm of a ſine, tangent, or ſecant; or the difference of that logarithm from the logarithm of 90 degrees.

ANTILOGY, in matters of literature, an inconſiſtency between two or more paſſages of the ſame book.

ANTILOPE. See CAPRA.

ANTIMENSIUM, a kind of conſecrated table-cloth, occaſionally uſed in the Greek church, in places where there is no proper altar. F. Goar obſerves, that in regard the Greeks had but few conſecrated churches, and that conſecrated altars are not things eaſy to be removed; that church has, for many ages, made uſe of certain conſecrated ſtuffs or linens, called *antimenſia*, to ſerve the purpoſes thereof.

ANTIMENSIUM, in the Greek church, anſwers to the *altare portabile*, or portable altar, in the Latin church. They are both only of late invention, though

Habertus would have them as old as St Baſil. But Durant and Bona do not pretend to find them in any author before the time of Bede and Charlemagne.

Antimensia is alſo applied to other tables, uſed in offices of religion, beſides thoſe whereon the euchariſt is adminiſtered: ſuch, *e. g.* are thoſe whereon the hoſt is expoſed, &c. The origin of the Antimenſia is deſcribed by Meurſius; when the biſhop had conſecrated a church, the cloth which had been ſpread on the ground, and over the communion table, was torn in pieces, and diſtributed among the prieſts, who carried each a fragment away, to ſerve to cover the tables in their churches and chapels. Not that it was neceſſary that ſuch cloths ſhould be laid on all tables; but only on thoſe which either were not conſecrated, or at leaſt whoſe conſecration was doubted of.

ANTIMERIA, in grammar, a figure whereby one part of ſpeech is uſed for another: e. g. *velle ſuam cuique eſt*, for *voluntas ſua cuique eſt*; alſo, *populus late rex*, for *populus late regnans*.

Antimeria, in a more reſtrained ſenſe, is a figure where the noun is repeated inſtead of the pronoun. The antimeria is frequent in the Hebrew, and is ſometimes retained in our verſion of the Old Teſtament accordingly: e. g. *Hear my voice, ye wives of Lamech*, for *my wives*, Gen. iv. 23.

ANTIMETABOLE, in rhetoric, a figure which ſets two things in oppoſition to each other. The word is Greek, compounded of αντι, *againſt*, and μεταβολη from μεταβαλλω, I *ſhift* or *transfer*; *i. e.* a ſhifting, or ſetting two things over-againſt each other. This figure is twice exemplified in an apophthegm of Muſonius: which, on account of its excellence, is called *aureum monitum*, the golden maxim or precept.

Αν τι πραξης καλον μετα πονȣ, ὁ μεν πονος οιχεται, το δε καλον μενει.

Αν τι ποιησης αισχρεν μετα ηδονης, το μεν ηδυ οιχεται, το δε αισχρον μενει.

In Engliſh thus:

"Allowing the performance of an honourable action to be attended with labour; the labour is ſoon over, but the honour immortal: whereas, ſhould even pleaſure wait on the commiſſion of what is diſhonourable, the pleaſure is ſoon gone, but the diſhonour eternal."

ANTIMETATHESIS, in rhetoric, is the inverſion of the parts or members of an Antitheſis. Such is that of Cicero, in Verrem, lib. iv. cap. 52. "Compare this peace with that war; the arrival of this governor with the victory of that general; his profligate troops with the invincible army ot the other; the luxury of the former with the temperance of the latter: you will ſay, that Syracuſe was founded by him who took it; and taken by him, who held it when founded."

ATIMONARCHICAL, an appellation given to whatever oppoſes monarchical government.

ANTIMONIALS, in medicine, preparations of antimony. See Pharmacy.

ANTIMONY, a blackiſh mineral ſubſtance, ſtaining the hands, full of long, ſhining, needle-like ſtriæ, hard, brittle, and conſiderably heavy. It is found in different parts of Europe, as Bohemia, Saxony, Tranſylvania, Hungary, France, and England; commonly in mines by itſelf, intermixed with earth and ſtony matters. Sometimes it is blended with the richer ores of ſilver, and renders the extraction of that metal difficult by volatillizing a part of the ſilver, or, in the language of the miners, *robbing the ore*. See Metallurgy for the different operations.

Antimony is the *ſtibium* of the ancients; by the Greeks called ϛιμμι. The reaſon of its modern denomination, *antimony*, is uſually referred to Baſil Valentine, a German monk, who, as the tradition relates, having thrown ſome of it to the hogs, obſerved, that, after purging them violently, they immediately grew fat upon it. This made him think, that, by giving his fellow-monks a like doſe, they would be the better for it. The experiment, however, ſucceeded ſo ill, that they all died of it; and the medicine thenceforwards was called *antimony*, q. d. *anti-monk*.

Uſes. Antimony at firſt was of ſervice only in the compoſition of paint. Scripture deſcribes it to us as a ſort of paint, with which the women blackened their eye-brows. Jezebel, underſtanding that Jehu was to enter Samaria, painted her eyes with antimony; or, according to the Hebrew, "put her eyes in antimony." As large black eyes were thought the fineſt, they of both ſexes, who were careful of their beauty, rubbed their eyes, eye-lids, and round the eyes, with a needle dipped in a box of paint made of antimony, with a deſign of blackening them.—At this day, the women of Syria, Arabia, and Babylonia, anoint and blacken themſelves about the eyes; and both men and women put black upon their eyes in the deſert, to preſerve them from the heat of the ſun and the piercing of its rays. Mr Darvieux tells us, that the Arabian women border their eyes with a black colour made of tutty, which the Arabians call *rehel*. They draw a line of the kind of blacking without the corner of their eyes, to make them appear larger. Iſaiah, in his enumeration of the ſeveral ornaments belonging to the daughters of Sion, has not forgot the needles which they made uſe of in painting their eyes and eyelids. Nor has this practice eſcaped the laſh of Juvenal:

Ille ſupercilium madida fuligine tinctum
Obliqua producit acu, pingitque trementes
Attollens oculos.

Ezekiel, diſcovering the irregularities of the Jewiſh nation under the idea of a debauched woman, ſays, that ſhe bathed and perfumed herſelf, and that ſhe anointed her eyes with antimony. Job ſhows ſufficiently how much antimony was in eſteem, by calling one of his daughters a veſſel of antimony, or a box to put paint in, *cornu ſtibii*. The author of the Book of Enoch ſays, that before the deluge the angel Azleel taught young women the art of painting themſelves.

Tertullian and St Cyprian have declaimed very warmly againſt this cuſtom of painting their eyes and eye-brows, which was much practiſed in Afric even by the men: *Inunge oculos tuos non ſtibio diaboli, ſed collyrio Chriſti*, ſays St Cyprian. Pliny, ſpeaking of the Roman ladies, ſays, that they painted their very eyes: *Tanta eſt decoris affectatio, ut tingantur oculi quoque.* Sardanapalus painted his eyes and eye-brows. Joſephus reproaches the ſeditious with the ſame, who aſſumed the name of zealots, and made themſelves maſters of the temple of Jeruſalem.

The modern uſes of antimony are very numerous and important. It is a common ingredient in ſpecula or burning concaves, ſerving to give the compoſition a finer texture. It makes a part in bell metal, and renders the ſound more clear. It is mingled with tin, to make it more hard, white, and ſounding; and with lead, in the caſting of printers letters, to render them more ſmooth and firm. It is alſo a general help in the melting of metals, and eſpecially in the caſting of cannon balls. It is likewiſe made uſe of for purifying and heightening the colour of gold. See CHEMISTRY, GOLD, PURIFICATION, &c.

For a long time this mineral was eſteemed poiſonous. In 1566, its uſe was prohibited in France by an edict of parliament; and in 1609, one Beſnier was expelled the faculty for having given it. The edict was repealed in 1650; antimony having a few years before been received into the number of purgatives. In 1668, a new edict came forth, forbidding its uſe by any but doctors of the faculty.—It is now univerſally allowed, that pure antimony in its crude ſtate has no noxious quality; and that though many of its preparations are moſt virulently emetic and cathartic, yet, by a ſlight alteration or addition, they loſe their virulence, and become mild in their operation. See CHEMISTRY and PHARMACY.

The virtues of antimony in the diſeaſes of animals are greatly extolled. Pigs that have the meaſles are at all times recovered by it, which proves it a great purifier of the blood. Horſes who have running heels that cannot be cured by the common methods uſed by the farriers, will generally be cured by this medicine in a little time. The manner of uſing it is this: Mix one dram with every feeding of oats which the horſe has in a morning. It is beſt put together in one place, buried under a few oats; and the horſe's head being with-held a little, and then let go juſt againſt that place, he will take it all in at a mouthful. Some horſes do not diſlike it; others obſtinately refuſe it, but to theſe it may eaſily be given in balls. The virtues of this drug in fattening of cattle has been thought imaginary, but experiment proves it to be a real truth. A horſe that is lean and ſcabby, and not to be fatted by any other means, will become fat on taking a doſe of antimony every morning for two months together. A boar fed for brawn, and having an ounce of antimony given him every morning, will become fat a fortnight ſooner than others put into the ſtye at the ſame time, and fed in the ſame manner, but without the antimony.

ANTINOE. See ENFINE′.

ANTINOEIA, in antiquity, annual ſacrifices, and quinquennial games, in memory of Antinous the Bithynian. They were inſtituted at the command of Adrian the Roman emperor, at Mantinea in Arcadia, where Antinous was honoured with a temple and divine worſhip.

ANTINOMIANS, in eccleſiaſtical hiſtory, certain heretics who maintain the law of no uſe or obligation under the goſpel-diſpenſation, or who hold doctrines that clearly ſupercede the neceſſity of good works and a virtuous life. The Antinomians took their origin from John Agricola about the year 1538; who taught, that the law is no ways neceſſary under the goſpel; that good works do not promote our ſalvation, nor ill ones hinder it; that repentance is not to be preached from the decalogue, but only from the goſpel.

This ſect ſprung up in England during the protectorate of Oliver Cromwell, and extended their ſyſtem of libertiniſm much farther than Agricola the diſciple of Luther. Some of their teachers expreſsly maintained, that as the elect cannot fall from grace, nor forfeit the Divine favour, the wicked actions they commit are not really ſinful, nor are to be conſidered as inſtances of their violation of the divine law; and that conſequently they have no occaſion either to confeſs their ſins, or to break them off by repentance. According to them, it is one of the eſſential and diſtinctive characters of the elect, that they cannot do any thing which is either diſpleaſing to God or prohibited by the law.—Luther, Rutherford, Schluſſelburg, Sedgwick, Gataker, Witſius, Bull, Williams, &c. have written refutations; Criſp, Richardſon, Saltmarſh, &c. defences, of the Antinomians; Wigandus, a compariſon between ancient and modern Antinomians.

The doctrine of Agricola was in itſelf obſcure, and perhaps repreſented worſe than it really was by Luther, who wrote with acrimony againſt him, and firſt ſtyled him and his followers *Antinomians*. Agricola ſtood on his own defence, and complained that opinions were imputed to him which he did not hold. Nicholas Amſdorf fell under the ſame odious name and imputation, and ſeems to have been treated more unfairly than even Agricola himſelf. It is rather hard to charge upon a man all the opinions that may be inferred from things that have haſtily dropped from him, when he himſelf diſavows ſuch inferences.

ANTINOUS, the favourite of Adrian, was born at Bithynus in Bithynia His beauty engaged the heart of Adrian in ſuch a manner, that there never was a more boundleſs and extravagant paſſion than that of this emperor toward this youth. After his death, the emperor ordered divine honours to be paid him; and he alſo erected a city of his name. See ENFINE′.

ANTIOCH, a city of Syria in Aſia, ſituated on the river Orontes, in E. Long. 37. 5. N. Lat. 36. 20. It was built by Seleucus Nicator, founder of the Syro-Macedonian empire, who made it his capital. It ſtood on the above-mentioned river, about 20 miles from the place where it empties itſelf into the Mediterranean; being equally diſtant from Conſtantinople and Alexandria in Egypt, that is, about 700 miles from each. Seleucus called it *Antioch*, from his fathers name, according to ſome; or from that of his ſon, according to others. He built 16 other cities bearing the ſame name; of which one, ſituated in Piſidia, is probably that where the name of *Chriſtians* was firſt given to the followers of Jeſus Chriſt. But that ſituated on the Orontes, by far eclipſed, not only all the others of this name, but all the cities built by Seleucus. Antigonus, not long before, had founded a city in that neighbourhood, which from his own name he had called *Antigonia*, and deſigned it for the capital of his empire; but it was raſed to the ground by Seleucus, who employed the materials in building his metropolis, and alſo tranſplanted the inhabitants thither.

The city of Antioch was afterwards known by the name of *Tetrapolis*, being divided as it were into four cities, each of them being ſurrounded with its proper wall.

wall, beſides a common one which incloſed them all. The firſt of theſe cities was built by Seleucus Nicator, as already mentioned; the ſecond by thoſe who flocked thither on its being made the capital of the Syro-Macedonian empire; the third by Seleucus Callinicus; and the fourth by Antiochus Epiphanes.—About four or five miles diſtant, ſtood a place called *Daphne*, which was nevertheleſs reckoned a ſuburb of Antioch. Here Seleucus planted a grove, and in the middle of it built a temple which he conſecrated to Apollo and Diana, making the whole an aſylum. To this place the inhabitants of Antioch reſorted for their pleaſures and diverſions; whereby it became at laſt ſo infamous, that, "to live after the manner of Daphne" was uſed as a proverb to expreſs the moſt voluptuous and diſſolute way of living. Here Lucius Verus, the colleague of M. Aurelius, choſe to take up his reſidence, inſtead of marching againſt the Parthians; while his general Caſſius forbade by proclamation any of his ſoldiers to enter or even go near the place. In ſhort, ſo remarkable was Daphne of old, that the metropolis itſelf was diſtinguiſhed by it, and called *Antioch near Daphne*.

Though Antioch continued to be, as Pliny calls it, the queen of the Eaſt, for near 1600 years; yet ſcarce any city mentioned in hiſtory hath undergone ſuch calamities, both from the attacks of its enemies, and its being naturally ſubjected to earthquakes.—The firſt diſaſter mentioned in hiſtory which befel the Antiochians happened about 145 years before Chriſt. Being at that time very much diſaffected to the perſon and government of Demetrius their king, they were continually raiſing tumults and ſeditions; inſomuch that he found himſelf at laſt obliged to ſolicit aſſiſtance from the Jews; and was furniſhed by Jonathan, one of the Maccabees, with 3000 men: by which reinforcement, believing himſelf ſufficiently ſtrong to reduce the mutineers by force, he ordered them immediately to deliver up their arms. This unexpected order cauſed a great uproar in the city. The inhabitants ran to arms, and inveſted the king's palace, to the number of 120,000, with a deſign to put him to death. All the Jews haſtened to his relief, fell upon the rebels, killed 100,000 of them, and ſet fire to the city. On the deſtruction of the Syrian empire by the Romans, Antioch ſubmitted to them as well as the other cities of that kingdom, and continued for a long time under their dominion. About the year 115, in the reign of the emperor Trajan, it was almoſt entirely ruined by one of the moſt dreadful earthquakes mentioned in hiſtory. Trajan himſelf happened to be there at that time, being returned from an expedition againſt the Parthians; ſo that the city was then full of troops, and ſtrangers come from all quarters either out of curioſity or upon buſineſs and embaſſies: the calamity was by this means felt almoſt in every province of the Roman empire. The earthquake was preceeded by violent claps of thunder, unuſual winds, and a dreadful noiſe under ground. The ſhock was ſo terrible, that great numbers of houſes were overturned, and others toſſed to and fro like a ſhip at ſea. Thoſe who happened to be in their houſes were for the moſt part buried under their ruins: thoſe who were walking in the ſtreets or in the ſquares, were, by the violence of the ſhock, daſhed againſt each other, and moſt of them either killed of dangerouſly wounded.—This earthquake continued, with ſome ſmall intermiſſion, for many days and nights; ſo that vaſt numbers periſhed. The moſt violent ſhock, according to the Acts of St Ignatius, was on a Sunday, December 23. By this Trajan was much hurt, but eſcaped through a window. Dio Caſſius pretends, that he was taken out of the window by one who exceded the human ſize in tallneſs. The ſame hiſtorian adds, that mount Liſon, which ſtood at a ſmall diſtance from the city, bowed with its head and threatened to fall down upon it; that other mountains fell; that new rivers appeared, and others that had flowed before forſook their courſe and vaniſhed. When the earthquake ceaſed, a woman was heard crying under the ruins; which being immediately removed, ſhe was found with a living child in her arms. Search was made for others; but none was found alive, except one child, which continued ſucking its dead mother.

No doubt, Trajan, who was an eye-witneſs of this terrible calamity, would contribute largely towards the re-eſtabliſhment of Antioch in its ancient ſplendor. Its good fortune, however, did not continue long; for in 155, it was almoſt entirely burnt by accidental fire; when it was again reſtored by Antoninus Pius. In 176 or 177, the inhabitants having ſided with Caſſius, the abovementioned Roman general, who had revolted from M. Aurelius, that emperor publiſhed a ſevere edict againſt them, deprived them of all their privileges, ſuppreſſed their public aſſemblies, and took from them the ſhows and ſpectacles to which they were greatly addicted: but his anger being ſoon appeaſed, he reſtored them to their former condition, and even condeſcended to viſit their city. In 194, having ſided with Niger againſt Severus, the latter deprived them of all their privileges, and ſubjected Antioch as a mere village to Laodicea; but, however, pardoned them the next year at the intreaties of his eldeſt ſon, then a child.

When the power of the Roman empire began to decline, Antioch became the bone of contention between them and the eaſtern nations; and accordingly, on the breaking out of a Perſian war, it was almoſt always ſure to ſuffer. In 242, it was taken and plundered by Sapor; and, though he was defeated by Gordian, it underwent the ſame misfortune in the time of Valerian, about 18 years after; and after the defeat and captivity of Valerian, being taken by the Perſian monarch a third time, he not only plundered it, but levelled all the public buildings with the ground. The Perſians, however, being ſoon driven out, this unfortunate city continued free from any remarkable calamity till about the time of the diviſion of the Roman empire by Conſtantine in 331. It was then afflicted with ſo grievous a famine, that a buſhel of wheat was ſold for 400 pieces of ſilver. During this grievous diſtreſs, Conſtantine ſent to the biſhop 30,000 buſhels of corn; beſides an incredible quantity of all kinds of proviſions, to be diſtributed among the eccleſiaſtics, widows, orphans, &c. In the year 347, Conſtantine II. cauſed an harbour to be made at Seleucia, for the convenience of Antioch. This was effected at an immenſe expence, the mouth of the Orontes, where the port was made, being full of ſands and rocks. When the emperor Julian ſet out on his expedition againſt the Perſians, he made a long ſtay at Antioch; during which time, many of the Roman provinces were afflicted with a famine, but which raged more violently at Antioch than in other places.

The eccleſiaſtical writers of thoſe times ſay, that this famine followed Julian from place to place; and as he continued longer at Antioch than any other city, it raged more violently there than any where elſe. To remedy this evil, Julian fixed the prices of corn; by which means the famine was greatly increaſed, the merchants conveying their corn privately to other places, ſo that this metropolis was reduced to a moſt deplorable ſituation. In 381, in the reign of Theodoſius the Great, Antioch was again viſited by a famine, accompanied by a grievous plague. The latter ſoon ceaſed: but, the famine ſtill continuing, the biſhop, Libanius, applied to Icarius, count of the Eaſt, requeſting him by ſome means or other to relieve the poor, who had flocked from all parts to the metropolis, and were daily periſhing in great numbers: but to this Icarius gave no other anſwer, than that they were abhorred and juſtly puniſhed by the gods. This inhuman anſwer raiſed great diſturbances; which, however, were terminated without bloodſhed. In 387, Theodoſius finding his exchequer quite drained, and being obliged to be at an extraordinary expence in celebrating the fifth year of the reign of his ſon Arcadius, and the tenth of his own, an extraordinary tax was laid upon all the people in the empire. Moſt of the cities ſubmitted willingly to this; but the people of Antioch, complaining of it as an unreaſonable oppreſſion, crowded to the houſe of Flavianus their biſhop, as ſoon as the edict was publiſhed, to implore his protection. Being unable to find him, they returned to the forum; and would have torn the governor in pieces, had not the officers who attended him kept back with great difficulty the enraged multitude, till he made his eſcape. Upon this, they broke ſome of the emperor's ſtatues, and dragged others through the city, uttering the moſt injurious and abuſive expreſſions againſt him and his whole family. They were however, diſperſed by a body of archers, who, by wounding only two of the rabble, ſtruck terror into all the reſt. The governor proceeded againſt the offenders with the utmoſt cruelty; expoſing ſome to wild beaſts in the theatre, and burning others alive. He did not ſpare even the children, who had inſulted the emperor's ſtatues; and cauſed ſeveral perſons to be executed, who had been only ſpectators of the diſorder. In the mean time, a report was ſpread, that a body of troops was at hand, with orders to plunder the city, and put all to the ſword, without diſtinction of ſex or age; upon which the citizens abandoned their dwellings in the utmoſt terror and confuſion, retiring to the neighbouring mountains with their wives and families. As the report proved groundleſs, ſome of them returned; but the greater part, dreading the cruelty of the governor, and the diſpleaſure of the emperor, continued in their retreats. To thoſe who returned, St Chryſoſtom preached ſome homilies, which have reached our times, and are greatly admired; and which are ſaid by St Chryſoſtom himſelf, as well as ſome cotemporary writers, to have had a conſiderable effect in reforming the lives of this licentious and diſſolute people. On hearing the news of this tumult, Theodoſius was ſo much enraged, that he commanded the city to be deſtroyed, and its inhabitants to be put to the ſword without diſtinction; but this order was revoked before it could be put into execution, and he contented himſelf with a puniſhment ſimilar to that inflicted by Severus above-mentioned. He appointed judges to puniſh the offenders; who proceeded with ſuch ſeverity, and condemned ſuch numbers, that the city was thrown into the utmoſt conſternation. On this occaſion, St Chryſoſtom and the hermits, who were very numerous in the neighbourhood, exerted all their eloquence in behalf of the unhappy people, and obtained a reſpite for thoſe who had been condemned. They next proceeded to draw up a memorial to the emperor in favour of the citizens in general; and being joined by Flavianus, at laſt obtained a general pardon, and had the city reſtored to all its former privileges.

In the year 458, Antioch was almoſt entirely ruined by an earthquake, which happened on the 14th of September; ſcarce a ſingle houſe being left ſtanding in the moſt beautiful quarter of the city. The like misfortune it experienced in 525, during the reign of the emperor Juſtin; and 15 years after, being taken by Coſrhoes king of Perſia, that inſulting and haughty monarch gave it up to his ſoldiers, who put all they met to the ſword. The king himſelf ſeized on all the gold and ſilver veſſels belonging to the great church; and cauſed all the valuable ſtatues, pictures, &c. to be taken down and conveyed to Perſia, while his ſoldiers carried off every thing elſe. The city being thus completely plundered, Coſrhoes ordered his men to ſet fire to it; which was accordingly done ſo effectually, that none of the buildings even without the walls eſcaped. Such of the inhabitants as eſcaped ſlaughter were carried into Perſia, and ſold as ſlaves.

Notwithſtanding ſo many and ſo great calamities, the city of Antioch ſoon recovered its wonted ſplendor; but in a ſhort time underwent its uſual fate, being almoſt entirely deſtroyed by an earthquake in 587, by which 30,000 perſons loſt their lives. In 634, it fell into the hands of the Saracens, who kept poſſeſſion of it till the year 858, when it was ſurpriſed by one Burtzas, and again annexed to the Roman empire. The Romans continued maſters of it for ſome time, till the civil diſſentions in the empire gave the Turks an opportunity of ſeizing upon it as well as the whole kingdom of Syria. From them it was again taken by the Cruſaders in 1098. In 1262, it was taken by Bibaris ſultan of Egypt, who put a final period to its glory.

Antioch is now no more than a ruinous town, whoſe houſes, built with mud and ſtraw, and narrow and miry ſtreets, exhibit every appearance of miſery and wretchedneſs. Theſe houſes are ſituated on the ſouthern bank of the Orontes, at the extremity of an old decayed bridge: they are covered to the ſouth by a mountain; upon the ſlope of which is a wall, built by the Cruſaders. The diſtance between the preſent town and this mountain may be about 400 yards, which ſpace is occupied by gardens and heaps of rubbiſh, but preſents nothing intereſting.

Notwithſtanding the unpoliſhed manners of its inhabitants, Antioch was better calculated than Aleppo to be the emporium of the Europeans. By clearing the mouth of the Orontes, which is ſix leagues lower down, boats might have been towed up that river, though they could not have ſailed up, as Pococke has aſſerted; its current is too rapid. The natives, who never knew the name Orontes, call it, on account of the ſwiftneſs of its ſtream, *El-aaſi*, that is, the rebel. Its breadth, at Antioch, is about forty paces. Seven leagues above that town it paſſes by a lake abounding in fiſh, and eſpecially in eels. A great quantity of theſe are ſalted every year, but not ſufficient for the numerous faſts of the Greek Chriſtians. It is to be remembered, we no longer hear at Antioch, either of the Grove, or Daphne, or of the voluptuous ſcenes of which it was the theatre.

The plain of Antioch, though the ſoil of it is excellent, is uncultivated, and abandoned to the Turcomans; but the hills on the ſide of the Orontes, particularly oppoſite Serkin, abound in plantations of figs and olives, vines, and mulberry trees, which, a thing uncommon in Turkey, are planted in quincunx, and exhibit a landſcape worthy our fineſt provinces.

Seleucus Nicator, who founded Antioch, built alſo at the mouth of the Orontes, on the northern bank, a large and well fortified city, which bore his name, but of which at preſent not a ſingle habitation remains: nothing is to be ſeen but heaps of rubbiſh, and works in the adjacent rock, which prove that this was once a place of very conſiderable importance. In the ſea alſo may be perceived the traces of two piers, which are indications of an ancient port, now choaked up. The inhabitants of the country go thither to fiſh, and call the name of the place *Souaidia*.

ANTIOCHETTA, a town of Turkey, in Aſia, in Carimania, with a biſhop's ſee, over-againſt the iſland of Cyprus. E. Long. 32. 15. N. Lat. 36. 42.

ANTIOCHIA (anc. geog.), a town of Aſſyria, ſituated between the rivers Tigris and Tornadotus (Pliny).—Another of Caria, on the Meander; called alſo *Pythopolis*, *Athymbra*, and *Nyſſa*, or *Nyſa* (Stephanus): but Strabo ſays, that Nyſa was near Tralles. —A third of Cilicia Trachea, on mount Cragus (Ptolemy).—A fourth, called *Epidaphnes*, the capital of Syria, diſtinguiſhed from cities of the ſame name, either by its ſituation on the Orontes, by which it was divided, or by its proximity to Daphne (See ANTIOCH). —A fifth Antiochia, a town of Comagene, on the Euphrates (Pliny).—A ſixth, of Lydia, *Tralles* ſo called (Pliny).—A ſeventh, of Margiana, (Strabo, Pliny, Ptolemy), on the river Margus, taking its name from Antiochus, ſon of Seleucus, who rebuilt it, and walled it round, being before called *Alexandria*, from Alexander the founder, and ſurnamed Syria; in compaſs ſeventy ſtadia: whither Orodes carried the Romans, after the defeat of Craſſus (Pliny)—An eighth, in Meſopotamia, on the lake Calirrhoe, the old name of Edeſſa (Pliny).—A ninth Antiochia, on the river Mygdonius, in Meſopotamia, ſituate at the foot of mount Maſius, and is the ſame with Niſibis (Strabo, Plutarch). It was the bulwark and frontier town of the Romans againſt the Parthians and Perſians, till given up to the Perſians, by Jovinian, by an ignominious peace (Ammian, Eutropius).—A tenth Antiochia, was that ſituate in the north of Piſidia (Luke, Ptolemy, Strabo): it was a Roman colony, with the appellation, *Cæſarea*. There is an Antiochia at mount Taurus, mentioned by Ptolemy, but by no other author.

ANTIOCHIAN SECT or *Academy*, a name given to the fifth academy, or branch of academies. It took the denomination from its being founded by Antiochus, a philoſopher contemporary with Cicero.—The Antiochian academy ſucceeded the Philonian. As to point of doctrine, the philoſophers of this ſect appear to have reſtored that of the ancient academy, except that in the article of the criterion of truth. Antiochus was really a ſtoic, and only nominally an academic.

ANTIOCHIAN Epocha, a method of computing time from the proclamation of liberty granted the city of Antioch, about the time of the battle of Pharſalia.

ANTIOCHUS, the name of ſeveral kings of SYRIA. See that article.

ANTIOCHUS of *Aſcalon*, a celebrated philoſopher, the diſciple of Philo of Lariſſa, the maſter of Cicero, and the friend of Lucullus and Brutus. He was founder of a fifth academy; but, inſtead of attacking other ſects, he ſet himſelf down to reconcile them together, particularly the ſect of the ſtoics with that of the ancient academy.

ANTIOPE, in fabulous hiſtory, the wife of Lycus, king of Thebes, who, being deflowered by Jupiter in the form of a ſatyr, brought for Amphion and Zethus.—Another Antiope was queen of the Amazons; and, with the aſſiſtance of the Scythians, invaded the Athenians; but was vanquiſhed by Theſeus.

ANTIPÆDOBAPTISTS, (derived from *αντι againſt*, *ϖαις*, *ϖαιδος*, *child*, and *βαπτιζω*, *baptize*, whence *βαπτιστης*), is a diſtinguiſhing denomination given to thoſe who object to the baptiſm of infants; becauſe they ſay, infants are incapable of being inſtructed, and of making that profeſſion of faith which intitles them to this ordinance and an admiſſion into church communion. See ANABAPTISTS and BAPTISTS.

ANTIPAROS, an iſland in the Archipelago, oppoſite to Paros, from which it is ſeparated by a ſtrait about ſeven miles over. It is the *Olearos*, or *Oliaros*, mentioned by Strabo, Pliny, Virgil, Ovid, &c.; and was, according to Heraclides Ponticus, as quoted by Stephanus, firſt peopled by a Phœnician colony from Sidon.—According to Mr Tournefort's account, it is about 16 miles in circumference, produces a little wine and cotton, with as much corn as is neceſſary for the maintenance of 60 or 70 families, who live together in a village at one end of the iſland, and are moſtly Malteſe and French corſairs.

This iſland is remarkable for a ſubterraneous cavern or grotto, accounted one of the greateſt natural curioſities in the world. It was firſt diſcovered in the laſt century by one Magni an Italian traveller, who has given us the following account. "Having been informed (ſays he) by the natives of Paros, that in the little iſland of Antiparos, which lies about two miles from the former, of a gigantic ſtatue that was to be ſeen at the mouth of a cavern in that place, it was reſolved that we (the French conſul and himſelf) ſhould pay it a viſit. In purſuance of this reſolution, after we had landed on the iſland, and walked about four miles through the midſt of beautiful plains and ſloping woodlands, we at length came to a little hill, on the ſide of which yawned a moſt horrid cavern, that with its gloom at firſt ſtruck us with terror, and almoſt repreſſed curioſity. Recovering the firſt ſurpriſe, however, we entered boldly; and had not proceeded above 20 paces, when the ſuppoſed ſtatue of the giant preſented itſelf to our view. We quickly perceived, that what the ignorant natives had been terrified at as a giant, was nothing more than a ſparry concretion, formed by the water dropping from the roof of the cave, and by degrees hardening into a figure which their fears had formed into a monſter. Incited by this extraordinary appearance, we were induced to proceed ſtill further, in queſt of new adventures in this ſubterranean abode. As we proceeded, new wonders offered themſelves: the ſpars, formed into trees and ſhrubs, preſented a kind of petrified grove; ſome white, ſome green; and all receding in due perſpective. They ſtruck us with the more amazement, as we knew them to be the mere productions of Nature, who, hitherto in ſolitude, had, in her playful moments, dreſſed the ſcene, as if for her own amuſement.

" But we had as yet ſeen but a few of the wonders of the place; and we were introduced as yet only into the portico of this amazing temple. In one corner of this half-illuminated receſs, there appeared an opening of about three feet wide, which ſeemed to lead to a place totally dark, and that, one of the natives aſſured us contained nothing more than a reſervoir of water. Upon this we tried, by throwing down ſome ſtones, which, rumbling along the ſides of the deſcent for ſome time, the ſound ſeemed at laſt quaſhed in a bed of water. In order, however, to be more certain, we ſent in a Levantine mariner, who, by the promiſe of a good reward, with a flambeau in his hand, ventured into this narrow aperture. After continuing within it for about a quarter of an hour, he returned, carrying ſome beautiful pieces of white ſpar in his hand, which art could neither imitate nor equal. Upon being informed by him that the place was full of theſe beautiful incruſtations, I venture in once more with him, for about 50 paces, anxiouſly and cautiouſly deſcending by a ſteep and dangerous way. Finding, however, that we came to a precipice which led into a ſpacious amphitheatre, if I may ſo call it, ſtill deeper than any other part, we returned, and being provided with a ladder, flambeaux, and other things to expedite our deſcent, our whole company, man by man, ventured into the ſame opening, and, deſcending one after another, we at laſt ſaw ourſelves all together in the moſt magnificent part of the cavern.

" Our candles being now all lighted up, and the whole place completely illuminated, never could the eye be preſented with a more glittering or a more magnificent ſcene. The roof all hung with ſolid icicles, tranſparent as glaſs, yet ſolid as marble. The eye could ſcarce reach the noble and lofty cieling; the ſides were regularly formed with ſpars; and the whole preſented the idea of a magnificent theatre, illuminated with an immenſe profuſion of lights. The floor conſiſted of ſolid marble; and in ſeveral places magnificent columns, thrones, altars, and other objects appeared as if nature had deſigned to mock the curioſities of art. Our voices, upon ſpeaking or ſinging, were redoubled to an aſtoniſhing loudneſs; and, upon the firing of a gun, the noiſe and reverberations were almoſt deafening. In the midſt of this grand amphitheatre, roſe a concretion of about 15 feet high, that, in ſome meaſure reſembled an altar; from which, taking the hint, we cauſed maſs to be celebrated there. The beautiful columns that ſhot up round the altar, appeared like candleſticks; and many other natual objects repreſented the cuſtomary ornaments of this ſacrament.

" Below even this ſpacious grotto, there ſeemed another cavern; down which I ventured with my former mariner, and deſcended about 50 paces by means of a rope. I at laſt arrived at a ſmall ſpot of level ground, where the bottom appeared different from that of the amphitheatre, being compoſed of ſoft clay, yielding to the preſſure, and in which I thruſt a ſtick to about ſix feet deep. In this, however, as above, numbers of the moſt beautiful cryſtals were formed; one of which, particularly, reſembled a table. Upon our egreſs from this amazing cavern, we perceived a Greek inſcription upon a rock at the mouth; but ſo obliterated by time, that we could not read it. It ſeemed to import, that one Antipater, at the time of Alexander, had come thither; but whether he penetrated into the depths of the cavern, he does not think fit to inform us."

From this account Mr Tournefort's differs conſiderably. Mr Magni mentions only one deſcent or precipice from the entry of the cave to the grotto, or moſt magnificent part: M. Tournefort ſays that there were many very dangerous precipices and rugged ways, thro' which they were obliged to paſs, ſometimes on their back, and ſometimes on their belly; but gives no particular account of his journey till he comes to the grand cavern. This indeed he deſcribes very pompouſly; but as by it he evidently wants to ſupport a favourite hypotheſis, namely, the vegetation of ſtones, perhaps the particulars are not altogether to be depended upon. He informs us, that, at the entry into the cavern, he met with a Greek inſcription almoſt defaced, containing a good number of proper names, and that there was a tradition among the inhabitants, that theſe were the names of ſome who had conſpired againſt Alexander the Great, and having miſſed their aim, had taken refuge in this grotto.

The moſt particular account, however, of this famous grotto that hath hitherto been publiſhed, appeared in the Britiſh magazine, in a letter ſigned *Charles Saunders*, and dated Feb. 24th, 1746-7; which, as it is very particular, and ſeems to bear ſufficient marks of authenticity, we ſhall here inſert. " Its entrance lies in the inſide of a rock, about two miles from the ſea-ſhore; and is a ſpacious and very large arch, formed of rough craggy rocks, overhung with brambles and a great many climbing plants, that give it a gloomineſs which is very awful and agreeable. Our ſurgeon, myſelf, and four paſſengers, attended by ſix guides with lighted torches entered this cavern about eight o'clock in the morning, in the middle of Auguſt laſt. We had not gone 20 yards in this cavity, when we loſt all ſight of day-light: but our guides going before us with lights, we entered into a low narrow kind of alley, ſurrounded every way with ſtones glittering like diamonds by the light of our torches; the whole being covered and lined throughout with ſmall cryſtals, which gave a thouſand various colours by their different reflections. This alley grows lower and narrower as one goes on, till at length one can ſcarce get along it. At the end of this paſſage we were each of us preſented with a rope to tie about our middles; which when we had done, our guides led us to the brink of a moſt horrible precipice. The deſcent into this was quite ſteep, and the place all dark and gloomy. We could ſee nothing, in ſhort, but ſome of our guides with torches in a miſerable dark place, at a vaſt diſtance below us. The dreadful depth of this place, and the horror of the deſcent thro' a miſerable darkneſs into it, made me look back to the lane of diamonds, if I may ſo call it, thro' which we had juſt paſſed, and I could not but think I was leaving heaven, to deſcend into the infernal regions. The hope of ſomething fine at my journey's end, tempted me, however, to truſt myſelf to the rope and my guides at the top, to let myſelf down. After about two minutes dangling in this poſture, not without much pain as well as terror, I found myſelf ſafe, however, at the bottom; and our friends all ſoon followed the example. When we had congratulated here with one another on our ſafe deſcent; I was inquiring where the grotto, as they called it, was. Our guides, ſhaking their heads, told us, we had a great way to that yet; and led us forward about 30 yards under a roof of ragged rocks in a ſcene of terrible darkneſs, and at a vaſt depth from the ſurface of the earth, to the brink of another precipice much deeper and more terrible than the former. Two of the guides went down here with their torches firſt; and by their light we could ſee, that this paſſage was not ſo perpendicular indeed as the other, but lay in a very ſteep ſlant, with a very ſlippery rock for the bottom; vaſt pieces of rough rugged rocks jutting out in many places on the right hand, in the deſcent, and forcing the guides ſometimes to climb over, ſometimes to creep under them, and ſometimes to round them; and on the left, a thouſand dark caverns, like ſo many monſtrous wells, ready, if a foot ſhould ſlip, to ſwallow them up for ever. We ſtood on the edge to ſee theſe people with their lights deſcend before us, and were amazed and terrified to ſee them continue deſcending till they ſeemed at a monſtrous and moſt frightful depth. When they were at the bottom, however, they hollowed to us; and we, trembling and quaking, began to deſcend after them. We had not got 30 feet down, when we came to the place where the rock was perfectly perpendicular; and a vaſt cavern ſeemed to open its mouth to ſwallow us up on one ſide, while a wall of rugged rock threatened to tear us to pieces on the other. I was quite diſheartened at this terrible proſpect, and declared I would go back: but our guides aſſured us there was no danger; and the reſt of the company reſolving to ſee the bottom now they were come ſo far, I would not leave them: ſo on we went to a corner where there was placed an old ſlippery and rotten ladder, which hung down cloſe to the rock; and down this, one after another, we at length all deſcended. When we had got to the bottom of this, we found ourſelves at the entrance of another paſſage, which was terrible enough indeed; but in this there was not wanting ſomething of beauty. This was a wide and gradual deſcent; at the entrance of which one of our guides ſeated himſelf on his breech, and began to ſlide down, telling us we muſt do the ſame. We could diſcover, by the light of his torch, that this paſſage was one of the nobleſt vaults in the world. It is about nine feet high, ſeven wide, and has for its bottom a fine green gloſſy marble. The walls and arch of the roof of this being as ſmooth and even in moſt places as if wrought by art, and made of a fine gliſtering red and white granite, ſupported here and there with columns of a deep blood-red ſhining porphyry, made, with the reflection of the lights, an appearance not to be conceived. This paſſage is at leaſt 40 yards long; and of ſo ſteep a deſcent, that one has enough to do, when ſeated on one's breech, not to deſcend too quickly. Our guides, that we kept with us, could here keep on each ſide of us: and, what with the prodigious grandeur and beauty of the place, our eaſy travelling through it, and the diverſion of our now and then running over one another whether we would or not; this was much the pleaſanteſt part of our journey. When we had entered this paſſage, I imagined we ſhould at the bottom join the two guides we had firſt ſet down; but alas! when we were got there, we found ourſelves only at the mouth of another precipice, down which we deſcended by a ſecond ladder not much better than the former. I could have admired this place alſo, would my terror have ſuffered me; but the dread of falling, kept all my thoughts employed during my deſcent. I could not but obſerve, however, as my companions were coming down after me, that the wall, if I may ſo call it, which the ladder hung by, was one maſs of blood-red marble, covered with white ſprigs of rock-cryſtal as long as my finger, and making, with the glow of the purple from behind, one continued immenſe ſheet of amethyſts. From the foot of this ladder we ſlided on our bellies through another ſhallow vault of poliſhed green and white marble, about 20 feet; and at the bottom of this joined our guides. Here we all got together once again, and drank ſome rum, to give us courage before we proceeded any farther. After this ſhort refreſhment, we proceeded by a ſtrait, but ſomewhat ſlanting paſſage, of a rough, hard, and ſomewhat coarſe ſtone, full of a thouſand ſtrange figures of ſnakes rolled round, and looking as if alive; but in reality as cold and hard as the reſt of the ſtone, and nothing but ſome of the ſtone itſelf in that ſhape. We walked pretty eaſily along this deſcent for near 200 yards; where we ſaw two pillars ſeemingly made to ſupport the roof from falling in: but in reality it was no ſuch thing; for they were very brittle, and made of a fine glittering yellow marble. When we had paſſed theſe about 200 yards, we found ourſelves at the brink of another very terrible precipice: but this our guides aſſured us was the laſt; and there being a very good ladder to go down by, we readily ventured. At the bottom of this ſteep wall, as I may call it, we found ourſelves for ſome way upon plain even ground; but, after about 40 yards walking, were preſented by our guides with ropes again; which we faſtened about our middles, though not to be ſwung down by, but only for fear of danger, as there are lakes and deep waters all the way from hence on the left hand. With this caution, however, we entered the laſt alley: and horrible work it was indeed to get through it. All was perfectly horrid and diſmal here. The ſides and roof of the paſſage were all of black ſtone; and the rocks in our way were in ſome places ſo ſteep, that we were forced to lie all along on our backs, and ſlide down; and ſo rough, that they cut our clothes, and bruiſed us miſerably in paſſing. Over out heads, there were nothing but ragged black rocks, ſome of them looking, as if they were every moment ready to fall in upon us; and, on our left hands, the light of our guides torches ſhowed us continually the ſurfaces of dirty and miſerably looking lakes of water. If I had heartily repented of my expedition often before, here I aſſure you I was all in a cold ſweat, and fairly gave myſelf over for loſt; heartily curſing all the travellers that had written of this place, that they had deſcribed it ſo as

Antiparos.

to tempt people to ſee it, and never told us of the horrors that lay in the way. In the midſt of all theſe reflections, and in the very diſmalleſt part of all the cavern, on a ſudden we had loſt four of our ſix guides. What was my terror on this ſight! This place was a thouſand times darker and more terrible for want of their torches; and I expected no other but every moment to follow them into ſome of theſe lakes, into which I doubted not but they were fallen. The remaining two guides ſaid all they could, indeed, to cheer us up; and told us we ſhould ſee the other four again ſoon; and that we were near the end of our journey. I don't know what effect this might have upon the reſt of my companions; but I aſſure you I believed no part of the ſpeech but the laſt, which I expected every moment to find fulfilled in ſome pond or precipice. Our paſſage was by this time become very narrow, and we were obliged to crawl on all-fours over rugged rocks; when in an inſtant, and in the midſt of theſe melancholy apprehenſions, I heard a little hiſſing noiſe, and ſaw myſelf in utter, and not to be deſcribed, darkneſs. Our guides called indeed cheerfully to us, and told us that they had accidentally dropped their torches into a puddle of water, but we ſhould ſoon come to the reſt of them, and they would light them again; and told us there was no danger, and we had nothing to do but to crawl forward. I cannot but ſay I was amazed at the courage of theſe people; who were in a place where, I thought, four of them had already periſhed, and from whence we could none of us ever eſcape; and determined to lie down and die where I was. Words cannot deſcribe the horror, or the extreme darkneſs, of the place. One of our guides, however, perceiving that I did not advance, came up to me, and clapping his hand firmly over my eyes, dragged me a few paces forward. While I was in this ſtrange condition, expecting every moment death in a thouſand ſhapes, and trembling to think what the guide meant by this rough proceeding, he lifted me at once over a great ſtone, ſet me down on my feet, and took his hand from before my eyes. What words can deſcribe at that inſtant my aſtoniſhment and tranſport! Inſtead of darkneſs and deſpair, all was ſplendor and magnificence before me, our guides all appeared about us; the place was illuminated by 50 torches, and the guides all welcomed me into the grotto of Antiparos. The four that were firſt miſſing, I now found had only given us the ſlip, to get the torches lighted up before we came; and the other two had put out their lights on purpoſe, to make us enter out of utter darkneſs into this pavilion of ſplendor and glory. I am now come to the proper buſineſs of this letter; which was, to deſcribe this grotto. But I muſt confeſs to you that words cannot do it. The amazing beauties of the place, the eye that ſees them only can conceive. The beſt account I can give you, however, pray accept of.

“ The people told us, the depth of this place was 485 yards. The grotto, in which we now were, is a cavern of 120 yards wide, and 113 long, and ſeems about 60 yards high in moſt places. Theſe meaſures differ ſomething from the accounts travellers in general give us; but you may depend upon them as exact, for I took them with my own hand. Imagine then with yourſelf, an immenſe arch like this, almoſt all over lined with fine and bright chryſtallized white marble, and illuminated with 50 torches; and you will then have ſome faint idea of the place I had the pleaſure to ſpend three hours in. This, however, is but a faint deſcription of its beauties. The roof, which is a fine vaulted arch, is hung all over with icicles of white ſhining marble, ſome of them ten feet long, and as thick as one's middle at the root: and among theſe there hang 1000 feſtoons of leaves and flowers of the ſame ſubſtance; but ſo very glittering, that there is no bearing to look up at them. The ſides of the arch are planted with ſeeming trees of the ſame white marble, riſing in rows one above another, and often incloſing the points of the icicles. From theſe trees there are alſo hung feſtoons, tied as it were from one to another in vaſt quantities; and in ſome places among them there ſeem rivers of marble winding through them in a thouſand meanders. All theſe things are only made, in a long courſe of years, from the dropping of water, but really look like trees and brooks turned to marble. The floor we trod upon was rough and uneven, with cryſtals of all colours growing irregularly out of it, red, blue, green, and ſome of a pale yellow. Theſe were all ſhaped like pieces of ſaltpetre; but ſo hard, that they cut our ſhoes: among theſe, here and there, are placed icicles of the ſame white ſhining marble with thoſe above, and ſeeming to have fallen down from the roof and fixed there; only the big end of theſe is to the floor. To all theſe our guides had tied torches, two or three to a pillar, and kept continually beating them to make them burn bright. You may gueſs what a glare of ſplendor and beauty muſt be the effect of this illumination, among ſuch rocks and columns of marble. All round the lower part of the ſides of the arch are a thouſand white maſſes of marble, in the ſhape of oak-trees. Mr Tournefort compares them to cauliflowers, but I ſhould as ſoon compare them to toad-ſtools. In ſhort, they are large enough to incloſe, in many places, a piece of ground big enough for a bed-chamber. One of theſe chambers has a fair white curtain, whiter than ſattin, of the ſame marble, ſtretched all over the front of it. In this we all cut our names, and the date of the year, as a great many people have done before us. In a courſe of years afterwards, the ſtone bliſters out like this white marble over the letters. Mr Tournefort thinks the rock grows like oaks or apple-trees for this reaſon; but I remember I ſaw ſome of the fineſt cockle and muſcle ſhells, in the rock thereabouts, that ever I ſaw in my life. I wonder whether he thinks they grow there too. Beſides, if this rock grows ſo faſt, the cavern ought to be all grown up by this time; and yet, according to his meaſures and mine, the cavern ſeems on the other hand to be turned larger ſince. Indeed, all that I can gather from his account of this glorious place is, that he had drank a bottle or two too much before he went down into it.”

Antiparos.

ANTIPAS-HEROD, or HEROD-ANTIPAS, the ſon of HEROD the Great, by one of his wives called Cleopatra, a native of Jeruſalem. Herod the Great, in his firſt will, appointed Antipas his ſucceſſor in the kingdom; but afterwards, altering that will, he named his ſon Archelaus his ſucceſſor, giving to Antipas the title only of Tetrach of Galilee and Peræa.

Antipas took a great deal of pains in adorning and fortifying the principal places of his dominions. He married the daughter of Aretas king of Arabia; whom he divorced about the year of Chriſt 33, to marry his ſiſter-in-law Herodias, wife to his brother Philip, who was ſtill living. St John the Baptiſt exclaiming continually againſt this inceſt, was taken into cuſtody by order of Antipas, and impriſoned in the caſtle of Machærus, (Mat. xiv. 3, 4. Mark i. 14. vi. 17, 18. Luke iii. 19, 20.) Joſephus ſays, that Antipas cauſed St John to be laid hold of becauſe he drew too great a concourſe of people after him; and that he was afraid leſt he ſhould make uſe of the authority which he had acquired over the minds and affections of the people, to induce them to revolt. But the evangeliſts, who were better informed than Joſephus, as being eye-witneſſes of what paſſed, and acquainted in a particular manner with St John and his diſciples, aſſures us that the true reaſon of impriſoning St John was, the averſion which Herod and Herodias had conceived againſt him for the liberty he had uſed in cenſuring their ſcandalous marriage. The virtue and holineſs of St John were ſuch, that even Herod feared and reſpected him; but his paſſion for Herodias had prevailed with him to have killed that prophet, had he not been reſtrained by his apprehenſions of the people, who eſteemed John the Baptiſt as a prophet. (Mat. xiv. 5, 6.) One day, however, while the king was celebrating the feſtival of his birth, with the principal perſons of his court, the daughter of Herodias danced before him; and pleaſed him ſo well, that he promiſed with an oath to give her whatever ſhe ſhould aſk of him. By her mother's advice ſhe aſked the head of John the Baptiſt; upon which the king commanded John to be beheaded in priſon, and the head to be given her.—Aretas, king of Arabia, to revenge the affront which Herod had offered to his daughter, declared war againſt him, and overcame him in a very obſtinate engagement. Herod being afterwards detected as a party in Sejanus's conſpiracy, was baniſhed by the emperor Caius into Lyons in Gaul; whither Herodias accompanied him.

This Antipas is the Herod who, being at Jeruſalem at the time of our Saviour's paſſion, (Luke xxiii. 11.) ridiculed him, by dreſſing him in a white robe, and directing him to be conducted back to Pilate, as a mock king, whoſe ambition gave him no umbrage. The time when Antipas died is not known: however, it is certain he died in exile, as well as Herodias. Joſephus ſays, that he died in Spain, whither Caius upon his coming to Gaul, the firſt year of his baniſhment, might order him to be ſent.

ANTIPATER, the diſciple of Ariſtotle, and one of Alexander the Great's generals, was a man of great abilities, and a lover of the ſciences; but was accuſed of poiſoning Alexander. He ſubdued the revolted Thracians, relieved Megalopolis, and overthrew the Spartans there. He died 321 years before the Chriſtian æra.

ANTIPATER, an Idumæan of illuſtrious birth, and poſſeſſed of great riches and abilities, taking advantage of the confuſion into which the two brothers Hyrcanus and Ariſtobulus plunged Judea by their conteſt for the office of high-prieſt, took ſuch meaſures as to gain Hyrcanus that office, and under his government to obtain the abſolute direction of all affairs; while his great abilities and application to buſineſs made him ſo conſiderable, that he was honoured as much as if he had been inveſted with the royal authority in form: but he was at laſt poiſoned by a Jew, named Malachus, 43 years before the Chriſtian æra. He left among his other children, the famous Herod king of the Jews.

ANTIPATER (Cælius), a Roman hiſtorian, who wrote a hiſtory of the Punic war, much valued by Cicero. The emperor Adrian preferred him to Saluſt.

ANTIPATER of Sydon, a ſtoic philoſpher, and likewiſe a poet, commended by Cicero and Seneca: he flouriſhed about the 171ſt Olympiad. We have ſeveral of his epigrams in the *Anthologia*.

ANTIPATHY, in phyſiology, is formed from the two Greek word, *αντι contrary*, and *παθος paſſion*. Literally taken, the word ſignifies *incompatibility*: but for the moſt part the term *antipathy* is not uſed to ſignify ſuch incompatibilities as are merely phyſical; it is reſerved to expreſs the averſion which an animated or ſenſitive being feels at the real or ideal preſence of particular objects. In this point of view, which is the light in which we at preſent conſider the term, *antipathy*, in common language, ſignifies "a natural horror and deteſtation, an inſuperable hatred, and involuntary averſion, which a ſenſitive being feels for ſome other object, whatever it is, though the perſon who feels this abhorrence is entirely ignorant of its cauſe, and can by no means account for it." Such is, they ſay, the natural and reciprocal hoſtility between the ſalamander and the tortoiſe; between the toad and the weaſel; or between ſheep and wolves. Such is the invincible averſion of particular perſons againſt cats, mice, ſpiders, &c.: a prepoſſeſſion which is ſometimes ſo violent, as make them faint at the ſight of theſe animals. Of theſe and a thouſand other antipathies the ancient naturaliſts, the ſchoolmen, and the vulgar, form ſo many legends; and relate them as certain facts, that they may demand an explication of them from the philoſophers. But theſe ſages begin with inveſtigating whether ſuch antipathies actually exiſt or not.

To explore the matter without prejudice, we ſhall find it neceſſary to abſtract from the ſubjects of this diſquiſition, 1. All ſuch antipathies as are not aſcertained; as that which is ſuppoſed to be felt by hens at the ſound of an harp whoſe ſtrings are made of a fox's bowels, between the ſalamander and tortoiſe, and between the weaſel and the toad. Nothing is leſs confirmed, or rather nothing is more falſe, than theſe facts, with which vulgar credulity and aſtoniſhment are amuſed and actuated: and though ſome of theſe antipathies ſhould be aſcertained, this would be no proof that the animals which feel them are not acquainted with their cauſes, according to their mode and proportion of knowledge; in which caſe it will be no longer the antipathy which we have defined.

2. We muſt abſtract thoſe antipathies which can be extinguiſhed or reſumed at pleaſure; thoſe fictitious averſions, which certain perſons feel, or pretend to feel, with affected airs, that they may appear more preciſe and finical, or ſingularly and prodigiouſly elegant; that they may ſeem to have qualities ſo exquiſitely fine, as require to be treated with peculiar delicacy. One who beſtows any attention on the ſubject, would be aſtoniſhed to find how many of theſe chimerical averſions there are, which are pretended, and paſſed upon the world by thoſe who affect them, as natural and unconquerable.

3. When we abſtract thoſe averſions the, cauſes of

which are known and evident; we ſhall be ſurpriſed, after our deduction of theſe pretended antipathies from the general ſum, how ſmall, how inconſiderable, is the quantity of thoſe which are conformable to our definition. Will any one pretend to call by the name of *antipathy*, thoſe real, innate, and inconteſtable averſions which prevail between ſheep and wolves? Their cauſe is obvious: the wolf devours the ſheep, and ſubſiſts upon his victim; and every animal naturally flies with terror from pain or deſtruction: ſheep ought therefore to regard wolves with horror, which for their nutrition tear and mangle the unreſiſting prey. From principles ſimilar to this, ariſe that averſion which numbers of people feel againſt ſerpents; againſt ſmall animals, ſuch as reptiles in general, and the greateſt number of inſects. During the credulous and ſuſceptible period of infancy, pains have been taken to impreſs on our minds the frightful idea that they are venomous; that their bite is mortal; that their ſting is dangerous, productive of tormenting inflammations or tumours, and ſometimes fatal: they have been repreſented to us as ugly and ſordid; as being, for that reaſon, pernicious to thoſe who touch them; as poiſoning to thoſe who have the misfortune to ſwallow them. Theſe horrible prepoſſeſſions are induſtriouſly inculcated from our infancy; they are ſometimes attended and ſupported by diſmal tales, which are greedily imbibed, and indelibly engraven on our memories. It has been taught us both by precept and example, when others at their approach have aſſumed in our view the appearance of deteſtation and even of terror, that we ſhould fly from them, that we ſhould not touch them. Is it then wonderful (if our falſe impreſſions as to this ſubject have been corrected neither by future reflections nor experiments), that we ſhould entertain, during our whole lives, an averſion for theſe objects, even when we have forgot the admonitions, the converſations, and examples, which have taught us to believe and apprehend them as noxious beings? and in proportion to the ſenſibility of our frame, in proportion as our nerves are irritable, our emotions at the ſight of what we fear will be more violent, eſpecially if they anticipate our expectation, and ſeize us unprepared, thought our ideas of what we have to fear from them are the moſt confuſed and indiſtinct imaginable. To explain theſe facts, is it neceſſary to fly to the exploded ſubterfuge of occult qualities inherent in bodies, to latent relations productive of antipathies, of which no perſon could ever form an idea?

It is often ſufficient to influence a perſon who had formerly no averſion for an object, if he lives with ſome other aſſociate who gives himſelf up to ſuch capricious panics; the habit is inſenſibly contracted to be agitated with diſagreeable emtions at the preſence of an object which had been formerly beheld with indifference and cold blood. I was acquainted (ſays the author of the article *Antipathy* in the French Encyclopédie) with a perſon of a very ſound underſtanding, whom thunder and lightning by no means terrified; nay, to whom the ſpectacle appeared magnificent and the ſound majeſtic; yet to a mind thus ſeemingly fortified againſt the infectious of terror, no more was neceſſary than ſpending the ſummer with a friend in whom the appearance of lightning excited the ſtrongeſt emotions, and whom the remoteſt clap of thunder affected with extravagant paroxiſms, to become timid in exceſs at the approach of thunder; nor could he ever afterwards ſurmount the fear which it inſpired.—The frightful ſtories of dogs and cats, which have killed their maſters, or which have given them mortal wounds, are more than ſufficient to inſpire a timorous perſon with averſion againſt theſe animals; and if the olfactory nerves of ſuch a perſon be delicate, he will immediately diſcover the ſmell of them in a chamber: diſturbed by the apprehenſion which theſe effluvia excite in his mind, he gives himſelf up to the moſt violent uneaſineſs, which is tranquillized when he is aſſured that the animal is no longer in the room. If by chance, in the ſearch which is made to calm the uneaſineſs of this timorous perſon, one of theſe creatures ſhould at laſt be diſcovered, every one preſently exclaims, *A miracle!* and admits the reality of *antipathies* into his creed; whilſt all this is nothing but the effect of a childiſh fear, founded on certain confuſed and exaggerated ideas of the hazard which one may run with theſe animals. The *antipathy* which ſome people entertain againſt eels, though they are eaten by others with pleaſure, ariſe from nothing but the fear of ſerpents, to which theſe fiſhes are in ſome degree ſimilar. There are likewiſe other *antipathies* which do not originate in the imagination, but ariſe from ſome natural incongruity; ſuch as we often remark in children, for particular kinds of victuals, with which their taſte is not offended, but which their ſtomachs cannot digeſt, and which are therefore diſgorged as ſoon as ſwallowed.

To what then are thoſe *antipathies*, of which we have heard ſo much, reducible? Either to legendary tales; or to averſions againſt objects which we believe dangerous; or to a childiſh terror of imaginary perils; or to a diſreliſh, of which the cauſe is diſguiſed; or to a ridiculous affectation of delicacy; or to an infirmity of the ſtomach; in a word, to a real or pretended reluctance for things which are either inveſted, or ſuppoſed to be inveſted, with qualities hurtful to us. Too much care cannot be taken in preventing, or regulating, the *antipathies* of children; in familiariſing them with objects of every kind; in diſcovering to them, without emotion, ſuch as are dangerous; in teaching them the means of defence and ſecurity, or the methods of eſcaping their noxious influence; and, when the rational powers are matured by age, in reflecting on the nature of thoſe objects which we fear, in aſcertaining what has been told concerning their qualities, or in vigorouſly operating upon our own diſpoſitions to overcome thoſe vain repugnancies which we may feel. See SYMPATHY, which is the oppoſite of *Antipathy*.

ANTIPATHY, in ethics, hatred, averſion, repugnancy. *Hatred* is entertained againſt perſons; *averſion*, and *antipathy*, indiſcriminately againſt perſons or things; and *repugnancy*, againſt actions alone.

Hatred is more voluntary than *averſion*, *antipathy*, or *repugnancy*. Theſe laſt have greater affinity with the animal conſtitution. The cauſes of ANTIPATHY are leſs known than thoſe of a *averſion*. *Repugnancy* is leſs permanent than either the one or the other—We hate a vitious character, we feel *averſion* to its exertions: we are affected with ANTIPATHY for certain perſons at firſt ſight; there are ſome affairs which we tranſact with *repugnancy*—*Hatred* calumniates; *averſion* keeps us at a diſtance from certain perſons; ANTIPATHY makes us deteſt them; *repugnancy* hinders us from imitating them.

ANTIPATRIS (Acts xxiii. 31.), a town of Paleſtine, anciently called *Caphar-Saba*, according to Joſephus, but named *Antipatris* by Herod the Great, in honour of his father Antipater. It was ſituated in a pleaſant valley, near the mountains, in the way from Jeruſalem to Cæſarea. Joſephus places it at about the diſtance of ſeventeen miles from Joppa.

ANTIPELARGIA, among the ancients, a law, whereby children are obliged to furniſh neceſſaries to their aged parents. The ciconia, or ſtork, is a bird famous for the care it takes of its parents when grown old. Hence, in ſome Latin writers, this is rendered *lex ciconiaria*, or the ſtorks law.

ANTIPHONARY, ANTIPHONARIUM, a ſervice-book which contained all the invitatories, reſponſories, collects, and whatever elſe was ſung or ſaid in the choir, except the leſſons. This is otherwiſe called *reſponſarium*, from the reſponces therein contained. The author of the Roman *antiphonary* was pope Gregory the Great. We alſo find mention of nocturnal and diurnal *antiphonaries*, for the uſe of the daily and nightly offices; ſummer and winter *antiphonaries*; alſo *antiphonaries* for country churches, &c. By the provincial conſtitutions of archbiſhop Winchelſey, made at Merton, A. D. 1305, it is required that one of theſe ſhould be found in every church within the province of Canterbury. The uſe of theſe, and many other popiſh books, were forbid by the 3d and 4th of Edward VI. c. 10.

ANTIPHONY, the anſwer made by one choir to another, when the pſalm or anthem is ſung between two.

ANTIPHONY, ſometimes denotes a ſpecies of pſalmody, wherein the congregation, being divided into two parts, repeat the pſalms, verſe for verſe, alternately. In this ſenſe, antiphony ſtands contradiſtinguiſhed from ſymphony, where the whole congregation ſings together.

Antiphony differs from reſponſorium, becauſe in this latter the verſe is only ſpoken by one perſon, whereas in the former, the verſes are ſung by the two choirs alternately. The original of Antiphonal ſinging in the weſtern churches is referred to the time of St Ambroſe, about the year 374. That father is ſaid to have firſt introduced it into the church of Milan, in imitation of the cuſtom of the eaſtern church, where it appears to be of greater antiquity, though as to the time of its inſtitution, authors are not agreed; it was moſt probably introduced at Antioch, between the year of Chriſt 347 and 356.

ANTIPHONY is alſo uſed to denote the words given out at the beginning of the pſalm, to which both the choirs are to accommodate their ſinging.

ANTIPHONY, in a more modern ſenſe, denotes a kind of compoſition made of ſeveral verſes extracted out of different pſalms, adapted to expreſs the myſtery ſolemnized on the occaſion.

ANTIPODES, in geography, a name given to thoſe inhabitants of the globe that live diametrically oppoſite to each other. The word is Greek, and compounded of αντι, *oppoſite*, and πος, *a foot*; becauſe their feet are oppoſite to each other.

The antipodes lie under oppoſite meridians and oppoſite parallels; in the ſame degree of latitude, but of oppoſite denominations, one being north and the other ſouth. They have nearly the ſame degree of heat and cold, days and nights of equal length, but in oppoſite ſeaſons. It is noon to one, when midnight to the other; and the longeſt day with the one, is the ſhorteſt with the other.

Plato is eſteemed the firſt who thought it poſſible that the antipodes ſubſiſted, and is looked upon as the inventor of the word. As this philoſopher apprehended the earth to be ſpherical, he had only one ſtep to make to conclude the exiſtence of the antipodes.

The ancients, in general, treated this opinion with the higheſt contempt; never being able to conceive how men and trees could ſubſiſt ſuſpended in the air with their feet upwards, for ſo they apprehended they muſt be in the other hemiſphere.

They never reflected that theſe terms *upwards* and *downwards* are merely relative; and ſignify only nearer to, or farther from, the centre of the earth, the common centre to which all heavy bodies gravitate; and that, therefore, our antipodes have not their feet upwards and head downwards any more than ourſelves; becauſe they, like us, have their feet nearer the centre of the earth, and their heads farther from it. To have the head downwards and feet upwards, is to place the body in a direction of gravity tending from the feet to the head: but this cannot be ſuppoſed with regard to the antipodes; for they, like us, tend toward the centre of the earth, in a direction from head to foot.

ANTIPOLIS (anc. geog.), now ANTIBES, on the coaſt of Provence, a colony of the Maſſilians, near the river Verus, in Gallia Narbonenſis (Livy), three leagues to the weſt of Nice. E. Long. 7° Lat. 43° 40′.

ANTIQUARE, among Roman lawers, properly denotes the rejecting of a new law, or refuſing to paſs it. In which ſenſe, *antiquating* differs from *abrogating*; as the latter imports the annulling an old law, the former the rejecting a new one.

ANTIQUARE is alſo uſed for a law's growing obſolete, or into diſuſe, either by age or non-obſervance.

ANTIQUARII, a name given to copies of old books. After the decline of learning amongſt the Romans, and when many religious houſes were erected, learning was chiefly in the hands of the clergy; the greateſt number of whom were regulars, and lived in monaſteries. In theſe houſes were many induſtrious men, who were continually employed in making new copies of old books, either for the uſe of the monaſtery or for their own emolument. Theſe writing monks were diſtinguiſhed by the name of *Antiquarii.* They deprived the poor librarii, or common ſcriptores, of great part of their buſineſs, ſo that theſe found it difficult to gain a ſubſiſtence for themſelves and families. This put them upon finding out more expeditious methods of tranſcribing books. They formed the letters ſmaller, and made uſe of more jugations and abbreviations than had been uſual. They proceeded in this manner till the letters became exceedingly ſmall; the abbreviations were very numerous, and extremely difficult to be read. This in ſome meaſure accounts for the great variety of hands in the ſpecies of writing called *Modern Gothic.* When a number of copies were to be made of the ſame work, it was uſual to employ ſeveral perſons at the ſame time in writing it; each perſon, except him who wrote the firſt ſkin, began where his fellow was to leave off.

ANTIQUARY, a perſon who ſtudies and ſearches after monuments and remains of antiquity, as old medals, books, ſtatues, ſculptures, and inſcriptions, and, in general all curious pieces that may afford any light into antiquity.

In the chief cities of Greece and Italy, there were perſons of diſtinction called *antiquaries*, whoſe buſineſs it was to ſhow ſtrangers the antiquities of the place, to explain the ancient inſcriptions, and to give them all the aſſiſtance they could in this way of learning.—Pauſanias calls theſe antiquaries Εξηγηται. The Sicilians call them *myſtogogi*.

There was an ancient college of antiquaries erected in Ireland by Ollamh Fodhla, 700 years before Chriſt, for compoſing a hiſtory of that country: And to this, ſay the Iriſh hiſtorians, it is owing that the hiſtory and antiquities of that kingdom may be traced back beyond thoſe of moſt other nations.

There is a ſociety of antiquaries in London, and another in Edinburgh, incorporated by the king's charter. See SOCIETY.

ANTIQUARY is alſo uſed by ancient writers for the keeper of the antiquarian or cabinet of antiquities. This officer is otherwiſe called *archæota*, or antiquary of a king, a prince, a ſtate, or the like.

Henry VIII. gave John Leland the title of his *antiquary*; a title which, ſays the author of his life, no body ever enjoyed beſides himſelf. But the reſtriction, we ſuppoſe, was only intended to be underſtood in reſpect of the kings of England. M. Schott, we find, had the title of *antiquary* to the king of Pruſſia; P. Pedruzzi, that of *antiquary* to the Duke of Parma; M. Galland reſided ſome time in Turky under the title of *antiquary* of the king of France.—The univerſity of Oxford have ſtill their antiquary under the denomination of *cuſtos archivorum*.—The kings of Sweden have been at great expences in order to illuſtrate the antiquity of their country, having eſtabliſhed an academy of antiquaries with this ſingle view.—The office of the ancient Iriſh antiquaries was to preſerve the genealogies of the kings of Ireland, to correct the regal tables of ſucceſſion, and deliver down the pedigree of every collateral branch of the royal family.

ANTIQUATED, ſomething obſolete, out of date, or out of uſe.

ANTIQUE, in a general ſenſe, ſomething that is ancient: but the term is chiefly uſed by ſculptors, painters, and architects, to denote ſuch pieces of their different arts as were made by the ancient Greeks and Romans. Thus we ſay, an antique buſt, an antique ſtatue, &c.

ANTIQUE is ſometimes contradiſtinguiſhed from *ancient*, which ſignifies a leſs degree of antiquity. Thus, antique architecture is frequently diſtinguiſhed from ancient architecture.

ANTIQUITIES, a term implying all teſtimonies, or authentic accounts, that have come down to us of ancient nations. Bacon calls antiquities *the wrecks of hiſtory*, or ſuch particulars as induſtrious and learned perſons have collected from genealogies, inſcriptions, monuments, coins, names, etymologies, archives, inſtruments, fragments of hiſtory, &c.

Antiquities, from a very extenſive ſcience, including "an hiſtorical knowledge of the edifices, magiſtrates, offices, habiliments, manners, cuſtoms, ceremonies, worſhip, and other objects worthy of curioſity, of all the principal ancient nations of the earth."

This ſcience is not a matter of mere curioſity, but is indiſpenſible to the theologian; who ought to be thoroughly acquainted with the antiquities of the Jews, to enable him properly to explain numberleſs paſſages in the Old and New Teſtaments: to the lawyer, who, without the knowledge of the antiquities of Greece and Rome, can never well underſtand, and properly apply, the greateſt part of the Roman laws: to the phyſician and the philoſopher, that they may have a complete knowledge of the hiſtory and principles of the phyſic and philoſophy of the ancients: to the critic, that he may be able to underſtand and interpret ancient authors: to the orator and poet, who will be thereby enabled to ornament their writings with numberleſs images, illuſions, compariſons, &c.

Antiquities are divided into ſacred and profane, into public and private, univerſal and particular, &c. It is true, that the antiquaries (eſpecially ſuch as are infected with a ſpirit of pedantry, and the number of theſe is great) frequently carry their inquiries too far, and employ themſelves in laborious reſearches after learned trifles: but the abuſe of a ſcience ought never to make us neglect the applying it to rational and uſeful purpoſes.

Many antiquaries alſo reſtrain their learned labours to the ecclairciſſement of the antiquities of Greece and Rome: but this field is far too confined, and by no means contains the whole of this ſcience, ſeeing it properly includes the antiquities of the Jews, the Egyptians, Perſians, Phœnicians, Carthaginians Hetruſcans, Germans, and in general, all thoſe principal nations mentioned in ancient hiſtory: ſo far as any accounts of them are come down to us.

If to the general ſubjects above mentioned we add the particular ſtudy of antiques, of the ſtatues, baſſreliefs, and the precious relics of architecture, painting, camaieus, medals, &c. it is eaſy to conceive that antiquities form a ſcience very extenſive and very complicated, and with which only a very ſmall acquaintance could have been attainable by any one man, if our predeceſſors had not prepared the way for us; if they had not left us ſuch ineſtimable works as thoſe of Gronovius, Grævius, Montfaucon, Count Caylus, Winckelman, the Hebraic antiquities of D. Iken of Bremen, the Grecian antiquities of Brunings, the Roman antiquities of Nieupoort, and eſpecially that work which is intitled *Bibliographia Antiquaria Joh. Alberti Fabricii*, profeſſor at Hamburg; &c. &c. Nor muſt we here forget that very valuable work, with which Mr Robert Wood has lately enriched this ſcience, and which is ſo well known, and ſo juſtly eſteemed by all true connoiſſeurs, under the title of the *Ruins of Palmyra* and thoſe of *Balbeck*. It is by this work that we are fully convinced of the grandeur and magnificence, the taſte and elegance, of the buildings of the ancients. We here ſee that the invention of theſe matters is not all owing to the Greeks, but that there were other nations who ſerved them as models. For, though many of the edifices of Palmyra are to be attributed to the emperor Aurelian, and to Odenatus and his wife Zenobia, who reigned there about the year

264, yet there are found, at the ſame place, ruins of buildings, that appear to be of far greater antiquity, and that are not leſs beautiful. The ancient Perſepolis is ſufficient to prove this aſſertion. When we duly reflect on all theſe matters, and eſpecially if we attempt to acquire any knowledge of this ſcience, we ſhall ſoon be convinced that it but ill becomes a petit-maitre to laugh at a learned antiquary.

The knowledge of thoſe monuments of the ancients, the works of ſculpture, ſtatuary, graving, painting, &c. which they call *antiques*, requires a ſtrict attention, with regard to the matter itſelf on which the art has been exerciſed; as the wax, clay, wood, ivory, ſtones of every kind, marble, flint, bronze, and every ſort of metal. We ſhould begin by learning on what matter each ancient nation principally worked, and in which of the fine arts they excelled. For the matter itſelf, as the different ſorts of marble, compoſitions of metals, and the ſpecies of precious ſtones, ſerve frequently to characterize the true antique, and to diſcover the counterfeit. The connoiſſeurs pretend alſo to know, by certain diſtinct characters in the deſign and execution of a work of art, the age and nation where it was made. They find, moreover, in the invention and execution, a degree of excellence, which modern artiſts are not able to imitate. Now, though we ought to allow, in general, the great merit of the ancients in the polite arts, we ſhould not, however, ſuffer our admiration to lead us into a blind ſuperſtition. There are pieces of antiquity of every ſort, which have come down to us; ſome that are perfectly excellent; and others ſo wretched, that the meaneſt among modern artiſts would not acknowledge them. The mixture of the good and bad has taken place in all ſubjects, at all times, and in all nations. The misfortune is, that moſt of our great antiquaries have been ſo little ſkilled in deſigning, as ſcarcely to know how to draw a circle with a pair of compaſſes. It is prejudice, therefore, which frequently directs them to give the palm to the ancients, rather than a judgment directed by a knowledge of the art. That character of expreſſion, which they find ſo marvellous in the works of antiquity, is often nothing more than a mere chimera. They pretend that the artiſts of our days conſtantly exaggerate their expreſſions; that a modern Bacchus has the appearance of a man diſtracted with intoxication; that a Mercury ſeems to be animated with the ſpirit of a fury; and ſo of the reſt. But let them not decide too haſtily. — Almoſt all the antique figures are totally void of all ſpirit of expreſſion; we are forced to gueſs at their characters. Every artificial expreſſion requires, moreover, to be ſomewhat exaggerated. A ſtatue or portrait is an inanimate figure; and muſt therefore have a very different effect from one which, being endowed with life, has the muſcles conſtantly in play, and where the continual change of the features, the motion of the eyes, and the looks, more or leſs lively, eaſily and clearly expreſs the paſſions and ſentiments. Whereas in a figure that is the produce of art, the delicate touches, that ſhould expreſs the paſſions, are loſt to the eyes of the ſpectators: they muſt therefore be ſtruck by ſtrong, bold characters, which can affect them at the firſt glance of the eye. A very moderate artiſt is ſenſible, at the ſame time, that he is not to give his figures extravagant expreſſions, nor to place them in diſtorted attitudes.

ANTIQUITY ſignifies times or ages paſt long ago. Thus, we ſay, the heroes of antiquity, &c.

ANTIQUITY is alſo uſed to denote the works or monuments of antiquity. See ANTIQUITIES.

ANTIQUITY likewiſe expreſſes the great age of a thing; and in this ſenſe we ſay the antiquity of a family, the antiquity of a kingdom.

ANTIRRHINUM, SNAP-DRAGON, or CALVES-SNOUT: A genus of the angioſpermia order, belonging to the didynamia claſs of plants; and in the natural method ranking under the 40th order, *Perſonatæ*. The eſſential characters are theſe: The calyx conſiſts of five leaves; the baſis of the corolla is bent backwards, and furniſhed with pectoria; the capſule is bilocular. There are 14 ſpecies of the antirrhinum, 10 of which are natives of Britain, viz. the cymbalaria, or ivy-leaved toad-graſs; the elatine, or ſharp-pointed fluellin; the ſpurium or round-leaved fluellin; the arvenſe, or corn-blue toad-flax; the repens, or creeping toad-flax; the monoſpermum, or ſweet-ſmelling toad-flax; the linaria, ar common yellow-toad-flax; the minus, or leſs toad-flax: the majus, or greater ſnap-dragon; and the orontium, or leaſt ſnap-dragon. The linaria is ſaid to be cathartic and diuretic; but it is not uſed in the ſhops.

ANTIRRHIUM (anc. geog.), a promontory at the mouth of the Corinthian bay, where it is ſcarce a mile broad, and where it ſeparates the Ætolians from the Peloponneſus; ſo called from its oppoſite ſituation to Rhium in Peloponneſus, (Pliny): both are now called the *Dardanelles* of *Lepanto*.

ANTISABBATARIANS, a modern religious ſect, who oppoſe the obſervance of the Chriſtian ſabbath. The great principle of the Antiſabbatarians is, that the Jewiſh ſabbath was only of ceremonial, not moral obligation; and conſequently is aboliſhed by the coming of Chriſt.

ANTISAGOGE, in rhetoric, a figure differing little from that called *conceſſion*. The following paſſage from Cicero is an inſtance of it: *Difficilis ratio belli gerendi; at plena Fidei, plena pietatis: & ſi dicas, magnus labor, multa pericula proponuntur; at gloria ex his immortalis eſt conſecutura.* See CONCESSION.

ANTISCII, in geography, people who live on different ſides of the equator, whoſe ſhadows at noon are projected oppoſite ways. Thus the people of the north are Antiſcii to thoſe of the ſouth; the one projecting their ſhadows at noon towards the north pole, and the other toward the ſouth pole.

ANTISCORBUTICS, medicines good in ſcorbutic caſes.

ANTISEPTICS (from αντι and σηπτος *putrid*, of σηπω, *to putrify*), an appellation given to ſuch ſubſtances as reſiſt putrefaction.

We have ſome curious experiments in relation to antiſeptic ſubſtances by Dr Pringle, who has aſcertained their ſeveral virtues. Thus in order to ſettle the antiſeptic virtue of ſalts, he compared it with that of common ſea-ſalt; which being one of the weakeſt, he ſuppoſes equal to unity, and expreſſes the proportional ſtrength of the reſt by higher numbers, as in the following table.

Antiſeptics, Antiſpaſmodics.

Salts, their antiſeptic virtue.

Sea-ſalt	1	Saline mixture	3
Sal gemma	1+	Nitre	4+
Tartar vitriolated	2	Salt of hartſhorn	4+
Spiritus Mindereri	2	Salt of wormwood	4+
Tartarus ſolubilis	2	*Borax*	12+
Sal diureticus	2+	Salt of amber	20+
Crude *ſal ammoniac*	3	Alum	30+

In this table the proportions are marked in integral numbers: only to ſome there is added the ſign +, to ſhow, that thoſe ſalts are poſſeſſed of a ſtronger antiſeptic virtue than the number in the table expreſſes, by ſome fractions; unleſs in the three laſt, where the ſame ſign imports, that the ſalt may be ſtronger by ſome units.

Some reſinous and other ſubſtances even exceed the antiſeptic virtues of the neutral ſalts; thus myrrh, aſafætida, terra japonica, and aloes, are at leaſt twelve times more antiſeptic than ſea-ſalt. Two grains of camphor is equivalent to ſixty grains of that ſalt. An infuſion of a few grains of Virginian ſnake-root, in powder, exceeds twelve times its weight of ſea-ſalt. Comomile flowers have nearly the ſame extraordinary quality. The Jeſuits bark has it alſo. Beſides theſe, pepper, ginger, ſaffron, contrayerva-root, are twelve times more antiſeptic than ſea-ſalt. Dried ſage, rhubarb, the root of the wild valerian, mint, angelica, ground ivy, ſenna, green tea, red roſes, wormwood, muſtard, and horſe-radiſh, were likewiſe found more antiſeptic than the ſtandard.

To the claſs of antiſeptic medicines may likewiſe be added fermented liquors, acids, ſpirits, and even thoſe plants called *anti-acids*, and erroneouſly ſuppoſed haſteners of putrefaction, particularly horſe-radiſh. Now vegetables, poſſeſſing this virtue, are the more valuable, in that being uſually free of acrimony, they may be taken in much greater quantities than either ſpirits, acids, reſins, or even the neutral ſalts.

Antiſeptics are preſcribed in all putrid, malignant, and peſtilential caſes. It is to be remarked, however, that different kinds of them are to be given in different diſeaſes, and even in different ſtages of the ſame diſeaſe. Thus, the bark is a ſpecific in a gangrene, when the veſſels are relaxed, and the blood reſolved or diſpoſed to putrefaction; but will fail, if the veſſel are too full, or the blood be too thick. With the ſame caution is the bark to be uſed in wounds, viz. chiefly in caſes of abſorbed matter, when it infects the humours, and brings on a hectic fever.

By the great antiſeptic virtue of alum, the bark, and other aſtringents, it ſhould ſeem, that aſtriction had no ſmall ſhare in the cure of putrid diſorders; and, indeed, the very nature of putrefaction conſiſts in a ſeparation or diſunion of the parts. But as aſtringents are improper to be adminiſtered in many caſes, contrayerva-root, ſnake-root, camphor, &c. may ſupply their place; which, though, highly antiſeptic, have very little, if any, of an aſtringent quality.

ANTISPASMODICS, are medicines proper for the cure of ſpaſms and convulſions. Opium, balſam of Peru, and the eſſential oils of many vegetables, are the principal in this claſs of medicines. Opium excels, for its immediate effects. Peruvian balſam, in many inſtances, produces more laſting benefit than opium, and ſometimes ſucceeds where opium fails. As antiſpaſmodics, the eſſential oils differ in this from opium, that they act more on a particular part than on the ſyſtem in general, and have no ſoporific effect. Some medicines remove ſpaſms by immediate contact, as aſſes milk, cream, oil of almonds; others by repelling heat, as gas, ſulphur, nitre, ſal ammoniac, &c. And where the ſtrictures are produced by inanition and a defect of vital heat, ſpaſms are removed by thoſe medicines that reſtore the *vis vitæ*, ſuch as valerian, caſtor, muſk, &c.

Antiſtaſis, Antitheſis.

ANTISTASIS, in oratory, a defence of an action from the conſideration that had it been omitted worſe would have enſued. This is called by Latin writers *comparativum argumentum*; ſuch, *e. gr.* would be the general's defence who had made an inglorious capitulation, That without it, the whole army muſt have periſhed.

ANTISTHENES, a Greek philoſopher, and founder of the Cynics. He was born at Athens, and paſſed the former part of his life as a ſoldier. Having afterwards been an attendant at the lectures of Socrates, he was principally charmed with thoſe exhortations of that great philoſopher, which perſuaded to frugality, to temperance, and to moderation: theſe Antiſthenes was reſolved to practiſe by carrying every precept to its utmoſt extent. Permitting therefore his beard to grow, he went about the ſtreets in a thread-bare coat, ſcarcely to be diſtinguiſhed from a common beggar. He prided himſelf upon the moſt rigid virtue, and thought himſelf obliged to attack the vicious wherever he found them. This gave him ſome reputation in the city; but it may be ſuppoſed, that, in a place ſo very luxurious as Athens, he had more enemies than diſciples. His philoſophy conſiſted rather in action than ſpeculation: it was therefore his conſtant maxim, That to be virtuous was to be happy, and that all virtue conſiſted in action; that the wiſe man ſhould live for himſelf, contented in all ſituations, and happy alone in the conſciouſneſs of his own virtue. He acknowledged nothing to be good but was was honourable; and aſſerted, that virtue might be acquired by practice. Laertius tells us there were 10 tomes of his works; and he has given us many of his apophthegms.

ANTISTOECHON, in grammar, the uſing one letter inſtead of another; as *olli* for *illi*.

ANTISTROPHE, in grammar, a figure by which two things mutually depending on one another, are reciprocally converted; as, *the ſervant of the maſter, the maſter of the ſervant*.

ANTISTROPHE, among lyric poets, that part of a ſong and dance in uſe among the ancients, which was performed before the altar, in returning from weſt to eaſt in oppoſition to ſtrophe. See STROPHE and ODE.

ANTITACTÆ, in church hiſtory, a branch of Gnoſtics, who held, that God was good and juſt, but that a creature had created evil; and conſequently that it is our duty to oppoſe this author of evil, in order to avenge God of his adverſary.

ANTITHENAR, in anotomy, a name given to the adductor incicis. See ANATOMY, *Table of the Muſcles*.

ANTITHESIS, in rhetoric, a contraſt or oppoſition of words or ſetiments. Such is that of Cicero, in the ſecond Catilinarian: "On one ſide ſtands modeſty, on the other impudence; on one fidelity, on the other deceit; here piety, there ſacrilege; here continency, there luſt, &c." Such alſo is that of Auguſtus to ſome ſeditious young men: *Audite, juvenes, ſenem, quem juvenem ſenes audivere.* Such again is that of Seneca; *Curæ leves loquuntur, ingentes ſtupent.* And that of Virgil:

Flectere ſi nequeo ſuperos, Acheronta movebo.

St Auguſtine, Seneca, Salvian, and many other ancient writers, ſeem greatly to affect antitheſis; but among the moderns they are generally decried. Deſmaretz repreſents them as the favourites of young writers. The following is an example of modern antitheſis:

———Though gentle, yet not dull;
Strong, without rage; without o'erflowing, full.

Antitheſis is ſometimes uſed for controverſy. In this ſenſe, we meet with *antithetic* method, *antithetic* diſcourſes, &c. Marcion compoſed a volume of Antitheſes, or contrarieties and oppoſitions between the law and the goſpel.

ANTITRAGUS musculus, in anatomy, a muſcle of the ear. See Anatomy, *Table of the Muſcles.*

ANTITRINITARIANS, thoſe who deny the Trinity, and teach that there are not three perſons in the Godhead. Thus in the Samoſatenians, who do not believe the diſtinction of perſons in God; the Arians, who deny the divinity of the Word; and the Macedonians, who deny that of the Holy Spirit, are all properly Antitrinitarians. Among the moderns, Antitrinitarians are particularly underſtood of Socinians, called alſo Unitarians.

The *Bibliotheca Antitrinitariorum,* or *Antitrinitarian Library,* is a poſthumous work of Chriſtopher Sandius, an eminent Antitrinitarian; wherein he gives a liſt, digeſted in order of time, of all the Socinian or modern Antitrinitarian authors, with a brief account of their lives, and a catalogue of their works. See Unitarian.

ANTITYPE, a Greek word, properly ſignifying a type or figure correſpondent to ſome other type.

The word antitype occurs twice in the New Teſtament; viz. in the Epiſtle to the Hebrews, ix. 24. and in St Peter, 1 Ep. iii. 21. where its genuine import has been much controverted. The former ſays, that "Chriſt is not entered into the holy places made with hands, which are αντιτυπα, the figures or antitypes of the true—now to appear in the preſence of God for us." Now τυπος, ſignifies the pattern by which another thing is made; and as Moſes was obliged to make the tabernacle, and all things in it, according to the pattern ſhowed him in the mount; the tabernacle ſo formed was the antitype of what was ſhown to Moſes: any thing, therefore, formed according to a model or pattern, is an antitype. In the latter paſſage, the Apoſtle, ſpeaking of Noah's flood, and the deliverance only of eight perſons in the ark from it, ſays, Ω και ημας αντιτυπον νυν σωζει βαπτισμα, *baptiſm, being an antitype to that, now ſaves us; not putting away the filth of the fleſh, but the anſwer of a good conſcience towards God, &c.* The meaning is, that righteouſneſs, or the anſwer of a good conſcience towards God, now ſaves us by means of the reſurrection of Chriſt, as formerly righteouſneſs ſaved thoſe eight perſons by means of the ark, during the flood. The word antitype, therefore, here ſignifies a general ſimilitude of circumſtances; and the particle ω, *whereunto,* refers, not to the immediate antecedent, υδατος, *water,* but to all that precedes.

Antitype, among the ancient Greek fathers, and in the Greek liturgy, is alſo applied to the ſymbols of bread and wine in the Sacrament. Hence it hath been argued, by many Proteſtants, that the Greeks do not really believe the doctrine of tranſubſtantiation; becauſe they call the bread and wine *antitypes,* αντιτυπα, q. d. figures, ſimilitudes; and this even after the conſecration.

ANTIUM, (anc. geog.) a city of the Volſci, (Livy); ſituated on the Tuſcan ſea, yet without a harbour, becauſe they had a neighbouring hamlet, called *Ceno,* with a harbour, (Strabo). The Romans gained the firſt reputation in naval affairs againſt the Antiates; part of whoſe ſhips they conveyed into the arſenal of Rome, and part they burnt; and with their beaks or roſtra adorned the pulpit erected in the Forum, thence called *Roſtra,* (Livy, Florus). Here ſtood a famous temple of Fortune, (Horace). Addiſon ſays, there were two Fortunæ worſhipped at Antium.—It is now extinct, but the name ſtill remains in the *Capo de' Anzo.*

ANTIVARI, a ſtrong town of Turky, in Europe, in Dalmatia, a Greek archbiſhop's ſee, and ſubject to the Turks. E. Lon. 29. 15. N. Lat. 43. 0.

ANTLER, among ſportſmen, a ſtart or branch of a deer's attire.

Brow-Antler, denotes the branch next the head; and,

Bes-Antler, the branch next above the brow-antler.

ANTLIA, an ancient machine, ſuppoſed to be the ſame with our pump. Hence the phraſe, *in antliam condemnari,* according to the critics, denotes a kind of puniſhment, whereby criminals were condemned to drain ponds, ditches, or the like.

ANTOECI, in geography, thoſe inhabitants of the earth who live under the ſame meridian, and at the ſame diſtance from the equator; the one toward the north, and the other toward the ſouth. Hence they have the ſame longitude; and their latitude is alſo the ſame, but of a different denomination. They are in the ſame ſemicircle of the meridian, but oppoſite in parallels. They have preciſely the ſame hours of the day and night, but oppoſite ſeaſons; and the night of the one is always equal to the day of the other.

ANTOINE, a town of France, in Dauphiny, in the dioceſe of Vienne, with a celebrated abbey. It is ſeated among the mountains, 13 miles eaſt of Lyons. E. Lon. 5. 20. N. Lat. 45. 43.

ANTONA, (Tacitus); a river of Britain, which Camden ſuppoſes to be a faulty reading for Avuona or Auſona, (the Avon).

ANTONACUM, Antonnacum, or Antunnacum, a town of the Treveri; now *Andernach* below Coblentz. E. Lon. 7° 5′. Lat. 50° 25′.

ANTONIA, a citadel of Jeruſalem, the origin of which we have in Joſephus; who ſays, that Hyrcanus, the firſt high-prieſt of that name, built Baris near the temple, a houſe with turrets, where he generally reſided

ſided. Herod afterwards made it ſtronger, for the ſecurity and defence of the temple; and in honour of Marc Anthony, who then commanded in the eaſt, called it *Antonia*. It was very extenſive, and could accommodate a Roman legion: from it there was a full view of the temple.

ANTONIA (St), a town of France, in Rouergue, in the dioceſe of Rhodez, whoſe fortifications are demoliſhed. It is ſeated on the river Aveirou. E. Lon. 0. 55. N. Lat. 44. 10.

ANTONIAN waters, medical waters of Germany, very pleaſant to the taſte, and eſteemed good in many chronic and hypochondriac caſes. See Tonstein.

ANTONIANO (Silvio), a man of great learning, who raiſed himſelf from a low condition by his merit, was born at Rome in the year 1540. When he was but ten years old, he could make verſes upon any ſubject propoſed to him; and theſe ſo excellent, though pronounced extempore, that even a man of genius could not compoſe the like without a good deal of time and pains. The Duke de Ferrara coming to Rome, to congratulate Marcellus II. upon his being raiſed to the pontificate, was ſo charmed with the genius of Antoniano, that he carried him to Ferrara, where he provided able maſters to inſtruct him in all the ſciences. From thence he was ſent for by Pius IV. who made him profeſſor of the belles lettres in the college at Rome. Antoniano filled this place with ſo much reputation, that, on the day when he began to explain the oration *pro Marco Marcello*, he had a vaſt crowd of auditors, and among theſe no leſs than 25 cardinals. He was afterwards choſen rector of the college; and after the death of Pius IV. being ſeized with a ſpirit of devotion, he joined himſelf to Philip Neri, and accepted the office of ſecretary to the ſacred college, offered him by Pius V. which he executed for 25 years with the reputation of an honeſt and able man. He refuſed a biſhopric which Gregory XIV. would have given him; but he accepted the office of ſecretary to the briefs, offered him by Clement VIII. who made him his chamberlain, and afterwards a cardinal. Antoniano killed himſelf by too great fatigue: for he ſpent whole nights in writing letters; which brought on a ſickneſs, whereof he died, in the 63d year of his age. He wrote with ſuch eaſe and fluency, that he never almoſt made any blot or raſure; and it is ſaid of him, that he preſerved the flower of his virginity during his whole life.

ANTONIDES vander Goes (John), an eminent Dutch poet, born at Goes in Zealand, the 3d of April 1647. His parents were Anabaptiſts, people of good character, but of low circumſtances. They went to live at Amſterdam when Antonides was about four years old; and, in the ninth year of his age, he began his ſtudies, under the direction of Hadrian Junius and James Cocceius. Antonides took great pleaſure in reading the Latin poets, and carefully compared them with Grotius, Heinſius, &c. By this means he acquired a taſte for poetry, and enriched his mind with noble ideas. He firſt attempted to tranſlate ſome pieces of Ovid, Horace, and other ancients; and, having formed his taſte on theſe excellent models, he at length undertook one of the moſt difficult taſks in poetry, to write a tragedy: this was intitled *Trazil*, or *The invaſion of China*. Antonides, however, was ſo modeſt, as not to permit it to be publiſhed. Vondel, who was then engaged in a dramatic piece, which was taken alſo from ſome event that happened in China, read Antonides's tragedy; and was ſo well pleaſed with it, that he declared, if the author would not print it, he ſhould take ſome paſſages out of it, and make uſe of them in his own tragedy. He accordingly did ſo; and it was reckoned much to the honour of Antonides, to have written what might be adopted by ſo great a poet as Vondel was acknowledged to be by all good judges. Upon the concluſion of the peace between Great Britain and Holland, in the year 1697, Antonides wrote a piece intitled *Bellona aan band*, i. e. "Bellona chained; a very elegant poem, conſiſting of ſeveral hundred verſes. He next wrote an ingenious heroic poem, which he intitled, *The River Y.* (the river on which Amſterdam is built).

Antonides's parents had bred him up an apothecary: but his remarkable genius for poetry ſoon gained him the eſteem and friendſhip of ſeveral perſons of diſtinction; and particularly of Mr Buiſero, one of the lords of the admiralty at Amſterdam, and a great lover of poetry, who ſent him at his expence to purſue his ſtudies at Leyden, where he remained till he took his degree of doctor of phyſic, and then his patron gave him a place in the admiralty. In 1678, Antonides married Suſanna Bermans, a miniſter's daughter, who had alſo a talent for poetry. His marriage was celebrated by ſeveral eminent poets, particularly by the famous Peter Francius, profeſſor of eloquence, who compoſed ſome Latin verſes on the occaſion. After marriage, he did not much indulge his poetic genius; and within a few years he fell into a conſumption, of which he died on the 18th September 1684, being then but thirty-ſeven years and a few months old. He is eſteemed the moſt eminent Dutch poet after Vondel. His works have been printed ſeveral times, having been collected by father Anthony Tanſz. The laſt edition was printed by Nicholas Ten Hoom, at Amſterdam, in the year 1714, in 4to, under the direction of David Van Hoogſtraaten, one of the maſters of the Latin ſchool of that city, who added to it alſo the life of the poet.

ANTONINUS Pius, the Roman emperor, was born at Lanuvium in Italy, A. C. 86, of a family originally from Niſmes in Languedoc. His character was in all reſpects one of the nobleſt that can be imagined; and he had the title of *Pius* given him by the ſenate. We have no regular account of the tranſactions of his reign, ſince Capitolinus has written in a very confuſed manner; and we have only an abridgment of Dion Caſſius's hiſtory by Xiphilin now remaining. He managed the public revenues with great frugality, yet was extremely generous; was fond of peace, and in war preferred the reputation of juſtice to all the advantages which might be gained by victory. He was more intent upon preſerving the bounds of his empire than extending them; and he often made uſe of Scipio's expreſſion, That he choſe rather to ſave one citizen than kill a thouſand enemies. By this conduct he made himſelf univerſally eſteemed and revered in that age, and admired by poſterity. This great and good emperor died in 161, aged 75 years, having reigned 23.

ANTONINUS Philosophus (Marcus Aurelius), the Roman emperor, born at Rome, the 26th of April, in the 121ſt year of the Chriſtian æra. He was called by ſeveral names till he was admitted into the Aurelian

lian family, when he took that of Marcus Aurelius Antoninus. Hadrian, upon the death of Cejonius Commodus, turned his eyes upon Marcus Aurelius; but, as he was not then 18 years of age, and conſequently too young for ſo important a ſtation, he fixed upon Antoninus Pius, whom he adopted, upon condition that he ſhould likewiſe adopt Marcus Aurelius. The year after this adoption, Hadrian appointed him quæſtor, though he had not yet attained the age preſcribed by the laws. After the death of Hadrian, Aurelius married Fauſtina, the daughter of Antoninus Pius, by whom he had ſeveral children. In the year 139, he was inveſted with new honours by the emperor Pius, in which he behaved in ſuch a manner as endeared him to that prince and the whole people.

Upon the death of Pius, which happened in the year 161, he was obliged by the ſenate to take upon him the government; in the management of which he took Lucius Verus as his colleague. Dion Caſſius ſays, that the reaſon of doing this was, that he might have leiſure to purſue his ſtudies, and on account of his ill ſtate of health; Lucius being of a ſtrong vigorous conſtitution, and conſequently more fit for the fatigues of war. The ſame day he took upon him the name of Antoninus, which he gave likewiſe to Verus his colleague, and betrothed his daughter Lucilla to him. The two emperors went afterwards to the camp; where, after having performed the funeral rites of Pius, they pronounced each of them a panegyric to his memory. They diſcharged the government in a very amicable manner. It is ſaid that, ſoon after Antoninus had performed the apotheoſis of Pius, petitions were preſented to him by the pagan prieſts, philoſophers, and governors of provinces, in order to excite him to perſecute the Chriſtians; which he rejected with indignation, and interpoſed his authority for their protection, by writing a letter to the common aſſembly of Aſia, then held at Epheſus (A). The happineſs which the empire began to enjoy under theſe two emperors was interrupted, in the year 162, by a dreadful inundation of the Tiber, which deſtroyed a vaſt number of cattle, and occaſioned a famine at Rome. This calamity was followed by the Parthian war; and at the ſame time the Catti ravaged Germany and Rhætia. Lucius Verus went in perſon to oppoſe the Parthians; and Antoninus continued at Rome, where his preſence was neceſſary.

During this war with the Parthians, about the year 163 or 164, Antoninus ſent his daughter Lucilla to Verus, ſhe having been betrothed to him in marriage, and attended her as far as Brunduſium: he intended to have conducted her to Syria; but it having been inſinuated by ſome perſons, that his deſign of going into the eaſt was to claim the honour of having finiſhed the Parthian war, he returned to Rome. The Romans having gained a victory over the Parthians, who were obliged to abandon Meſopotamia, the two emperors triumphed over them at Rome in the year 166; and were honoured with the title of *Fathers of their country*. This year was fatal, on account of a terrible peſtilence which ſpread itſelf over the whole world, and a famine under which Rome laboured: it was likewiſe in this year that the Marcomanni, and many other people of Germany, took up arms againſt the Romans; but the two emperors havidg marched in perſon againſt them, obliged the Germans to ſue for peace. The war, however, was renewed the year following, and the two emperors marched again in perſon; but Lucius Verus was ſeized with an apoplectic fit, and died at Altinum. The Romans were now defeated with great ſlaughter; and the emperor, not chooſing to burden his ſubjects with new taxes, expoſed to public ſale the furniture of the palace, the gold and ſilver plate belonging to the crown, and his wife's rich garments embroidered with gold, and a curious collection of pearls, which Adrian had purchaſed during his long progreſs thro' the provinces of the empire, and was called *Adrian's cabinet*.

In the year 170, Antoninus made vaſt preparations againſt the Germans, and carried on the war with great vigour. During this war, in 174, a very extraordinary event is ſaid to have happened, which, according to Dion Caſſius, was as follows: Antoninus's army being blocked up by the Quadi, in a very diſadvantageous place, where there was no poſſibility of procuring water; in this ſituation, being worn out with fatigue and wounds, oppreſſed with heat and thirſt, and incapable of retiring or engaging the enemy, in an inſtant the ſky was covered with clouds, and there fell a vaſt quantity of rain: the Roman army were about to quench their thirſt, when the enemy came upon them with ſuch fury, that they muſt certainly have been defeated, had it not been for a ſhower of hail, accompanied with a ſtorm of thunder and lightning, which fell upon the enemy, without the leaſt annoyance to the Romans, who by this means gained the victory (B). In 175, Antoninus made a treaty with ſeveral nations of Germany. Soon after, Avidius Caſſius, governor of Syria, revolted from the emperor: this inſurrection, however, was put an end to by the death of Caſſius, who was killed by a centurion named *Anthony*. Antoninus behaved with great lenity towards thoſe who had been engaged in Caſſius's party:

(A) Euſebius has preſerved this letter, Hiſt. Eccleſ. lib. iv. cap. 13. but he falſely aſcribes it to Antoninus Pius, whereas it was wrote by Marcus Antoninus, as Valerius makes it appear in his annotations on Euſebius.

(B) The pagans as well as Chriſtians, according to Mr. Tillemont (p. 621. art. xvi.), have acknowledged the truth of this prodigy, but have greatly differed as to the cauſe of ſuch a miraculous event; the former aſcribing it, ſome to one magician and ſome to another: In Antoninus's Pillar, the glory is aſcribed to Jupiter the god of rain and thunder. But the Chriſtians affirmed, that God granted this favour at the prayer of the Chriſtian ſoldiers in the Roman army, who are ſaid to have compoſed the twelfth or Melitene legion; and, as a mark of diſtinction, we are told that they received the title of the *Thundering Legion*, from Antoninus (Euſeb. Eccleſ. Hiſt. lib. v. cap. 5). Mr Moyle, in the letters publiſhed in the ſecond volume of his works, has endeavoured to explode this ſtory of the Thundering Legion; which occaſioned Mr Whiſton to publiſh an anſwer, in 1726, intitled, *Of the Thundering Legion; or, Of the miraculous deliverance of Marcus Antoninus, and his army, upon the prayers of the Chriſtians.*

ty: he would not put to death, nor impriſon, nor even ſit in judgment himſelf upon any of the ſenators engaged in this revolt; but he referred them to the ſenate, fixing a day for their appearance, as if it had been only a civil affair. He wrote alſo to the ſenate, deſiring them to act with indulgence rather than ſeverity; not to ſhed the blood of any ſenator or perſon of quality, or of any other perſon whatſoever, but to allow this honour to his reign, that, even under the misfortune of a rebellion, none had loſt their lives, except in the firſt heat of the tumult. In 176, Antoninus viſited Syria and Egypt: the kings of thoſe countries, and ambaſſadors alſo from Parthia, came to viſit him. He ſtaid ſeveral days at Smyrna; and, after he had ſettled the affairs of the eaſt, went to Athens, on which city he conferred ſeveral honours, and appointed public profeſſors there. From thence he returned to Rome with his ſon Commodus, whom he choſe conſul for the year following, though he was then but 16 years of age, having obtained a diſpenſation for that purpoſe. On the 27th of September, the ſame year, he gave him the title of *Imperator*; and on the 23d of December, he entered Rome in triumph, with Commodus, on account of the victories gained over the Germans. Dion Caſſius tells us, that he remitted all the debts which were due to himſelf and the public treaſury during 46 years, from the time that Hadrian had granted the ſame favour, and burnt all the writings relating to thoſe debts. He applied himſelf likewiſe to correct many enormities, and introduced ſeveral excellent regulations. In the year 179, he left Rome with his ſon Commodus, in order to go againſt the Marcomanni, and other barbarous nations; and the year following gained a conſiderable victory over them, and would, in all probability, have entirely ſubdued them in a very ſhort time, had he not been taken with an illneſs, which carried him off on the 17th of March 180, in the 59th year of his age, and 19th of his reign. The whole empire regretted the loſs of ſo valuable a prince, and paid the greateſt regard to his memory: he was ranked amongſt the gods, and almoſt every perſon had a ſtatue of him in their houſes. His book of Meditations has been much admired by the beſt judges.

ANTONINE's Column. See COLUMN.

ANTONINUS's Wall, the name of the third rampart or defence that had been built or repaired by the Romans againſt the incurſions of the North Britons. It is called by the people in the neighbourhood, *Graham's Dyke*; from the notion that one Graham, or Grimus, firſt made a breach in it after the retreat of the Romans out of Britain. The firſt barrier erected by the Romans was the chain of forts made by Agricola[*] from the frith of Forth to that of Clyde, in the year 81, to protect his conqueſts from the inroads of the Caledonians. The ſecond was the vallum, or dyke, flung up by Adrian[†] in the year 121. It terminated on the weſtern ſide of the kingdom, at *Axelodunum*, or *Brugh*, on the Solway ſands; and was ſuppoſed to have reached no further than *Pons Ælii*, or *Newcaſtle*, on the eaſtern. But from an inſcription lately diſcovered, it appears to have extended as far as the wall of Severus.[‡] This rampart of Adrian's was ſituated much further ſouth than Agricola's chain; the country to the north having been either, according to ſome authors, recovered by the native Britons after the departure of Agricola; or, according to others, voluntarily ſlighted by Adrian. However, this work of Adrian's did not long continue to be the extreme boundary of the Roman territories to the north in Britain. For Antoninus Pius, the adopted ſon and immediate ſucceſſor of Adrian, having, by his lieutenant Lollius Urbicus, recovered the country once conquered by Agricola, commanded another rampart to be erected between the friths of Forth and Clyde, in the tract where Agricola had formerly built his chain of forts. The great number of inſcriptions which have been found in or near the ruins of this wall, or rampart to the honour of Antoninus Pius, leave us no room to doubt its having been built by his direction and command. If the fragment of a Roman pillar with an inſcription, now in the college library of Edinburgh, belonged to this work, as it is generally ſuppoſed to have done, it fixes the date of its execution to the third conſulſhip of Antoninus, which was A. D. 140, only 20 years after that of Adrian, of which this ſeems to have been an imitation. This wall or rampart, as ſome imagine, reached from Caer-ridden on the frith of Forth to Old Kirkpatrick on the Clyde; or, as others think, from Kinniel on the eaſt to Dunglaſs on the weſt. Theſe different ſuppoſitions hardly make a mile of difference in the length of this work, which, from ſeveral actual menſurations, appears to have been 37 Engliſh or 40 Roman miles. Capitolinus, in his life of Antoninus Pius, directly affirms, that the wall which that emperor built in Britain was of turf. This in the main is unqueſtionably true; though it is evident (from the veſtiges of it ſtill remaining, which not very many years ago were dug up and examined for near a mile together) that the foundation was of ſtone. Mr Camden alſo tells us, from the papers of one Mr Anthony Pont, that the principal rampart was faced with ſquare ſtone, to prevent the earth from falling into the ditch. The chief parts of this work were as follows: 1. A broad and deep ditch, whoſe dimenſions cannot now be diſcovered with certainty and exactneſs, tho' Mr Pont ſays it was 12 feet wide. 2. The principal wall or rampart was about 12 feet thick at the foundation, but its original height cannot now be determined. This wall was ſituated on the ſouth brink of the ditch. 3. A military way on the ſouth ſide of the principal wall, well paved, and raiſed a little above the level of the ground. This work, as well as that of Adrian, was defended by garriſons placed in forts and ſtations along the line of it. The number of theſe forts or ſtations, whoſe veſtiges were viſible in Mr Pont's time, were 18, ſituated at about the diſtance of two miles from each other. In the intervals between the forts, there were turrets or watch-towers. But the number of theſe, and their diſtance from each other, cannot now be diſcovered.

It is not a little ſurpriſing, that though it is now more than 1600 years ſince this work was finiſhed, and more than 1300 ſince it was ſlighted, we can yet diſcover, from authentic monuments, which are ſtill remaining, by what particular bodies of Roman troops almoſt every part of it was executed. This diſcovery is made from inſcriptions upon ſtones, which were originally built into the face of the wall, and have been found in or near its ruins, and are carefully preſerved. The number of ſtones with inſcriptions of this kind now extant, is 11: of which ſix may be ſeen at one view

[*] See *Agricola.*

[†] See *Adrian.*

[‡] See *Severus.*

in the college of Glaſgow, one in the college of Aberdeen, one in the college of Edinburgh, one in the collection of Baron Clerk, one at Cochnoch-houſe, and one at Calder-houſe. From theſe inſcriptions it appears in general, that this great work was executed by the ſecond legion, the vexillations of the ſixth legion and of the twentieth legion, and one cohort of auxiliaries. If theſe corps were all complete, they would make in all a body of 7800 men. Some of theſe inſcriptions have ſuffered greatly by the injuries of time and other accidents; ſo that we cannot diſcover from them with abſolute certainty, how many paces of this work were executed by each of theſe bodies of troops. The ſum of the certain and probable information contained in theſe inſcriptions, as it is collected by the learned and illuſtrious Mr Horſley, ſtands thus:

	Paces.
The ſecond legion built - -	11,603
The vexillation of the ſixth legion -	7,411
The vexillation of the twentieth legion -	7,801
All certain - -	26,815
The vexillation of the twentieth legion, the monuments certain, and the number probable	3,411
The ſame vexillation, on a plain monument, no number viſible, ſuppoſed - -	3,500
The ſixth legion, a monument, but no number, ſuppoſed - - -	3,000
Cohors prima Cugernorum - -	3,000
Total	39,726

or 39 miles 726 paces, nearly the whole length of the wall. It would have been both uſeful and agreeable to have known how long time theſe troops were employed in the execution of this great work. But of this we have no information. Neither do we know what particular bodies of troops were in garriſon in the ſeveral forts and ſtations along the line of this wall, becauſe theſe garriſons were withdrawn before the *Notitia Imperii* was written.

Though we cannot diſcover exactly how many years this wall of the emperor Antoninus continued to be the boundary of the Roman territories in Britain, yet we know with certainty that it was not very long. For we are told by an author of undoubted credit, that, Dio. l 72. p. 820. in the reign of Commodus, A. D. 180, "he had wars with ſeveral foreign nations, but none ſo dangerous as that of Britain. For the people of the iſland, having paſſed the wall which divided them from the Romans, attacked them, and cut them in pieces."

ANTONIO (Nicholas), knight of the order of St James and canon of Seville, did great honour to the Spaniſh nation by his Bibliotheque of their writers. He was born at Seville in 1617, being the ſon of a gentleman whom king Philip IV. made preſident of the admiralty eſtabliſhed in that city in 1626. After having gone through a courſe of philoſophy and divinity in his own country, he went to ſtudy law at Salamanca; where he cloſely attended the lectures of Franciſco Ramos del Manzano, afterwards counſellor to the king and preceptor to Charles II. Upon his return to Seville, after he had finiſhed his law-ſtudies at Salamanca, he ſhut himſelf up in the royal monaſtery of Benedictines, where he employed himſelf ſeveral years in writing his *Bibliotheca Hiſpanica,* having the uſe of the books of Bennet de la Sana abbot of that monaſtery and dean of the faculty of divinity at Salamanca. In the year 1659, he was ſent to Rome by king Philip IV. in the character of agent-general from this prince: he had alſo particular commiſſions from the inquiſition of Spain, the viceroys of Naples and Sicily, and the governor of Milan, to negociate their affairs at Rome. The cardinal of Arragon procured him, from Pope Alexander VII. a canonry in the church of Seville, the income whereof he employed in charity and purchaſing of books: he had above 30,000 volumes in his library. By this help, joined to continual labour and indefatigable application, he was at laſt enabled to finiſh his Bibliotheca Hiſpanica, in four volumes in folio, two of which he publiſhed at Rome in the year 1672. The work conſiſts of two parts; the one containing the Spaniſh writers who flouriſhed before the 15th century, and the other thoſe ſince the end of that century. After the publication of theſe two volumes, he was recalled to Madrid by king Charles II. to take upon him the office of counſellor to the cruſade; which he diſcharged with great integrity till his death, which happened in 1684. He left nothing at his death but his vaſt library, which he had brought from Rome to Madrid; and his two brothers and nephews being unable to publiſh the remaining volumes of his Bibliotheca, ſent them to Cardinal d'Aguiſne, who paid the charge of the impreſſion, and committed the care thereof to Monſieur Marti, his librarian, who added notes to them in the name of the Cardinal.

Antonio (St), one of the Cape de Verd iſlands, lying in E. Long. 0. 26. N. Lat. 18. 10. It is ſeparated from St Vincent's by a clear navigable channel two leagues in breadth. On the north ſide, it has a good road for ſhipping, with a collection of freſh water riſing from ſprings, which, however, ſcarcely merits the name of a pond. The iſland ſtretches from north-eaſt to ſouth-weſt, and is filled with mountains; one of which is of ſo extraordinary a height, as to be compared with the Peak of Teneriffe: Its top is conſtantly covered with ſnow, and, notwithſtanding the clearneſs of the ſky, is generally hid in clouds. Here are produced a variety of fruits; oranges, lemons, palms, melons, &c. and ſome ſugar-canes. The potatoes and melons are particularly excellent, and are much ſought after by mariners. But, notwithſtanding all this plenty, the inhabitants live in the moſt wretched poverty. They are in number about 500, chiefly negroes, under the protection of the Portugueſe, whoſe language they ſpeak, and imitate their manners. To the north-weſt ſtands a village, containing about 20 huts, and at leaſt 50 families, under the direction of a governor, or, as they call him, a *captain,* a prieſt, and a ſchoolmaſter.

Antonio (St), a Dutch fort in Axim, on the gold coaſt of Africa. It ſtands on a high rock, which projects into the ſea in form of a peninſula; and is ſo environed by rocks and dangerous ſhoals, as to be inacceſſible to an enemy but by land, where it is fortified by a parapet, draw-bridge, and two batteries of heavy canon. Beſides this it has a battery towards the ſea. The three batteries conſiſt of 24 canon. Its form is triangular; the building is neat, ſtrong, and commodious for the extent, that being but ſmall, on account of the narrowneſs of the rock on which it is built. The garriſon is uſually compoſed of 25 white men, and an equal number of negroes, under the command of a ſerjeant.

Antonius.

jeant. It is maintained at the expence of the Weſt-India Company; and, when well ſtored with proviſions, is capable of making a long defence againſt any number of negroes. It is, however, as well as all other forts on this coaſt, liable to inconveniences from the heavy and continual rains, which damage the walls, and render frequent reparations neceſſary. This obliges the Dutch always to keep ready a quantity of lime or cement made of calcined oyſter-ſhells, of which the coaſt produces great numbers.—This ſettlement was firſt founded by the Portugueſe during the reign of Emanual. They fixed at firſt upon a ſmall point; where, finding themſelves inſecure, they built the fort where it now ſtands. They were driven out by the Dutch in 1642; and, upon the concluſion of a peace with the States-general, the fort remained by treaty in the hands of the Dutch Weſt-India Company, who have kept poſſeſſion of it ever ſince.

ANTONIUS (Marcus), a famous Roman orator. While he filled the office of prætor, Sicily fell to his lot, and he cleared the ſeas of the pirates which infeſted that coaſt. He was made conſul with A. Poſthumius Albinus, in the year of Rome 653; when he oppoſed the turbulent deſigns of Sextus Titus, tribune of the people, with great reſolution and ſucceſs. Some time after, he was made governor of Cilicia, in quality of proconſul; where he performed ſo many great exploits, that he obtained the honour of a triumph. We cannot omit obſerving, that, in order to improve his great talent for eloquence, he became a ſcholar to the greateſt men at Rhodes and Athens, in his way to Cilicia, and when on his return to Rome. Soon after he was appointed cenſor; which office he diſcharged with great reputation, having carried his cauſe before the people, againſt Marcus Duronius, who had preferred an accuſation of bribery againſt him, in revenge for Antonius's having eraſed his name out of the liſt of ſenators, which this wiſe cenſor had done, becauſe Duronious, when tribune of the people, had abrogated a law which reſtrained immoderate expence in feaſts. He was one of the greateſt orators ever known at Rome; and it was owing to him, according to the teſtimony of Cicero, that Rome might boaſt herſelf a rival even to Greece itſelf in the art of eloquence. He defended, amongſt many others, Marcus Aquilius; and moved the judges in ſo ſenſible a manner, by the tears he ſhed, and the ſcars he ſhowed upon the breaſt of his client, that he carried his cauſe. He never would publiſh any of his pleadings, that he might not, as he ſaid, be proved to ſay in one cauſe, what might be contrary to what he ſhould advance in another. He affected to be a man of no learning. His modeſty, and many other qualifications, rendered him no leſs dear to many perſons of diſtinction, than his eloquence made him univerſally admired. He was unfortunately killed during thoſe bloody confuſions raiſed at Rome by Marius and Cinna. He was diſcovered in the place where he hid himſelf, and ſoldiers were ſent to diſpatch him; but his manner of addreſſig them had ſuch an effect, that none but he who commanded them, and had not heard his diſcourſe, had the cruelty to kill him. His head was expoſed before the roſtra, a place which he had adorned with his triumphal ſpoils. This happened 90 years before the Chriſtian æra.

ANTONIUS (Marcus) the triumvir, grandſon to the former, was very handſome in his youth; for which reaſon he was greatly beloved by Curio a ſenator, who, by carrying him about in all his debaucheries, made him contract ſuch heavy debts, that his own father forbad him his houſe. Curio, however, was ſo generous as to bail him for 250 talents. When the civil war broke out, Curio took Cæſar's party, and prevailed with Antonius to do the ſame; for which he was made a tribune of the people, and in that office did Cæſar great ſervice. Cæſar, having made himſelf maſter of Rome, gave Antonius the government of Italy: at the battle of Pharſalia, Cæſar confided ſo much in him, that he gave him the command of the left wing of his army, whilſt he himſelf led the right. After Cæſar was made dictator, he made Antonius general of the horſe, though he had never been prætor; in which command he exerted his power with the utmoſt violence. He was made conſul, when Cæſar enjoyed that honour for the fifth time, the laſt year of that uſurper's life. On Cæſar's death he harrangued the populace with great art, and raiſed their fury againſt his murderers; flattering himſelf that he ſhould eaſily get into the place which Cæſar had filled: but his haughty behaviour made him loſe all the advantages his affected concern for Cæſar had gained him. His ill treatment of Octavius, and quarrel with him, produced another civil war; which ended in an accommodation between him, Octavius, and Lepidus, fatal to the peace of Rome. They agreed to ſhare the ſupreme power among them; and many of the moſt illuſtrious Romans were ſacrificed by proſcription to cement this bloody league, which is known by the name of the *Second Triumvirate*. But the triumvirs were too ambitious, and hated one another too much, to be long united. Antonius went into Aſia to raiſe money for his ſoldiers: during his abſence, Fulvia his wife quarrelled with Octavius. When Antonius was in Aſia, indulging himſelf in all manner of luxury, the famous Cleopatra inſpired him with the moſt violent paſſion. Hearing of the quarrel between Fulvia and Octavius, and finding Octavius was become publicly his enemy, Antonius entered into a confederacy with Sextus Pompeius, who was ſtill maſter of Sicily. He then went into Italy, in order to fight Octavius; but Fulvia, who had been the author and promoter of this war, dying, Octavius and Antonius came to an agreement. One of the conditions of this new peace was, that they ſhould together attack Pompey, though the former had lately made an alliance with him. Antonius then married Octavia, ſiſter to Octavius, as a pledge of their renewed friendſhip; but returned ſoon after to his beloved Cleopatra, and again lived with her in Alexandria. Octavius took hold of this pretence to inveigh againſt him, and begin the war again. At laſt they engaged in a ſea-fight at Actium, in which Octavius gained a complete victory; which was followed by the deaths both of Antonius and Cleopatra. The infatuated Antonius fell upon his own ſword; and Cleopatra ſtung herſelf to death with an aſp, as was ſuppoſed, to avoid gracing the victor's triumph at Rome.

Antonius, Antonomaſia.

ANTONOMASIA, a form of ſpeech, in which, for a proper name, is put the name of ſome dignity, office, profeſſion, ſcience, or trade; or when a proper name is put in the room of an appellative. Thus a king is called his *majeſty*; a nobleman, his *lordſhip*. We ſay the *philoſopher* inſtead of Ariſtotle, and the *ora-*

tor for Cicero: Thus a man is called by the name of his country, a *German*, an *Italian*; and a grave man is called a *Cato*, and a wiſe man a *Solomon*.

ANTOSIANDRIANS, a ſect of rigid Lutherans, who oppoſe the doctrine of Oſiander relating to juſtification. Theſe are otherwiſe denominated *Oſiandromaſtiges*.—The Antoſiandrians deny that man is made juſt, with that juſtice wherewith God himſelf is juſt; that is, they aſſert, that he is not made eſſentially, but only imputatively, juſt; or, that he is not really made juſt, but only pronounced ſo.

ANTRIM, the moſt northerly county of Ireland. It is bounded by that of Down on the ſouth-eaſt, that of Londonderry on the weſt, from which it is ſeparated by the river Bann, part of Armagh on the ſouth, St George's channel on the eaſt, and the Deucaledonian ocean on the north. Its greateſt length is about 46 miles, its greateſt breadth about 27; and the number of acres it contains, plantation-meaſure, are computed at 383,000. Though the country is much incumbered with bogs and marſhes, yet it enjoys a pretty good air, and is well peopled, chiefly with proteſtants. Where it is free from bogs the ſoil is fruitful. It ſends two members for the ſhire, and two for each of the following towns, viz. Liſburn, Belfaſt, Antrim, and Randalſtown.

Certain narrow valleys, called *glyns*, beginning here, and running a great way along the coaſt, belonged formerly to the Biſſets, noblemen of Scotland, who having been obliged to quit that country for having aſſaſſinated Patrick earl of Athol upon a private quarrel, came hither, and had a great eſtate beſtowed upon them by Henry III. of England; of which, in the reign of Edward II. a part was forfeited by the rebellion of Hugh, then chief of the family. Another tract near this, called the *Rowte*, belonged anciently to the Macguillers, but now to the M'Donnels earls of Antrim.

Upon the coaſt of this country are the promontories called by Ptolemy, *Robogdium*, *Vennicinium*, and *Boræum*, now *Fair Foreland*, *Ramſhead*, and *St Helen's-head*. The river alſo, ſtyled by the ſame author *Vidua*, and now *Crodagh*, runs through this county.—Here alſo is the remarkable natural curioſity called the *GIANT's-Cauſeway*; for a particular deſcription of which ſee that article.

ANTRIM, the capital town of the county of Antrim, in Ireland, ſeated at the north end of the lake Lough-Neagh, about ſix miles from the mouth of the bay, having a good road before it, with a pier near the place, within which veſſels lie dry at low water. It was anciently a borough of great conſequence, as appears from the mayor's being admiral of a conſiderable extent of coaſt, as well in Down as in this county; the corporation enjoying the cuſtoms paid by all veſſels within thoſe bounds, the creeks of Bangor and Belfaſt only excepted. This grant, however, the crown repurchaſed, and thereupon transferred the cuſtom-houſe to Belfaſt, to which town it is now much inferior as well in ſize as in trade. It is, however, ſtill a place of note, and ſends two members to the houſe of commons. It gives the title of *earl* to the noble family of M'Donnell.—At Antrim is a ſeat, with noble demeſnes, and beautiful and highly cultivated lands, of the Earl of Maſſareene.—It is but a poor place, 13 miles weſt of Carrickfergus. W. Long. 6. 26. N. Lat. 54. 45. It ſends two members to parliament.

ANTRUM, among anatomiſts, a term uſed to denote ſeveral cavities of the body: as the *antrum highmorianum*, or that in the maxillary or jaw bone; *antrum pylori*, or that at the bottom of the pylorus, &c.

ANTWERP, a city of the duchy of Brabant, in the Auſtrian Netherlands, capital of the marquiſate of Antwerp, otherwiſe called the *marquiſate of the holy Roman empire*, ſituated in E. Long. 4. 15. N. Lat. 51. 12. It lies in a low marſhy ground on the Scheld. 24 miles from Bruſſels to the north. It is the third city in rank in Brabant, large and well built, containing 22 ſquares, and above 200 ſtreets, all ſtraight and broad, eſpecially that called the *Mere*, in which ſix coaches can go abreaſt. Moſt of the houſes are of free-ſtone, and have an air of antiquity, being high, with courts before and gardens behind. At the head of the Mere is a crucifix of braſs thirty-three feet high. The cathedral dedicated to the Virgin Mary, the ſtadt-houſe, and the exchange, are magnificent ſtructures: the latter is the firſt building of that kind in Europe, and on its model the exchanges of London and Amſterdam are built. Its pillars are all of blue marble, and carved, but all in a different manner. The exchange coſt the city 300,000 crowns. Antwerp, towards the end of the fifteenth century, was one of the moſt celebrated towns that ever exiſted. The Scheld, on which it ſtands, being 20 feet at low water, and riſing 20 feet more at flood, ſhips of the greateſt burden came up to the keys, as in the river Thames at London; but when the United Provinces formed themſelves into a free ſtate, after having ſhaken off the yoke of Spain, they got the entire command of the navigation of the Scheld; which ruined the trade of Antwerp, and transferred it to Amſterdam. This made the inhabitants turn their heads to painting, jewelling, and banking, which they have continued to this day with great ſucceſs and reputation: for at Antwerp bills of exchange may be negociated for any ſum to any part of Europe; and in the time of Queen Anne's wars, two brothers of the name of De Koning, paid the one the army of France, and the other that of the confederates. Beſides, here is a fine manufacture of tapeſtry and lace; and, for the promoting of trade, an inſurance-company has been erected. This city is the ſee of a biſhop, who, as abbot of St Bernard, is the ſecond prelate in Brabant. The biſhopric is of great extent, and the cathedral a moſt noble pile, with one of the fineſt ſteeples in the world. The emperor Charles V. when he made his entry into Antwerp, ſaid it ought to be put in a caſe, and ſhowed only once a-year for a rarity. The houſe of the hanſe-towns, built when the city was in its flouriſhing condition, is a ſtately building, with magazines above for dry goods, and cellars below for wet, and in the middle ſtory were 300 lodging-rooms for merchants; but now it is turned to a horſe-barrack. There is a market here called the *Friday's market*, becauſe it is held every Friday, where all ſorts of houſehold goods, pictures, and jewels, are ſold by auction. No city in the Netherlands has ſo many and ſo fine churches as this. Many of them, particularly the cathedral and Jeſuits church, are adorned with paintings, by Sir Peter Paul Rubens, who was a native of this city; and by Quintin Maſſeys, who is ſaid to have been a blackſmith; but having fallen in love with a painter's daughter, and been told by her father, when he aſked her of him in marriage, that he would have none but a painter for his ſon-in-law, he went to Italy to ſtudy painting, and, in a few years, returned ſo eminent in his new profeſſion, that he found no difficulty in obtaining the father's conſent. He is interred at the entry of the cathedral, where his effigy is put up, with an inſcription, ſignifying, that conjugal love made an Apelles of a blackſmith. The abovementioned Jeſuits church is extremely magnificent, and the chapel of the Virgin, joining to it, ſtill more ſo. Among the cloiſters the moſt remarkable are, the noble and rich abbey of St Michael, on the banks of the Scheld, the apartments of which are truly royal, and in which all ſovereign princes that paſs this way actually lodge; and the Engliſh nunnery, of the order of St Tereſa, the nuns of which never wear linen, nor eat fleſh, and lie upon ſtraw: the grates of the convent are ſo diſmal, that it looks like a priſon. As to the fortifications of the city, it is environed with a fine wall, planted with rows of trees on each ſide, with walks between broad enough for two coaches to go abreaſt, being alſo defended by a very ſtrong, large, regular citadel, in form of a pentagon, erected by the Duke of Alva in 1568, which commands the town and the neighbouring country. The magiſtracy of this city is choſen only out of the ſeven patrician families; and conſiſts of two burgomaſters and 18 echevins, beſides inferior magiſtrates. Among the privileges granted to it by its princes, there is one by which every perſon born in it is a citizen, though both his father and mother were foreigners.

In 1585, Antwerp underwent a remarkable ſiege by the Duke of Parma. It was then the moſt wealthy city in the Netherlands, and had long been the object of his deſigns; but the difficulties attending the enterprize obliged him to poſtpone it for a conſiderable time. In order to ſucceed, it was neceſſary to cut off the communication of the city with Holland, Ghent, and all places above and below Antwerp on the Scheld. To effect this, he laid ſiege to Liſkenſhouk and Tillo, places of the utmoſt conſequence to the ſecurity and commerce of the city: both were obſtinately defended; and the ſiege of the latter was raiſed, after it had been carried on for three months: however, the Duke gained ſeveral other poſts on the river, where he built forts, and greatly annoyed the ſhipping and trade of the city. He next laid ſiege to Dendermonde, in order to cut off the communication with Ghent, in which he ſucceeded by the reduction of the town. His next attempt was on Vilvorde: this place he took by aſſault, and thereby cut off the communication with Bruſſels. Finding, however, this method of hemming in the city tedious, and ineffectual while an opening to the mouth of the river remained, he formed a deſign of building a bridge acroſs the Scheld, the extremities of which were to be defended by ſtrong forts and out-works. He began with collecting great quantities of wood at Callo and fort St Philip, where he intended the bridge ſhould be built; but his project was for ſome time retarded by the Antwerpers, who broke down the dykes, overflowed the whole country, and carried of his magazines by the inundation. Not diſcouraged by this loſs, he applied himſelf diligently to repair it, and with incredible expedition cut a canal from Steken to Callo, by which he carried off the waters. He then ſet to work upon the bridge, and finiſhed it in ſeven months, without any interruption from the Zealanders. During the building of this bridge, Aldegonde, governor of Antwerp, propoſed to build a fort on Couvenſteyn dyke, in order to ſecure that important poſt, and then breaking down the dyke when the bridge was near finiſhed: but he was violently oppoſed by certain citizens, who apprehended that their lands and villas would be deſtroyed by the inundation. This unſeaſonable oppoſition, with the negligence of the magiſtrates, who, becauſe the markets were high, had not laid in a ſufficient ſtock of corn, occaſioned the loſs of the city. However, in deſpite of all the Duke of Parma's precautions, the Zealanders found means to throw in a convoy of corn; but the citizens, knowing they would not run the riſk of carrying it back again, ſo cheapened the price, that theſe bold traders refuſed ever to bring their goods again to ſo bad a market. The Antwerpers, having thus through avarice brought on their ruin, began in a ſhort time to ſuffer by famine; they then preſſed the Zealanders to attempt ſomething for their relief, but it was now too late. While the magiſtrates were deliberating on ſome means for deſtroying the bridge, which they might have prevented from being ever completed, one Ginebelli, a Mantuan engineer, offered his ſervices, undertaking at a certain expence to blow it into the air. Even in this extremity the expence was grudged: but neceſſity at laſt overcame this obſtacle; Ginebelli was furniſhed with two large veſſels, a number of ſmall boats, and every thing neceſſary. He formed the two large veſſels into fire-ſhips, which he ſet adrift with the ſtream, deceiving the enemy by means of falſe fires lighted up in the fleet of ſmall boats. The train of one of the fire-ſhips was expended before the time expected, and ſhe blew up with a terrible exploſion, but with little damage to the bridge. The other was more ſucceſsful, carrying off all the outworks, ſetting fire to the whole bridge, and burying above 500 ſoldiers in the ruins it made. The fire, however, was ſoon extinguiſhed, and the bridge repaired by the Duke of Parma, while the Antwerpers were prevented by avarice from repeating the experiment; ſo that they were ſoon reduced to the greateſt ſtraits, and obliged to ſurrender. It is ſaid that the city of Amſterdam had obſtructed every meaſure for the relief of Antwerp, hoping to profit by its deſtruction. It was not doubted but the Proteſtants would forſake it as ſoon as it fell into the hands of an arbitrary Catholic prince; and this conjecture was ſoon fulfilled by the removal of many families with their effects to Amſterdam.—After the battle of Ramillies, the city of Antwerp ſurrendered to the Duke of Marlborough. It was taken by the French in 1746, but reſtored to the houſe of Auſtria at the treaty of Aix-la-Chapelle.

ANUBIS, a ſymbolical deity of the Egyptians, was regarded as the faithful companion of Oſiris and of Iſis. Temples and prieſts were conſecrated to him, and his image was borne in all religious cerimonies.

Cynopolis, the preſent Minich, ſituated in the lower Thebais, was built in honour of Anubis. The temple wherein he was worſhipped no longer ſubſiſts. The prieſts celebrated his feſtivals there with great pomp, and conſecrated the dog to him as his living repreſentation. "Anubis (ſays Strabo) is the city of dogs, the captal of the Cynopolitan prefecture. Theſe animals are fed there on ſacred aliments, and religion has decreed them a worſhip." An event, however, related by Plutarch, brought them into conſiderable diſcredit with the people. Cambyſes having ſlain the god Apis, and thrown his body into a field, all animals reſpected it except the dogs, which alone eat of his fleſh. This impiety diminiſhed the popular veneration for them.

Cynopolis was not the only city which burned incenſe on the altars of Anubis. He had chapels in almoſt all the temples. On ſolemnities, his image always accompanied thoſe of Iſis and Oſiris. Rome having adopted the ceremonies of Egypt, the emperor Commodus, to celebrate the Iſiac feaſts, ſhaved his head, and himſelf carried the god Anubis. The ſtatue of this god was either of maſſive gold or gilt, as well as the attributes that accompanied them. Anubis ſignifies *gilded*. The denomination was myſterious; and the Egyptian prieſts, it would ſeem, had not given it without reaſon.

The ſignification of this emblematical deity is thus explained by Plutarch: "The circle which touches and ſeparates the two hemiſpheres, and which is the cauſe of this diviſion, receiving the name of *horizon*, is called *Anubis*. He is repreſented under the form of a dog, becauſe that animal watches day and night." St Clemens of Alexandria, who was well informed in the myſtic theology of the Egyptians, favours this explication. The two dogs, ſays he, (the two Anubis) are the ſymbols of two hemiſpheres which environ the terreſtial globe. He adds in another place: Others pretend that theſe animals, the faithful guardians of men, indicate the tropics, which guard the ſun on the ſouth and on the north like porters.

According to the former of theſe interpretations, the prieſts, regarding Anubis as the horizon, gilded his ſtatue; to mark, that this circle, receiving the firſt rays of the ſun, appears ſparkling with brightneſs on his riſing, and that at his ſetting he reflects his laſt rays upon the earth. They ſaid in their ſacred fables, that Anubis was the ſon of Oſiris, but illegitimate. In fact, he only gives to the earth a borrowed light; and cannot be eſteemed, like Horus, as the father of the day, or as the legitimate offspring of Oſiris. It may be added that the viſible horizon turning with the ſun, is his inſeparable companion.

In the latter of theſe explications, where Anubis repreſents the tropics, he is alſo the faithful guardian of Iſis and Oſiris. In fact, the courſe of the ſun and of the moon is contained between the circles wherein the ſolſtices are performed. They neither deviate to the right nor left. Theſe limits aſſigned by the Author of nature might therefore, in hieroglyphic language, be repreſented by a divinity with the head of a dog, who ſeemed to oppoſe their paſſage on the ſide of the two poles The other opinion, notwithſtanding, ſeems more natural, and to be more analogous to the ideas of the prieſts.

Upon the whole, it is reaſonable to imagine, that Anubis at firſt was only a ſymbolical image, invented by aſtronomers to give a ſenſible expreſſion of their diſcoveries; that afterwards, the people, accuſtomed to ſee it in their temples, which were the depoſitaries of ſcience, adored it as a deity; and that the prieſts favoured their ignorance by connecting it with their religion. The worſhip of Anubis introduced, that of the dog became his emblem. Almoſt all the gods of the Gentiles have originated in this manner.

ANUS, in anatomy, the lower extremity of the inteſtinum rectum, or orifice of the fundament.

ANVIL, a ſmith's utenſil, ſerving to place the work on to be hammered or forged. The face or uppermoſt ſurface of the anvil, muſt be very flat, and ſmooth, without flaws, and ſo hard that a file will not touch it. At one end there is ſometimes a pike, bickern, or beak-iron, for the rounding of hollow work. The whole is uſually mounted on a firm wooden block. Forged anvils are better than thoſe of caſt work, and the beſt have the upper part made of ſteel. Lockſmiths have a ſmaller kind of anvil called the *ſtake*, which is moveable, and placed ordinarily on their work-bench. Its uſe is for ſetting ſmall cold work ſtraight, or to cut or punch on with the cold chiſſel or cold punch.

ANXUR, (anc. geog.), a city of the Volſci, in Latium; called *Tarracina*, by the Greeks and Latins; Now *Terracina*; ſituated on an eminence (Livy, Horace, Sil. Italicus). *Anxuras*, a citizen of Anxur (Livy). And the epithet *Anxurus*, a name of Jupiter, worſhipped without a beard at Anxur (Virgil). Though others read *Axurus*, or *Axyrus*, without a razor. E. Long. 14. 5. Lat. 41. 18.

AONIDES, in mythology, one of the many appellations of the muſes; ſo called from Aonia, a part of ancient Bœotia.

AORASIA, in antiquity, the inviſibility of the gods. The word is Greek, αορασια, and derived from α, priv. and οραω, to ſee. The opinion of the ancients with regard to the appearance of the gods to men, was, that they never ſhowed themſelves face to face, but were known from their backs as they withdrew. Neptune aſſumed the form of Calchas to ſpeak to the two Ajaxes; but they knew him not till he turned his back to leave them, and diſcovered the god by his majeſtic ſtep as he went from them. Venus appeared to Æneas in the character of a huntreſs: but her ſon knew her not, till ſhe departed from him; her divinity was then betrayed by her radiant head, her flowing robe, and her majeſtic pace.

AORIST, among grammarians, a tenſe peculiar to the Greek language, comprehending all the tenſes; or rather, expreſſing an action in an indeterminate manner, without any regard to paſt, preſent, or future.

AORISTIA, in the ſceptic philoſophy, denotes that ſtate of the mind wherein we neither aſſert nor deny any thing poſitively, but only ſpeak of things as ſeeming or appearing to us in ſuch a manner. The aoriſtia is one of the great points or terms of ſcepticiſm, to which the philoſophers of that denomination had continual recourſe by way of explication, or ſubterfuge. Their adverſaries, the Dogmatiſts, charged them with dogmatizing, and aſſerting the principles and poſitions of their ſect to be true and certain.

AORNUS, a very high rock of India, having its name from its extraordinary height, as being above the flight of a bird. Its circuit was about 25 miles, its height 11 furlongs, and the way leading up to the top artificial and narrow. At the bottom, on one ſide, ran the river Indus: on the top was a fine plain, part of which was covered with a thick wood; the reſt arable land, with a fountain furniſhing abundance of excellent water. This rock was taken by Alexander the Great, in whoſe time there was a report that Hercules had attempted it in vain; however, according to Arrian, this report was without foundation. It is probable indeed, that it was raiſed after the place was taken, in order to magnify Alexander's exploit. While the Macedonian monarch was preparing all things neceſſary for the ſiege, an old man with his two ſons, who had long lived in a cave near the ſummit, came and offered to ſhow him a private way of aſcending. This being readily accepted, Ptolemy, with a conſiderable body of light-armed troops, was diſpatched with them, with orders in caſe they ſucceeded, to entrench themſelves ſtrongly upon the rock, in the wood to which the old man was to direct them, before they ventured to attack the Indians. Ptolemy exactly executed his orders; and gave notice, by a lighted torch ſet upon a pole, that he had got ſafely up. Upon this, Alexander gave immediate orders for a body of troops to attempt the paſſage by which the rock was commonly aſcended; but they were repulſed with great ſlaughter. He then ſent an Indian with letters to Ptolemy, deſiring him, the next time an attack was made by the common way, to fall upon the enemy behind. But in the mean time, thoſe who defended the rock attacked Ptolemy with great vigour; but were at laſt repulſed, though with much difficulty: but the next day, when Alexander renewed the attack, though Ptolemy attacked the Indians in the rear, the Macedonians were repulſed on both ſides. At laſt the king, perceiving that the ſtrength of the Indians lay in the ſtraitneſs and declivity of the way by which they were attacked, cauſed a great quantity of trees to be felled, and with them filled the cavities between the plain on which the Indians were encamped and the higheſt of his own advanced poſts. The Indians at firſt derided his undertaking; but at length perceiving the ardour with which the work was carried on, and having felt the effects of the miſſile weapons of the Macedonians, they ſent deputies to propoſe terms of capitulation. Alexander, ſuſpecting that their deſign was only to amuſe him till they made their eſcape, withdrew his guards from the avenues. As ſoon as he knew the Indians were deſcended, he, with 700 of Ptolemy's light-armed foot, took poſſeſſion of the deſerted rock, and then made a ſignal for his forces to fall upon the flying Indians. They ſetting up a loud ſhout, ſo terrified the fugitives, that numbers of them fell from the rocks and precipices, and were daſhed to pieces, while the greateſt part of the remainder were cut off in the roads.

AORTA, in anatomy, the great artery which riſes immediately from the left ventricle of the heart, and is from thence diſtributed to all parts of the body. It is divided into two grand trunks, diſtinguiſhed by the epithets *aſcending* and *deſcendiug*. See ANATOMY.

AOUSTA, or AOST, a town of Italy, in Piedmont, and capital of the duchy of the ſame name, a biſhop's ſee, and ſubject to the king of Sardinia. It is remarkable for ſeveral monuments of the Romans, and for the birth of Anſelm archbiſhop of Canterbury. It is ſeated at the foot of the Alps, on the river Doria. E. Long. 7. 33. N. Lat. 45. 38.

AOUSTA, a territory of Piedmont, with the title of a duchy. It is a valley 30 miles in length, and extends from the paſs of St. Martin's, near the frontiers of Yvree, to St. Bernard. It abounds in paſtures, and all ſorts of fruits; the capital is of the ſame name.

AOUTA, the name of the paper-mulberry tree at Otaheite, in the South Sea, from which a cloth is manufactured, that is worn by the principal inhabitants. See the article BARK.

APACHES, a people of New Mexico, in North America. They are brave, reſolute, and warlike, fond of liberty, and the inveterate enemies of tyranny and oppreſſion. Of this diſpoſition the Spaniards had fatal experience towards the end of the laſt century, when they revolted againſt the Catholic king, maſſacred ſeveral of his officers, and committed the greateſt devaſtations. Ever ſince they have remained the allies, not the ſubjects, of the Spaniards; and the viceroy of Mexico has been obliged to maintain a more formidable garriſon, and a greater number of troops.

APÆDUSIA, denotes ignorance or unſkilfulneſs in what relates to learning and the ſciences. Hence alſo perſons uninſtructed and illiterate are called *Apædeutæ*. The term *Apædeutæ* was particularly uſed among the French in the time of Huet; when the men of wit at Paris were divded into two factions, one called by way of reproach *apædeutæ*, and the other *eruditi*. The *apædeutæ* are repreſented by Huet, as perſons who, finding themſelves either incapable or unwilling to undergo a ſevere courſe of ſtudy in order to become truly learned, conſpired to decry learning, and turn the knowledge of antiquity into ridicule, thus making a merit of their own incapacity. The *apædeutæ* in effect were the men of pleaſure; the *eruditi* the men of ſtudy. The *apædeutæ* in every thing preferred the modern writers to the ancient, to ſuperſede the neceſſity of ſtudying the latter. The *eruditi* derided the moderns, and valued themſelves wholly on their acquaintance with the ancients.

APAGOGE, in logic. See ABDUCTION.

APAGOGE, in the Athenian law, the carrying a criminal taken in the fact to the magiſtrate. If the accuſer was not able to bring him to the magiſtrate, it was uſual to take the magiſtrate along with him to the houſe where the criminal lay concealed, or defended himſelf.

APAGOGE, in mathematics, is ſometimes uſed to denote a progreſs or paſſage from one propoſition to another; when the firſt having been once demonſtrated, is afterwards employed in the proving of others.

APAGOGICAL DEMONSTRATION, an indirect way of proof, by ſhowing the abſurdity of the contrary.

APALACHIAN MOUNTAINS, more properly called the *Allegany Mountains*, have their ſouthern beginning near the bay of Mexico, in the latitude of 30°, extending northerly in many broken ridges, running nearly parallel to the ſea to Hudſon's river, in the latitude of about 40°. North. A great part of theſe mountains is covered with rocks, ſome of which are of a ſtupendous height and bulk; the ſoil between them is generally black and ſandy, but in ſome places differently coloured, compoſed of pieces of broken rock and ſpar, of a glittering appearance, which ſeem to be indications of minerals and ores if proper ſearch was made for them. Cheſnuts and ſmall oaks are the trees that principally grow on theſe mountains, with ſome *Chinkapin** and other ſmall ſhrubs. The graſs is thin, mixed with vetch and ſmall peaſe; and in ſome places there is very little vegetable appearance.

* Fagus pumila. See *Fagus*.

The rocks of the Apalachian mountains ſeem to engroſs one-half of the ſurface. They are moſtly of a light grey colour: ſome are of a coarſe-grained marble like alabaſter; others, of a metallic luſtre: ſome pieces are in the form of ſlate, and brittle; others in lumps, and hard: and ſome appear with ſpangles, or covered over with innumerable ſmall ſhining ſpecks, like ſilver. Theſe frequently appear at the roots of trees when blown down. The different ſpars are found moſt on the higheſt and ſteepeſt parts of the hills, where there is little graſs and few trees; but the greateſt part of the ſoil between the rocks is generally a dark ſandy-coloured kind of mould, and ſhallow; yet fertile, and productive of good corn, which encourages the Tallipooſes, a clan of the Cherokee Indians, to ſettle among them in latitude 34°' and they are the only Indian nation that has a conſtant reſidence on theſe mountains.

APAMEA, or APAMIA, the name of ſeveral ancient cities.

1. One of Bithynia, formerly called *Myrlea*, from Myrlus, general of the Colophonians: deſtroyed by Philip, father of Perſeus; and given to his ally Pruſius, who rebuilt it, and called it *Apamea*, from the name of his queen Apama (Strabo). Stephanus ſays, that Nicomedus Epiphanes, ſon of Pruſius, called it after his mother; and that it had its ancient name from Myrlea, an Amazon. The Romans led a colony thither (Strabo); called *Colonea Apamena* (Pliny, Appian). The gentilitious name is *Apamæus*, and *Apamenus* (Trajan in a letter to Pliny).

2. Another *Apamea*, called *Cibotos*, of Phrygia, at ſome diſtance from the Meander (Agathodæmon); but by a coin of Tiberius on the Meander. The name is from Apame, mother of Antiochus Soter, the founder, and the daughter of Artabazus (Strabo). The riſe, or at leaſt the increaſe, of Apamea, was owing to the ruins of Celenæ. The inhabitants were called *Apamienſis*, and, though inland, were worſhippers of Neptune. The reaſon, it has been conjectured, was, that they had ſuffered often from earthquakes, of which he was ſuppoſed the author. Mithridites gave an hundred talents towards the reſtoration of the city, which, it is ſaid, had likewiſe been overthrown in the time of Alexander. Their tribute money was remitted to them for five years on the ſame account under the Emperor Tiberius. The ſubterraneous paſſage of the Lycus and the other ſtreams ſhowed that the ground had many cavities; and theſe, it has been ſurmiſed, rendered the region very liable to be ſhaken.

3. A third, on the confines of Parthia and Media, ſurnamed *Raphane* (Strabo, Pliny).

4. A fourth, *Apamea*, a town in Meſene, an iſland in the Tigris (Pliny, Ammian); where a branch of the Euphrates, called the *Royal river*, falls into the Tigris (Ptolemy).

5. A fifth in Meſopotamia, on the other ſide the Euphrates, oppoſite to Zeugma on this ſide, both founded by Seleucus, and joined by a bridge, from which the latter takes its name (Pliny, Iſidor, Characenus).

6. Another *Apamea*, near *Famia*, alſo in Syria, below the confluence of the Orontes and Marſyas; a ſtrong city, and ſituated in a peninſula, formed by the Orontes and a lake. "It was here (ſays Strabo) that the Seleucidæ had eſtabliſhed the ſchool and nurſery of their cavalry." The ſoil of the neighbourhood, abounding in paſturage, fed no leſs than thirty thouſand mares, three hundred ſtalions, and five hundred elephants; inſtead of which the marſhes of Famia at preſent ſcarcely afford a few buffaloes and ſheep. To the veteran ſoldiers of Alexander, who here repoſed after their victories, have ſucceeded wretched peaſants, who live in perpetual dread of the oppreſſions of the Turks and the inroads of the Arabs.

Apamea was alſo the ancient name of *Pella*, in the Decapolis.

APANAGE, or APPENNAGE, in the French cuſtoms, lands aſſigned by a ſovereign for the ſubſiſtence of his younger ſons, which revert to the crown upon the failure of male iſſue in that branch to which the lands are granted.

APANOMIA, a town of Santorin, an iſland in the Mediterranean ſea, called in this part, by ſome, the *Sea of Candia*: it has a ſpacious harbour, in the form of a half-moon; but the bottom is ſo deep, that ſhips cannot anchor there, E. Long. 25. 59. N. Lat. 36. 18.

APANTHROPY, in medicine, denotes a love of ſolitude, and averſion for the company of mankind. Apanthropy is by ſome reckoned among the ſymptoms, by others among the ſpecies or degrees, of melancholy; and alſo paſſes for an ill indication in leucophlegmatic caſes.

APARINE, in botany, a ſynonime of the utricularia and ſeveral other plants.

APARITHMESIS, in rhetoric, denotes the anſwer to the protaſis or propoſition itſelf. Thus, if the protaſis be, *Appellandi tempus non erat*, —the aparithmeſis is, *At tecum anno plus vixi.*

APARTISMENUS, in the ancient poetry, an appellation given to a verſe, which comprehended an entire ſenſe or ſentence in itſelf. This is ſometimes alſo written, *appartemenus*, i. e. ſuſpended, as not needing any following verſe.

APATHY, among the ancient philoſophers, implied an utter privation of paſſion, and an inſenſibility of pain. The word is compounded of α priv. and ϖαθος, affection. The Stoics affected an entire apathy: they conſidered it as the higheſt wiſdom to enjoy a perfect calmneſs or tranquillity of mind, incapable of being ruffled by either pleaſure or pain. In the firſt ages of the church, the Chriſtians adopted the term *apathy* to expreſs a contempt of all earthly concerns; a ſtate of mortification, ſuch as the goſpel preſcribes. Clemens Alexandrinus, in particular, brought it exceedingly in vogue; thinking hereby to draw the philoſophers to Chriſtianity, who aſpired after ſuch a ſublime pitch of virtue. Quietiſm is only apathy diſguiſed under the appearance of devotion.

APATURIA, in antiquity, a ſolemn feaſt celebrated by the Athenians in honour of Bacchus. The word is uſually derived from απατη, *fraud*. It is ſaid to have been inſtituted in memory of a fraudulent victory obtained by Melanthus, King of Athens, over Xanthus king of Boeotia, in a ſingle combat, which they agreed upon, to put an end to a debate between them relating to the frontiers of their countries. Hence Budæus calls it *feſtum deceptionis*, "the feaſt of deceit."

Other authors give a different etymology of this feaſt: They tell us, that the young Athenians were not admitted into the tribes on the third day of the apaturia, till their fathers had firſt ſworn, that they were their own children; and that, till that time, they were ſuppoſed, in ſome meaſure, to be without fathers, απατορες; whence the feaſt, ſay they, took its name. Xenophon, on the other hand, informs us, that the relations and friends met on this occaſion, and joined with the fathers of the young people who were to be received into the tribes; and that from this aſſembly the feaſt took its name: that in απατουρια, the α, far from being a privative, being here a conjunctive, ſignifies the ſame thing with ομου, *together*. This feaſt laſted four days: the firſt day, thoſe of the ſame tribe made merry together; and this they called δορπια. The ſecond day, which they called αναρρυσις, they ſacrificed to Jupiter and Minerva. The third day, which they called κουρεωτις, ſuch of their young men and maids as were of age were admitted into their tribes. The fourth day they called επιβδης.

APAULIA, in antiquity, the third day of a marriage ſolemnity. It was thus called, becauſe the bride, returning to her father's houſe, did απαυλιζεσθαι του νυμφιω, lodge apart from the bridegroom. Some will have the apaulia to have been the ſecond day of the marriage, viz. that whereon the chief ceremony was performed; thus called by way of contradiſtinction from the firſt day, which was called προαυλια. On the day called απαυλια (whenever that was), the bride preſented her bridegroom with a garment called απαυλητηρια.

APE, in zoology, the general Engliſh name of a very numerous race of animals, the natural hiſtory of which is given at large under the article SIMIA: comprehending *Apes* properly ſo called, or ſuch as want tails; and *Monkeys* and *Baboons*, or ſuch as have tails, the former *long*, and the other *ſhort*, ones. See SIMIA.

Sea-APE, a name given by Steller to a marine animal which he ſaw on the coaſt of America, and is thus deſcribed*. "The head appeared like that of a dog, with ſharp and upright ears, large eyes, and with both lips bearded: the body round and conoid; the thickeſt part near the head: the tail forked; the upper lobe the longeſt: the body covered with thick hair, grey on the back, reddiſh on the belly. It ſeemed deſtitute of feet. It was extremely wanton, and played a multitude of monkey-tricks. It ſometimes ſwam on one ſide, ſometimes on the other ſide of the ſhip, and gazed at it with great admiration. It made ſo near an approach to the veſſel, as almoſt to be touched with a pole; but if any body moved, it inſtantly retired. It would often ſtand erect for a conſiderable ſpace, with one-third of its body above water; then dart beneath the ſhip, and appear on the other ſide; and repeat the ſame thirty times together. It would frequently ariſe with a ſea-plant, not unlike the bottle-gourd, toſs it up, and catch it in its mouth, playing with it numberleſs fantaſtic tricks.

APELYTES, Chriſtian heretics in the ſecond century, who affirmed that Chriſt received a body from the four elements, which at his death he rendered back to the world, and ſo aſcended into heaven without a body.

APELLA, among phyſicians, a name given to thoſe whoſe prepuce is either wanting or ſhrunk, ſo that it can no longer cover the glans. Many authors have ſuppoſed this ſenſe of the word *Apella* warranted from the paſſage in Horace, *credat Judæus Apella, non ego*. But, according to Salmaſius and others, *Apella* is the proper name of a certain Jew, and not an adjective ſignifying *circumciſed*.

APELLIS, one of the moſt celebrated painters of antiquity. He was born in the iſle of Cos, and flouriſhed in the time of Alexander the Great, with whom he was in high favour. He executed a picture of this prince, holding a thunderbolt in his hand: a piece, finiſhed with ſo much ſkill and dexterity, that it uſed to be ſaid there were two Alexanders; one invincible, the ſon of Philip; the other inimitable, the production of Apelles. Alexander gave him a remarkable proof of his regard: for when he employed Apelles to draw Campaſpe, one of his miſtreſſes, having found that he had conceived an affection for her, he reſigned her to him; and it was from her that Apelles is ſaid to have drawn his Venus Anadyomene.

One of Apelles's chief excellencies was his making his pictures ſo exactly reſemble the perſons repreſented; inſomuch that the phyſiognomiſts are ſaid to have been able to form a judgment of the perſons deſtiny as readily from his portraits as if they had ſeen the originals. But what is called *grace* was the characteriſtic of this artiſt. His pencil was ſo famous for drawing fine lines, that Protogenes diſcovered by a ſingle line that Apelles had been at his houſe. Protogenes lived at Rhodes: Apelles ſailed thither, and went to his houſe with great eagerneſs, to ſee the works of an artiſt who was known to him only by name. Protogenes was gone from home: but an old woman was left watching a large piece of canvas, which was fitted in a frame for painting. She told Apelles that Protogenes was gone out; and aſked him his name, that ſhe might inform her maſter who had inquired for him. "Tell him (ſays Apelles) he was enquired for by this perſon;"—at the ſame time taking up a pencil, he drew on the canvaſs a line of great delicacy. When Protogenes returned, the old woman acquainted him with what had happened. That artiſt, upon contemplating the fine ſtroke of the line, immediately pronounced that Apelles had been there; for ſo finiſhed a work could be produced by no other perſon. Protogenes, however, himſelf drew a finer line of another colour; and, as he was going away, ordered the old woman to ſhow that line to Apelles if he came again; and to ſay, "This is the perſon for whom you are enquiring." Apelles returned, and ſaw the line: he would not for ſhame be overcome; and therefore, in a colour different from either of the former, he drew ſome lines ſo exquiſitely delicate, that it was utterly impoſſible for finer ſtrokes to be made. Protogenes now confeſſed the ſuperiority of Apelles, flew to the harbour in ſearch of him, and reſolved to leave the canvaſs with the lines on it for the aſtoniſhment of future artiſts.

Apelles ſhowed great liberality of mind towards Protogenes. With ideas enlarged by education and literature,

* *Hiſt. of Kamtſchatka*, p. 136.

Apelles.

ture, he was incapable of harbouring little jealouſies of noble competitors; on the contrary, he was the firſt who made the works of Protogenes to be valued as they deſerved among the Rhodians. He acknowledged that Protogenes was in ſome reſpects ſuperior to himſelf; but that in one particular himſelf excelled, viz. in knowing when to take his hand from the Picture; an art which Protogenes had not yet learned, and therefore over-worked his pieces. Apelles equally diſapproved of too elaborate diligence, or too haſty negligence, in execution. A ſtudied work of Protogenes he eſteemed leſs on the one account; and on the other, when a ſilly painter once brought him a picture, and ſaid, "This I painted in a hurry,"—he replied, "Though you had not told me ſo, I perceive it was painted in haſte: but I wonder you could not execute more ſuch pieces in the ſame time.

There are two ſtories related of Apelles, which ſhow him to be at once an artiſt of modeſty in amending even trifling improprieties, when pointed out to him by competent judges; and yet of ſelf-confidence ſufficient to make him know the perfection and value of his own paintings. It was cuſtomary with Apelles to expoſe to public view the works which he had finiſhed, and to hide himſelf behind the picture, in order to hear the remarks paſſed on it by perſons who chanced to view it. He once overheard himſelf blamed by a ſhoemaker for a fault in the ſlippers of ſome picture: he corrected the fault which the man had noticed: but on the day following the ſhoemaker began to animadvert on the leg; upon which Apelles with ſome anger looked out from behind the canvaſs, and bade him keep to his own province, "Ne ſutor ultra crepidam." It is well known that Alexander forbade any one beſides Apelles to paint his portrait. We are not, however, to conclude from this, that Alexander was a more ſkilful judge of painting than he was of poetry. Like Auguſtus, he cheriſhed the fine arts more from vanity than taſte. A remarkable proof is given of this prince's inability to diſcern merit, and of the painter's freedom in expreſſing the mortification he felt, when a work of his was not ſufficiently commended. "Alexander (ſays Ælian, lib. ii. c. 3. Var. Hiſt.) having viewed the picture of himſelf which was at Epheſus, did not praiſe it as it deſerved. But when a horſe was brought in, and neighed at ſeeing the figure of a horſe in the picture, as though it had been a real horſe; *O king!* (ſaid Apelles) *this horſe ſeems to be by far a better judge of painting than you.*" It happened more than once that the horſes drawn by him were miſtaken for real ones, by living horſes which ſaw and neighed at the pictures. In his finiſhing a drawing of this animal, a remarkable circumſtance is related of him. He had painted a horſe returning from battle, and had ſucceeded to his wiſhes in deſcribing every other mark that could indicate a mettleſome ſteed, impatient of reſtraint; there was wanting nothing but a foam of a bloody hue iſſuing from the mouth. He again and again endeavoured to expreſs this, but his attempts were unſucceſsful. At laſt, with vexation, he threw againſt the reins of the horſe a ſponge which had in it many colours; a mixture of which coming out of the ſponge, and tinging the reins, produced the very effect deſired by the painter.

The works of Apelles were all admired; but the moſt celebrated were the picture of Alexander in the

Apene ‖ Apenzel,

temple of Diana at Epheſus, and that of Venus emerging from the ſea. Alexander was drawn with thunder in his hand; and ſuch relief was produced by the chiaroſcuro in this piece, that the fingers ſeemed to ſhoot forward, and the thunder-bolt to be out of the picture. His Venus Αναδυομενη was eſteemed the moſt exquiſite figure which the pencil could create: it is therefore extolled by the Roman poets Propertius and Ovid; and the poet of Sidon, Antipater, has left us the following Greek epigram on it:

Ταν αναδυομεναν απο ματερος αρτι θαλαττας
  Κυπριν, Απελλειου μοχθον ορα γραφιδος,
Ως χερι συμμαρψασα διαβροχον υδατι καιταν
  Εκθλιβει νοτερων αφρον απο πλοκαμων.
Αυται νυν ερεουσιν Αθηναιη τε και Ηρη
  "Ουκ ετι σοι μορφας εις εριν ερχομεθα."

Anth. iv. 12.

Graceful as from her natal ſea ſhe ſprings,
  Venus, the labour of Apelles, view:
With preſſing hand her humid locks ſhe wrings,
  While from her treſſes drips the frothy dew:
Ev'n Juno and Minerva now declare,
  "No longer we contend whoſe form's moſt fair."

APENE, in antiquity, a kind of chariot wherein the images of the gods were carried in proceſſion on certain days, attended with a ſolemn pomp, ſongs, hymns, dancing, &c. It was very rich, made ſometimes of ivory, or of ſilver itſelf, and variouſly decorated.

APPENNINUS, now the *Appennine;* a mountain, or ridge of mountains, running through the middle of Italy, from north-weſt to the ſouth-weſt for 700 miles, in the form of a creſcent, (Pliny); beginning at the Alps in Liguria, or the Rivierra di Genoa; and terminating at the ſtrait of Meſſana, or at Reggio, and the promontory Leucopetra; and ſeparating, as by a back or ridge, the Adriatic from the Tuſcan ſea, (Pliny, Strabo, Ptolemy, Polybius, Vitruvius). This mountain, though high, is greatly ſhort of the height of the Alps. Its name is Celtic, ſignifying a *high mountain.*

APENRADE, a town of Denmark, in the duchy of Sleſwick, ſeated at the bottom of a gulph in the Baltic ſea, between Flenſbourg and Hadaſchleben. It is 25 miles north from Sleſwick. E. Long. 9. 28, N. Lat. 55. 4.

APENZEL, a town of Switzerland, in the canton of the ſame name, ſeated on the river Chuz, E. Long. 9. 1. N. Lat. 47. 31. The canton itſelf, which was allied to the others in 1513, conſiſts only of three or four valleys; having the town and abbey of St Gall on the north; the county of Toggenburg on the weſt; the lordſhip of Sax in the canton of Zurich, and that of Gambs in the canton of Shweiz, on the ſouth; and the Rheinthall, or Rhine-valley, on the eaſt. Its greateſt length is about 30 miles, and its breadth about 20. It yields good paſturage, and conſequently is not deſtitute of cattle, milk, butter, or cheeſe. Conſiderable quantities alſo of wheat, rye, barley, oats beans, peaſe, flax, and wine, are produced in it; beſides a great deal of fruit, wood, and turf; with mineral waters, and warm baths. There are many mountains in the canton, the higheſt of which it that called the *Hoheſantis*, or the *Hohe-Meſmer*, which commands a proſpect of a prodigious extent. There are alſo ſeveral lakes and rivers. The inhabitants, who are partly Proteſtants,

teſtants, and partly Roman-catholis, ſubſiſt chiefly by their manufactures of linen, crape, fuſtian, and thread, or by bleaching, and the ſale of their cattle, butter, cheeſe, horſes, wood, and coal. Of the twenty-three pariſhes in the canton, four are Popiſh, and nineteen proteſtant. Before the Reformation, the inhabitants were ſubject to the abbot of St. Gall; but they then ſhook off his yoke, and united themſelves with the other cantons: after that, however, there were violent animoſities between the Papiſts and Proteſtants, the former continually perſecuting the latter, till at laſt, in 1587, by the mediation of the other cantons, the two parties came to an accommodation, by which certain diſtricts were aſſigned to each party, whereas before they lived promiſcuouſly together; and though theſe two diviſions now conſtitute but one canton, yet each forms a diſtinct community or free ſtate, ſending its particular repreſentatives to the diets of the confederacy, and having its ſeparate councils and officers. In ſpirituals the Papiſts are ſubject to the biſhop of Conſtance, but the Proteſtants to their own conſiſtory. The militia of the former does not exceed 3000, whereas thoſe of the latter amount to 10,000.

APEPSIA, (from α neg. and πεπτω, to *digeſt.*) Indigeſtion.

Abſtemiouſneſs and exceſs are alike cauſes of indigeſtion. An over-diſtenſion of the ſtomach may in ſome meaſure injure its proper tone; and long faſting, by inducing a bad quality in the juices ſecerned into the ſtomach, renders it feeble, and generates wind. Hard drinking, and any of the cauſes of an anorexy, alſo injure digeſtion.

The columbo root is ſaid to be particularly uſeful when the ſtomach is languid, the appetite defective, digeſtion with difficulty carried on, or when a nauſea with flatulency attends. It is preſcribed in ſubſtance with any grateful aromatic, or infuſed in Madeira wine, now and then interpoſing gentle doſes of the tincture of rhubarb.

A mixture of muſtard-ſeed with the columbo root is of admirable utility in complaints of this kind; particularly where acidity and flatulence prevail much in the primæ viæ.

APER, in zoology, a ſynonime of the ſus ſcrofa. See Sus.

APERIENTS, in the materia medica, an appellation given to ſuch medicines as facilitate the circulation of the humours by removing obſtructions.—The five aperient roots of the ſhops are ſmallage, fennel, aſparagus, parſley, and butcher's broom.

APERTURE, the opening of any thing, or a hole or cleft in any continuous ſubject.

Aperture, in geometry, the ſpace between two right lines which meet in a point and form an angle.

Aperture, in optics, a round hole in a turned bit of wood or plate of tin, placed within the ſide of a teleſcope or microſcope, near to the object-glaſs, by means of which more rays are admitted, and a more diſtinct appearance of the object is obtained.

Apertures, or *Apertions*, in architecture, are uſed to ſignify doors, windows, chimnies, &c.

APETALOSE, or Apetalous, among botaniſts, an appellation given to ſuch plants as have no flower-leaves.

APEX, the vertex or ſummit of any thing.

Apex, in antiquity, the creſt of a helmet, but more eſpecially a kind of cap worn by the flamens.

Apex, among grammarians, denotes the mark of a long ſyllable, falſely called a *long accent.*

APHACA, (anc. geog.) the name of a place in Syria, ſituated between Heliopolis and Byblus, near Lebanon; infamous for a temple of Venus, called *Aphacitis*, near which was a lake, round which fire uſually burſt forth, and its waters were ſo heavy, that bodies floated on them. The temple was deſtroyed by Conſtantine, as being a ſchool of incontinence, (Euſebius). The name is of Syriac origin, ſignifying *embraces.*

APHÆRESIS, in grammar, a figure by which a letter or ſyllable is cut off from the beginning of a word. Thus *ciconio*, by aphæreſis, is written *oonia*; *contemnere*, *temnere*; *omittere*, *mittere*, &c.

A like retrenchment at the end of a word is called Apocope.

Aphæresis, in medicine, denotes a neceſſary taking away or removal of ſomething that is noxious.—In ſurgery, it ſignifies an operation whereby ſomething ſuperfluous is taken away.

APHANES: a genus of the monogynia order, belonging to the tetrandia claſs of plants; and in the natural method ranking under the 35th order, *Senticoſæ*. The eſſential characters are theſe: The calyx is divided into eight parts; there is no corolla; the ſeeds are two, and naked. There is only one ſpecies, the arvenſis or penſley-piert, a native of Britain. It is extremely common in corn-fields. The ſtalks riſe five or ſix together; they are three inches long, round, hairy, and procumbent: the leaves ſtand very thick upon them, and are roundiſh, but divided, as it were, into three parts, and thoſe deeply ſerrated at their edges. The flower comes out in a double ſeries, arranged all along the branches, and are of a greeniſh white, and the whole plant is of a greyiſh or whitiſh-green colour.

APHASIA, (from α, and φημι. "I ſpeak,") in the ſceptic philoſophy, denotes a ſtate of doubt, wherein a perſon not knowing what to determine on, it is beſt for him to be ſilent. In this ſenſe, *Aphaſia* ſtands oppoſed to *phaſis*, under which are included both aſſertion and negation.

APHEK, the name of ſeveral cities mentioned in ſcripture. 1. Aphek in the tribe of Judah, where the Philiſtines encamped, when the ark was brought from Shiloh, which was taken by them in battle, 1 Sam. iv. 1, 2. &c. It is thought to be the ſame with Aphekah mentioned in Joſh. xv. 53. 2. Aphek in the valley of Jezreel, where the Philiſtines encamped while Saul and his army were near Jezreel, upon the mountains of Gilboa, 1 Sam. xxix. 1, &c. 3. APHEK a city belonging to the tribe of Aſher, near the country of the Sidonians; (Joſh. xix. 30, and xiii. 4.) 4. Aphek a city of Syria, one of the principal in Benhadad's kingdom, near which the battle was fought between Ahab and Benhadad, wherein the Syrians were worſted; and whereof, as they retreated with precipitation into the city, the walls fell upon them, and cruſhed in pieces 27,000, (1 Kings xx. 26, *et ſeq.*) This city lay between Heliopolis and Biblos.

APHELIUM, or Aphelion, in aſtronomy, is that point in any planet's orbit, in which it is fartheſt diſtant

ſtant from the ſun, being that end of the greater axis of the elliptical orbit of the planet moſt remote from the focus where the ſun is.

APHIOM KARAHISSART, a town of Natolia, in Aſiatic Turkey; it is named *Aphiom*, becauſe it produces a great deal of opium, called *aphiom* by the Turks. E. Long. 32. 18. N. Lat. 38. 35.

APHIS, in zoology, the PUCERON, VINE-FRETTER, or PLANT-LOUSE; a genus of inſects belonging to the order of inſecta hemiptera. The roſtrum or beak of the aphis is inflected; the antennæ or feelers are longer than the thorax; the wings are four, and erect, or they are wanting; the feet are of the ambulatory kind; and the belly often ends in two horns, from which is ejected that moſt delicate juice called *Honey-dew*. HONEY-DEW.

Linnæus enumerates 33 ſpecies of the aphis, all of them inhabitants of particular plants, from which their trivial names are taken; as, aphis *ribis*, *ulmi*, *roſæ*, &c.: And he adds, that there ſeem to be a greater variety of plants producing aphides than there are different ſorts of this inſect. But ſome late obſervers have been able to diſtinguiſh more than double the above number of ſpecies; and it is probable that many more remain ſtill to be added, as many of the ſame kind of plants are found to ſupport two or three quite different ſorts of aphides. Thus the plum-tree has two ſorts very diſtinct from each other: one of a yellowiſh green, with a round ſhort body; the other of a bluiſh green, as it were enamelled with white, and the ſhape more oblong. On the gooſe-berry buſh and currant the ſame aphides may be found; but each of theſe is inhabited by two very different ſpecies: one being of a duſky green, with a ſhort plump body; the other of a paler green, the body more taper, and tranſverſely wrinkled. The roſe-tree, again, ſupports not leſs than three diſtinct ſpecies: the largeſt is of a deep green, having long legs of a browniſh caſt, with the joints of a very dark brown, as are alſo the horns and antennæ; a ſecond ſort is of a paler green, has much ſhorter legs, and a more flat body; the third ſort is of a pale red, its body traſverſely wrinkled, and is moſt frequently on the ſweet-briar.

The extraordinary nature of theſe inſects have for ſome time paſt juſtly excited the wonder and attention of naturaliſts. They were long ranked among the animals which had been claſſed with the true androgynes ſpoken of by Mr Breynius: for having never been catched copulating, it was haſtily concluded that they multiplied without copulation. This, however, was but a doubt, or at beſt a mere ſurmiſe: but this ſurmiſe was believed and adopted by Mr Reaumur; and though he ſupported it by ſome obſervations peculiar to himſelf, the queſtion remained ſtill undecided, till Mr Bonnet ſeemed to have cleared it up in the affirmative, by taking and ſhutting up a young aphis at the inſtant of its birth, in the moſt perfect ſolitude, which yet brought forth in his ſight 95 young ones. The ſame experiment being made on one of the individuals of this family, that had been tried with its chief, the new hermit ſoon multiplied like its parent; and one of this third generation, in like manner brought up in ſolitude, proved no leſs fruitful than the former. Repeated experiments, in this reſpect, as far as the fifth or ſixth generation, all uniformly preſenting the obſerver with *fecund virgins*, were communicated to the Royal Academy of Sciences; when an unforeſeen and very ſtrange ſuſpicion, imparted by Mr Trembley to Mr Bonnet, engaged him anew in a ſeries of ſtill more painful experiments than the foregoing. In a letter which that celebrated obſerver wrote to him from the Hague, the 27th January, 1741, he thus expreſſes himſelf: "I formed ſince the month of November, the deſign of rearing ſeveral generations of ſolitary pucerons, in order to ſee if they would all equally bring forth young. In caſes ſo remote from uſual circumſtances, it is allowed to try all ſorts of means; and I argued with myſelf, Who knows, that but one copulation might ſerve for ſeveral generations? This "*who knows*," to be ſure, was next to avouching nothing; but as it came from Mr. Trembley, it was ſufficient to perſuade Mr Bonnet that he had not gone far enough in his inveſtigation. If the fecundity of aphides was owing to the ſecret copulation ſuggeſted by Mr Trembley; this copulation ſerved at leaſt five or more ſucceſſive generations. Mr Bonnet therefore reared to the amount of the tenth generation of ſolitary aphides, and had the patience to keep an account of the days and hours of the birth of each generation. In ſhort, it was diſcovered, That they are really diſtinguiſhed by ſexes: That there are males and females among them, whoſe amours are the leaſt equivocal of any in the world: that the males are produced only in the tenth generation, and are but few in number: that theſe, ſoon arriving at their full growth, copulate with the females: that the virtue of this copulation ſerves for ten generations: that all theſe generations, except the firſt (from the fecundated eggs), are produced viviparous; and all the individuals are females, except thoſe of the laſt generations, among whom, as we have already obſerved, ſome males make their appearance, to lay the foundations of a freſh ſeries.—Theſe circumſtances have been confirmed by other naturaliſts. In particular, we have a curious and accurate detail of them by Dr Richardſon of Rippon, in the Philoſophical Tranſactions, Vol. xi. art. 22. an extract of which we ſhall here inſert, in order to give the reader as full an inſight into the nature of theſe ſingular inſects, as can be done by a mere detail of facts in themſelves utterly unaccountable.

"The great variety of ſpecies which occur in the inſects now under conſideration, may make an inquiry into their particular nature ſeem not a little perplexed; having them, however, ſkilfully reduced under their proper genus, the difficulty is by this means conſiderably diminiſhed. All the inſects comprehended under any diſtinct genus, we may reaſonably ſuppoſe to partake of one general nature; and, by diligently examining any of the particular ſpecies, may thence gain ſome inſight into the nature of all the reſt. With this view I have choſen, out of the various ſorts of aphides, the largeſt of thoſe found on the roſe-tree; not only as its ſize makes it the more conſpicuous, but as there are few others of ſo long a duration. This ſort, appearing early in the ſpring, continues late in the autumn; while ſeveral are limited to a much ſhorter term, in conformity to the different trees and plants from whence they drew their nouriſhment.

1. "If at the beginning of February the weather happens to be ſo warm as to make the buds of the roſe-tree ſwell and appear green; ſmall aphides are frequently to be found upon them, not larger than the

young ones in ſummer when firſt produced. But there being no old ones to be found at this time of the year, which in ſummer I had obſerved to be viviparous, I was formerly not a little perplexed by ſuch appearances, and almoſt induced to give credit to the old doctrine of equivocal generation. That the ſame kind of animal ſhould at one time of the year be viviparous, and at another time oviparous, was an opinion I could then by no means entertain. This, however, frequent obſervation has at laſt convinced me to be fact; having found thoſe aphides which appear early in the ſpring, to proceed from ſmall black oval eggs which were depoſited on the laſt year's ſhoots in autumn: though, when it happens that the inſects make too early an appearance, I have obſerved the greateſt part to ſuffer from the ſharp weather that uſually ſucceeds, by which means the roſe-trees are ſome years in a manner freed from them.

"Thoſe which withſtand the ſeverity of the weather ſeldom come to their full growth before the month of April; at which time they uſually begin to breed, after twice caſting off their exuviæ or outward covering. It appears then that they are all females, which produce each of them a very numerous progeny, and that without having intercourſe with any male inſect. As I obſerved before, they are viviparous; and what is equally uncommon, the young ones all come into the world backwards. When they firſt come from the parent, they are enveloped by a thin membrane, having in this ſituation the appearance of an oval egg; which, I apprehend, muſt have induced Reaumur to ſuſpect that the eggs diſcovered by Bonnet were nothing more than mere abortions. Theſe egg-like appearances adhere by one extremity to the mother; while the young ones contained in them extend the other; by that means gradually drawing the ruptured membrane over the head and body to the hind feet. During this operation, and for ſome time after, by means of ſomething glutinous, the fore part of the head adheres to the vent of the parent. Being thus ſuſpended in the air, it ſoon frees itſelf from the membrane in which it was confined, and, after its limbs are a little ſtrengthened, is ſet down on ſome tender ſhoot, and then left to provide for itſelf.

2. "In the ſpring months, there appear on the roſe-trees but two generations of aphides, including thoſe which immediately proceed from the laſt year's eggs; the warmth of the ſummer adds ſo much to their fertility, that no leſs than five generations ſucceed one another in the interval. One is produced in May, which caſts off its covering; while the months of June and July each ſupply two more, which caſt off their coverings three or four times, according to the different warmth of the ſeaſon. This frequent change of the outward covering is the more extraordinary, as it is the ofteneſt repeated when the inſects come the ſooneſt to their growth; which I have ſometimes obſerved to happen in ten days, where warmth and plenty of nouriſhment have mutually conſpired. From which conſiderations I am thouroghly convinced that theſe various coverings are not connate with the inſect; but that they are, like the ſcarf-ſkin, ſucceſſively produced.

"Early in the month of June, ſome of the third generation which were produced about the middle of May, after caſting off their laſt covering, diſcover four erect wings, much longer than their bodies: and the ſame is obſervable in all the ſucceeding generations, which are produced during the ſummer months; without, however, diſtinguiſhing any diverſity of ſex, as is uſual in ſeveral other kinds of inſects. For ſome time before the aphides come to their full growth, it is eaſy to diſcover which of them will have wings, by a remarkable fullneſs of the breaſt, which, in the others, is hardly to be diſtinguiſhed from the body. When the laſt covering is rejected, the wings, which were before folded up in a very narrow compaſs, gradually extend themſelves in a moſt ſurpriſing manner, till their dimenſions were at laſt very conſiderable. But theſe winged ones have the peculiarity, that the number of them does not ſeem ſo much to depend on their original ſtructure, as on the quantity or quality of the nouriſhment with which they are ſupplied: it being frequently obſerved, that thoſe on a ſucculent ſhoot have few or none with wings among them, while others of the ſame generation, on a leſs tender branch, are moſt of them winged; as if only the firſt rudiments of wings were compoſed in the former, while nature thought proper to expand them in the latter, that they might be more at liberty to ſupply their wants.

"The increaſe of theſe inſects in the ſummer-time is ſo very great, that, by wounding and exhauſting the tender ſhoots, they would frequently ſuppreſs all vegetation, had they not many enemies which reſtrain them. To enumerate the variety of other inſects that in their worm and fly ſtate are conſtantly deſtroying them, would exceed the bounds of the preſent deſign: there is one, however, ſo ſingular in the manner of executing its purpoſe, that I cannot paſs by it without ſome further notice. This is a very ſmall black ichneumon fly, with a ſlender body and very long antennæ, which darts its pointed tail into the bodies of the aphides, at the ſame time depoſiting an egg in each. This egg produces a worm, which feeds upon the containing inſect till it attains its full growth; when it is uſually changed to that kind of fly from whence it came. In this, however, it is ſometimes prevented by another ſort of ſmall black fly, which wounds this worm through its pear-like habitation; and by laying one of its eggs therein, inſtead of the former fly, produces its own likeneſs. I muſt, however, further obſerve, notwithſtanding theſe inſects have many enemies, they are not without friends; if we may conſider thoſe as ſuch who were very officious in their attendance, for the good things they expect to reap thereby. The ant and the bee are both of this kind, collecting the honey in which the aphides abound; but with this difference, that the ants are conſtant viſitors, the bee only when flowers are ſcarce. To which let me alſo add, that the ants will ſuck in the delicious nectar while the aphides are in the act of diſcharging it from the anus; but the bees only collect it from the leaves on which this honey-dew has fallen.

3. "In the autumn I find three more generations of aphides to be produced; two of which make their appearance in the month of Auguſt, and the third uſually appear before the middle of September. As the two firſt differ in no reſpect from thoſe which we meet with in ſummer, it would be waſting time to dwell any longer upon them; but the third, differing greatly from all the reſt, demands our giving it a more

ſerious attention. Though all the aphides which have hitherto appeared were females, in this tenth generation are found ſeveral male inſects; not that they are by any means ſo numerous as the females, being only produced by a ſmall number of the former generation. To which I muſt further add, that I have obſerved thoſe which produce males, previouſly to have produced a number of females; which in all reſpects reſembling thoſe already deſcribed, I ſhall decline taking into any further conſideration.

"The females have at firſt altogether the ſame appearance with thoſe of the former generations; but in a few days their colour changes from a green to a yellow, which is gradually converted into an orange colour before they come to their full growth. They differ likewiſe in another reſpect, at leaſt from thoſe which occur in the ſummer, that all thoſe yellow females are without wings. The male inſects are, however, ſtill more remarkable, their outward appearance readily diſtinguiſhing them from the females of this and of all other generations. When firſt produced, they are not of a green colour like the reſt, but of a reddiſh brown; and have afterwards, when they begin to thicken about the breaſt, a dark line along the middle of the back. Theſe male inſects come to their full growth in about three weeks time, and then caſt off their laſt covering; the whole inſect being, after this operation, of a bright yellow colour, the wings only excepted. But after this they ſoon change to a darker yellow, and in a few hours to a very dark brown; if we except the body, which is ſomething lighter coloured, and has a reddiſh caſt. They are all of the winged ſort; and the wings, which are white at firſt, ſoon become tranſparent, and at length appear like very fine black guaze.

"The males no ſooner come to maturity than they copulate with the females; in which act they are readily diſcovered, as they remain in conjunction for a conſiderable time, and are not eaſily diſturbed. The commerce between them continues the whole month of October, and may be obſerved at all times of the day, though I have found it moſt frequent about noon; eſpecially when the weather is moderately warm, and the ſun overcaſt. The females, in a day or two after their intercourſe with the males, I have obſerved to lay their eggs; which they uſually do near the buds, when they are left to their own choice. Where there are a number crowded together, they of courſe interfere with each other; in which caſe they will frequently depoſite their eggs on other parts of the branches, or even on the ſpines with which they are beſet."

See plate I. (vol. i.)

Theſe inſects are found in great numbers not only on the ſtems and leaves, but even upon roots of many trees and plants. Thoſe trees that are moſt loaded with the inſects, as already obſerved, ſuffer greatly from them. The plant-lice thruſt their ſharp-pointed roſtrum into the ſubſtance of the leaf to draw out their ſuſtenance, which warps the ſtem and leaves, and occaſions in the latter cavities underneath, and ſwellings above; nay, even in ſome, a kind of hollow gall filled with inſects, as is often ſeen on elm-leaves.

It appears aſtoniſhing that the ſlight puncture of ſo ſmall an animal ſhould ſo greatly disfigure a plant: but it muſt be remembered, that plant-lice always live in numerous aſſociations, which increaſe viſibly by the prodigious fruitfulneſs of thoſe inſects; ſo that although each puncture be ſlight, yet the number of them is ſo great, ſo reiterated, that it is no longer a wonder the leaves ſhould be disfigured. Lovers of gardening and plants are extremely anxious to free and cleanſe their trees from this vermin; but their care often proves unavailing, the inſect is ſo fruitful that it ſoon produces a freſh colony. The beſt and ſureſt method of extirpating it, is to put on the trees infeſted with them ſome larvæ of the plant-louſe lion, or aphidivorous flies*; for thoſe voracious larvæ deſtroy every day a great number of the inſects, and that with ſo much the more facility, as the latter remain quiet and motionleſs in the neighbourhood of theſe dangerous enemies, who range over heaps of plant-lice, which they gradually waſte and diminiſh.

* See *Coccinella*, *Ichnemon*, *Hemerobius*, &c.

APHLASTUM, in the ancient navigation, a wooden ornament, ſhaped like a plume of feathers, faſtened on the gooſe's or ſwan's neck uſed by the ancient Greeks in the heads of their ſhips. The aphlaſtum had much the ſame office and effect in a ſhip that the creſt had on the helmet. It ſeems alſo to have had this further uſe, viz. by the waving of a party-coloured ribband faſtened to it, to indicate from what quarter the wind blew.

APHONIA, among phyſicians, ſignifies a ſuppreſſion or total loſs of voice. It is never a primary diſeaſe; but a conſequence of many different diſorders. The cure is to be effected by removing the diſorder from whence the aphonia proceeds.

APHORISM, a maxim or principle of a ſcience; or a ſentence which comprehends a great deal in a few words. The word comes from αφοριζω, *I ſeparate*; q. d. a choice or ſelect ſentence.—The term is chiefly uſed in medicine and law. We ſay, the aphoriſms of Hippocrates, of Sanctorius, of Boerhaave, &c. aphoriſms of the civil law, &c.

APHRACTI, in the ancient military art, denotes open veſſels, without decks or hatches, furniſhed only at head and ſtern, with croſs planks, whereon the men ſtood to fight.

APHRODISIA, in antiquity, feſtivals kept in honour of Venus, the moſt remarkable of which was that celebrated by the Cyprians. At this ſolemnity ſeveral myſterious rites were practiſed: all who were initated to them offered a piece of money to Venus as an harlot, and received as a token of the goddeſs's favour a meaſure of ſalt, and a φαλλος; the former, becauſe ſalt is a concretion of ſea-water, to which Venus was thought to owe her birth; the latter, becauſe ſhe was the goddeſs of wantonneſs.

APHRODISIACS, among phyſicians, medicines which increaſe the quantity of ſemen, and create an inclination to venery.

APHRODITA, in zoology, an inſect of the order of vermes molluſca. The body of the aphrodita is oval, with many ſmall tentacula or protuberances on each ſide, which ſerve as ſo many feet: The mouth is cylindrical at one end of the body, and capable of being retracted, with two briſtly tentacula. There are four ſpecies of this inſect; viz. 1. The aculeata, by ſome called the *ſea-mouſe*, with 32 tentacula or feet, an inhabitant of the European ſeas, and often found in the belly of the cod-fiſh. It feeds upon ſhell-fiſh. See Plate XVII. fig. 4. 2. The ſcabra, of an oblong ſhape, ſcabrous on the back, with 20 tentacula. It inhabits the Belgic ſea. It is ſometimes taken off Brighthelmſtone, an inch long. 3. The ſquamata, with 24 feet, and ſcaly on the back. The mouth is wrapt up in an aperture, and the tail is terminated by a few very ſhort briſtles. It inhabits the European ocean. 4. The imbricata, is very like the former, only its ſcales are more glabrous. It inhabits the northern ocean.

APHRODITE, in mythology, a name of Venus, derived from αφρος, *froth;* becauſe, according to the poets, Venus is ſuppoſed to have been produced from the froth or foam of the ſea.

APHRONITRE, in natural hiſtory, a name given by the ancients to a particular kind of natrum.

APHTHÆ, in medicine, ſmall, round, and ſuperficial ulcers ariſing in the mouth. See MEDICINE-*Index.*

APHTHARTODOCETÆ, a ſect ſworn enemies of the council of Chalcedon. The word is derived from αφθαρος, *incorruptible*, and δοκεω, *I imagine;* and was given them, becauſe they imagined the body of Jeſus Chriſt was incorruptible and impaſſible, and not capable of death. They aroſe among the Eutychians, and made their firſt appearance in the year 535.

APHYLLANTHES, LEAFLESS FLOWER, or BLUE MONTPELLIER PINK: A genus of the monogynia order, belonging to the hexandria claſs of plants; and in the natural method ranking under the 5th order, *Tetrapetaloidæ.* In character it differs not from the JUNCUS or ruſh, but in having a calyx of ſix petals, whereas the juncus has no calyx. There is only one ſpecies, the Monſpelienſes, a native of France. The root conſiſts of a number of ſlender, hard, woody, long and contorted fibres: the radical leaves are very numerous, two inches long, extremely narrow, and wither very quickly. The ſtalk is round, ſmooth, without a joint or knot, naked, and tolerably firm; at its top ſtands a ſingle and very beautiful blue flower, ariſing from a kind of compound imbricated cup.

APIARY, a place where bees are kept. See the article BEE.

APIASTER, in ornithology, the trivial name of a ſpecies of the merops. See MEROPS.

APICES, in botany, the ſame with ANTHERÆ.

APICIUS. There were at Rome three of that name, famous for their gluttony: the ſecond is the moſt celebrated of the three. He lived under Tiberius, ſpent immenſe ſums on his belly, and invented divers ſorts of cakes which bore his name. He kept as it were a ſchool of gluttony at Rome. After having ſpent two millions and a half in entertainments, finding himſelf very much in debt, he examined into the ſtate of his affairs; and ſeeing that he had but 250,000 livers remaining, he poiſoned himſelf, out of apprehenſion of ſtarving with ſuch a ſum. He had proſtituted himſelf when very young to Sejanus.

APINA, or *Apinæ*, a town of Apulia, built by Diomedes, as was alſo Tricæ, (Pliny). *Apinæ* and *Tricæ* is a very proverbial ſaying for things trifling and of no value, (Martial); and *Apinarii* was the appellation for triflers or buffoons, (Trebellius Pollio.)

APION, a famous grammarian, born in Egypt, was a profeſſor at Rome in the reign of Tiberius. He had all the arrogance of a mere pedant, and amuſed himſelf with difficult and inſignificant inquiries. One of his principal works was his Antiquities of Egypt.

APIS, in mythology, a divinity worſhipped by the ancient Egyptians at Memphis. It was an ox, having certain exterior marks; in which animal the ſoul of the great Oſiris was ſuppoſed to ſubſiſt. This animal had the preference to all others, as being the ſymbol of agriculture, the improvement of which that prince had ſo much at heart.

According to ſeveral learned writers on the Egyptian religion, Apis was only a ſymbolical deity. "Amongſt the animals conſecrated to ancient rites (ſays Ammianus Marcellinus), Mnevis and Apis are the moſt celebrated: the firſt is an emblem of the ſun, the ſecond of the moon." Prophyry tells us, that Apis bore the characteriſtic ſigns of the two ſtars; and Macrobius, who confirms this opinion, adds, that he was equally conſecrated to them both.

This bull, become the object of public adoration, it may be ſuppoſed, could not be born like other animals; accordingly the prieſts publiſhed that his origin was celeſtial. "An Apis is ſeldom born, ſays Pomponius Mela. He is not produced by the ordinary laws of generation. The Egyptians ſay he owes his birth to celeſtial fire." Plutarch explains this paſſage: "The prieſts pretend that the moon diffuſes a generative influence, and as ſoon as a cow who takes the bull is ſtruck by it, ſhe conceive an Apis. Accordingly we diſcover in him the ſigns of that ſtar."

Such were the fables induſtriouſly ſpread by thoſe who preſided over the divine inſtitutions. The vulgar, to whom this emblematical deity preſaged abundance, received them eagerly, and implicitly believed them. Pliny has deſcribed the characters which diſtinguiſhed this ſacred bull: "A white ſpot, reſembling a creſcent, on the right ſide, and a lump under the tongue, were the diſtinguiſhing marks of Apis." When a cow, therefore, which was thought to be ſtruck with the rays of the moon, produced a calf, the ſacred guides went to examine it, and if they found it conformable to this deſcription, they announced to the people the birth of Apis, and fecundity.

"Immediately (ſays Ælian), they built a temple to the new god, facing the riſing ſun, according to the precepts of Mercury, where they nouriſhed him with milk for four months. This term expired, the prieſts repaired in pomp to his habitation, and ſaluted him by the name of Apis. They then placed him in a veſſel magnificently decorated, covered with rich tapeſtry, and reſplendent with gold, and conducted him to Nilopolis, ſinging hymns, and burning perfumes. There they kept him for forty days. During this ſpace of time, women alone had permiſſion to ſee him, and ſaluted him in a particular manner. After the inauguration of the god in this city, he was conveyed to Memphis with the ſame retinue, followed by an innumerable quantity of boats, ſumptuouſly decked out. There they completed the ceremonies of his inauguration, and he became ſacred to all the world. Apis was ſuperbly lodged, and the place where he lay was myſtically called *the bed.* Strabo having viſited his palace, thus deſcribes it: "The edifice where Apis is kept, is ſituated near the temple of Vulcan. He is fed in a ſacred apartment, before which is a large court. The houſe in which they keep the cow that produced him, occupies one of its ſides. Sometimes, to ſatisfy the curioſity of ſtrangers, they make him go out into this court. One may ſee him at all times through a window; but the prieſts produce him alſo to public view." Once a year (ſays Solinus) they preſent a heifer to him, and the ſame day they kill her.

A bull, born in ſo marvellous a manner, muſt be poſſeſſed of ſupernatural knowledge. Accordingly the prieſts publiſhed, that he predicted future events by geſtures, by motions, and other ways, which they conſtrued according to their fancy. "Apis (ſays Pliny) has two temples called *Beds*, which ſerve as an augury for the people. When they come to conſult him, if he enters into a particular one, it is a favourable preſage, and fatal if he paſſes into the other. He gives anſwers to individuals by taking food from their hands. He refuſed that offered him by Germanicus, who died ſoon after." It would be unjuſt to conclude, that this reſpectable writer gave credit to ſuch arguries. He relates the opinion of the Egyptians, and contents himſelf with citing facts without offering his judgment.

Such was the inſtallation of Apis. His anniverſary was always celebrated for ſeven days. The people aſſembled to offer ſacrifices to him, and what is extraordinary oxen were immolated on the occaſion. This ſolemnity did not paſs without prodigies. Ammianus Marcellinus, who has collected the teſtimonies of the ancients, relates them in theſe words: "During the ſeven days in which the prieſts of Memphis celebrate the birth of Apis, the crocodiles forget their natural ferocity, become gentle, and do no harm to any body."

This bull, however, ſo honoured, muſt not exceed a myſterious term fixed for his life. "Apis (ſays Pliny) cannot live beyond a certain number of years. When he has attained that period, they drown him in the fountain of the prieſts; for it is not permitted, adds Ammianus Marcellinus, to let him prolong his life beyond the period preſcribed for him by the ſacred books." When this event happened, he was embalmed, and privately let down into the ſubterraneous places deſtined for that purpoſe. In this circumſtance, the prieſts announced that Apis had diſappeared; but when he died a natural death, before this period arrived, they proclaimed his death, and ſolemnly conveyed his body to the temple of Serapis.

"At Memphis was an ancient temple of Serapis, which ſtrangers were forbidden to approach, and where the prieſts themſelves only entered when Apis was interred. It was then (ſays Plutarch) that they opened the gates called *Lethes* and *Cocythe* (of oblivion and lamentation), which made a harſh and piercing ſound."

Ammianus Marcellinus, and Solinus, paint with great energy the general deſpair of the Egyptians, who with cries and lamentations demanded another Apis from heaven.

According to Plutarch, the term preſcribed for the life of Apis was 25 years; which number marked a period of the ſun and of the moon, and the bull was conſecrated to thoſe two bodies. Syncellus, in his Chronography, when he comes down to the 32d Pharaoh, called *Aſeth*, ſays, "Before Aſeth, the ſolar year conſiſted of 360 days. This prince added five to complete its courſe. In his reign a calf was placed amongſt the gods, and named *Apis*." And in the Bibliotheca of Fabricius we have the following paſſage: "It was cuſtomary to inaugurate the kings of Egypt at Memphis, in the temple of Apis. They were here firſt initiated in the myſteries, and were religiouſly inveſted; after which, they were permitted to bear the yoke of God, through a town to a place called the *Sanctuary*, the entrance of which was prohibited to the profane. There they will be obliged to ſwear that they would neither inſert months nor days in the year, and that it ſhould remain compoſed of 365 days, as had been eſtabliſhed by the ancients."—From theſe facts Mr Savary, in his letters on Egypt, infers, that Apis was the tutelary divinity of the new form given to the ſolar year, and of the cycle of 25 years, diſcovered at the ſame time. This deity, beſides, had a marked relation of the ſwelling of the Nile, as is teſtified by a great number of hiſtorians. The new moon which followed the ſummer ſolſtice, was the æra of this phenomenon, on which the eyes of every body were fixed: And Pliny ſpeaks as follows on this ſubject: "Apis had on his right ſide a white mark, repreſenting the creſcent: this mark (continues Ælian) indicated the commencement of the inundation." If Apis poſſeſſed the characteriſtic ſigns which proved his divine origin, he promiſed fertility and abundance of the fruits of the earth. It ſeems demonſtrated therefore, Mr Savary adds, that this ſacred bull, the guardian of the ſolar year of 365 days, was alſo regarded as the genius who preſided over the overflowing of the river. The prieſts, by fixing the courſe of his life to 25 years, and by making the inſtallation of a new Apis, concur with the renewal of the period above mentioned, had probably perceived, as the reſult of long meteorological obſervations, that this revolution always brought about abundant ſeaſons, Nothing was better calculated to procure a favourable reception of this emblematical deity from the people, ſince his birth was a preſage to them of a happy inundation, and of all the treaſures of teeming nature.

The ſolemnity of his inauguration was called *Apparition*. That which was renewed every year towards the 12th or 13th of the month *Payn*, which correſponds with the 17th or 18th of June, was called *the birth of Apis*. It was a time of rejoicing, which Ælian deſcribes in the following manner: "What feſtivals! what ſacrifices take place in Egypt at the commencement of the inundation! It is then that all the people celebrate the birth of Apis. It would be tedious to deſcribe the dances, the rejoicings, the ſhews, the banquets, to which the Egyptians abandon themſelves on this occaſion, and impoſſible to expreſs the intoxication of joy which breaks forth in all the towns of the kingdom."

Theſe obſervations Mr Savary thinks further confirmed by the name of this reſpectable bull; *Api*, in the Egyptian tongue, ſignifying number, meaſure. This epithet perfectly characterizes an animal eſtabliſhed as the guardian of the ſolar year, the type of the cycle of 25 years, and the preſage of a favourable inundation.

Monſieur Huet, Biſhop of Avranche, has endeavoured to prove that Apis was a ſymbolical image of the Patriarch Joſeph, and has ſupported his opinion with all his erudition. Dr Bryant apprehends that the name of *Apis* was an Egyptian term for a father; that it referred to the Patriarch Noah; and that the creſcent which was uſually marked on the ſide of the animal, was a repreſentation of the ark.

APIS, or Bee, in zoology, a genus of inſects belonging to the order of inſecta hymenoptera. The mouth is furniſhed with two jaws, and a proboſcis infolded in a double ſheath; the wings are four in number, the two foremoſt covering thoſe behind when at reſt: in the anus or tail of the females and working bees there is a hidden ſting.

Theſe inſects are diſtinguiſhed into ſeveral ſpecies, each of which has its peculiar genius, talents, manners, and diſpoſition. Variety prevails in the order of their architecture, and in the nature of their materials. Some live in ſociety, and ſhare the toils; ſuch are the common bee and the drone. Others dwell and work in ſolitude, building the cradles of their families; as the leaf-cutter bee does with the roſe-tree leaf; the upholſterer with the gaudy tapeſtry of the corn-roſe; the maſon-bee with a plaſter, the wood-piercer with ſawduſt. All are employed in their little hermitage, with the care of providing for the wants of their poſterity. —The ſpecies enumerated by Linnæus are no fewer than 55; of which the following are the moſt remarkable:—

1. The floriſomnis, or black bee with a cylindrical incurvated belly, having two tooth-like protuberances at the anus, and a kind of prickles on the hind-legs. This bee ſleeps in flowers. 2. The dentata, or ſhining green bee, with black wings, and a kind of teeth on the hind thighs. The tongue of this bee is almoſt as long as its body. 3. The variegata: the breaſt and belly are variegated with white and black ſpots; the legs are of an iron colour. It is a native of Europe. This ſpecies ſleeps in the geraneum phæum, or ſpotted crane's-bill. 4. The roſtrata is diſtinguiſhed by the upper lip being inflected and of a conical ſhape, and by the belly being inveſted with bluiſh belts. They build their neſts in high ſandy grounds, and there is but one young in each neſt. 5. The ferruginea, or ſmooth black bee, with the feelers, mouth, belly, and feet, of an iron colour. This is a ſmall bee, and ſuppoſed to be of an intermediate kind between the bee and waſp. It is a native of Europe. 6. The carioſa is a yellowiſh hairy bee; and the feet and front are of a bright yellow colour. It builds in the rotten trees of Europe. 7. The braſilianorum, or pale-red, hairy bee, with the baſis of the thighs black. This is a very large bee, every where covered with a teſtaceous ſkin. It is a native of America. 8. The lapidaria, or red hairy bee, with a yellow anus, builds in holes of rocks. 9. The terreſtris is black and hairy, with a white belt round the breaſt, and a white anus: it builds its neſt very deep in the earth. 10. The violacea is a red bee, and very hairy, with bluiſh wings. It is a native of Europe. The violacea is ſaid to perforate trees, and hollow them out in a longitudinal direction; they begin to build their cells at the bottom of theſe holes, and depoſit an egg in each cell, which is compoſed of the farina of plants and honey or a kind of gluten. 11. The muſcorum, or yellow hairy bee with a white belly, builds in moſſy grounds. The ſkill diſplayed by theſe builders is admirable. In order to enjoy the pleaſure of ſeeing their operations, let a neſt be taken to pieces, and the moſs conveyed to a diſtance. The bees will be ſeen to form themſelves into a chain, from their neſt to the place where the moſs has been laid. The foremoſt lays hold of ſome with her teeth, clears it bit by bit with her feet (which circumſtance has alſo gotten them the name of carding-bees), then, by the help of her feet, ſhe drives the unravelled moſs under her belly; the ſecond, in like manner, puſhes it on to the third. Thus there is formed an uninterrupted chain of moſs, which is wrought and interwoven with the greateſt dexterity by thoſe that abide by the neſt; and to the end, their neſt may not be the ſport of the winds, and may ſhelter them from rain, they throw an arch over it, which they compoſe with a kind of wax, tenaceous, though thin in ſubſtance, which is neither the unwrought bees-wax nor the real wax. Diſſolved in oil of turpentine, it may be uſed in taking off impreſſions. 12. The centuncularis, leaf-cutter, or black bee, having its belly covered with yellow down. The neſts of this ſpecies are made of leaves curiouſly plaited in the form of a matt or quilt. There are ſeveral varieties of the leaf-cutting bees, all equally induſtrious. They dig into the ground, and build their neſts, of which ſome have the form and ſize of thimbles inſerted one within another, others the ſhape and ſize of gooſe-quills. Theſe neſts are compoſed of pieces of leaves. Each ſort of bees cut into its own materials; ſome the roſe-leaf tree, others the horſe cheſnut. A careful obſerver may diſcover roſe-tree leaves cut as it were with a pinking iron; and there he may procure himſelf the pleaſure of ſeeing with what dexterity a bee, deſtitute of any mathematical inſtrument, cuts out a circular piece, fit to be either the bottom or the lid of one of thoſe neſts; others it cuts out into ovals and ſemi-ovals, which form the ſides of the neſt, into each of which it depoſits one egg with ready prepared victuals. 13. The mellifica, or domeſtic honey-bee. But the particulars concerning this valuable ſpecies are ſo numerous and intereſting as to require a ſeparate article for their detail; which the reader will therefore find at due length under the Engliſh or popular name Bee.

In the Philoſophical Tranſactions, N° 172*, we have an account of a ſpecies of honey-bee found in ſome parts of America, very different in form and manners from the common bee of Europe. Their combs are compoſed of a ſeries of ſmall bottles or bladders of wax, of a duſky brown or blackiſh colour: and each of theſe is much of the ſize and ſhape of a Spaniſh olive. They hang together in cluſters, almoſt like a bunch of grapes, and are ſo contrived, that each of them has its aperture, while the bees are at work upon it; but as ſoon as it is filled with honey, this aperture is cloſed, and the bees leave it, and go to work upon another veſſel. Their lodgings are uſually taken up in the hollow of an old tree, or in ſome cavity of a rock by the ſea-ſide. They are ſagacious in chooſing the moſt ſecure retreats; becauſe their honey is ſo delicious a bait, that they are hunted after by many animals; and they have no power of defending themſelves, having no ſtings as our bees have. The combs are brittle; and the honey is clear and liquid like rock-water. It is uſed by the natives rather as a drink with their food than as honey. They uſe it alſo in medicine as a purge, drinking half a pint of it in the morning faſting.

*Vol I. 68.

Pl. LVIII.

The Abbé Clavigero, in his Hiſtory of Mexico, mentions a ſpecies ſimilar in every reſpect to ours, but without the ſting. This is the bee of Yucatan and Chiapa, which makes the fine clear honey of *Eſtabentun*, of an aromatic flavour, ſuperior to that of all the other kinds of honey with which we are acquainted. The honey is taken from them ſix times a-year, that is, once in every other month; but the beſt is that which is got in November, being made from a fragrant white flower like jeſſamine, which blows in September, called in that country *Eſtabentun*, from which the honey has derived its name. This honey is ſaid to be in high eſtimation with the Europeans who touch at the ports of Yucatan. According to our author, the French of Guarico buy it ſometimes for the purpoſe of ſending it as a preſent to the king. Another ſpecies deſcribed by the ſame author, reſembles in its form the winged ants, but is ſmaller than the common bee and without a ſting. This inſect, which is peculiar to warm and temperate climates, forms neſts in ſize and ſhape reſembling ſugar-loaves, and even ſometimes greatly exceeding theſe in ſize, which are ſuſpended from rocks, or from trees, and particularly from the oak. The populouſneſs of theſe hives are much greater than thoſe of the common bee. The nymphs of this bee, which are eatable, are white and round, like a pearl. The honey is of a greyiſh colour, but of a fine flavour.

APIUM, PARSLEY: A genus of the digynia order, belonging to the pentandria claſs of plants; and in the natural menthod ranking under the 45th order, *Umbellatæ*. The fruit is of an oval ſhape, and ſtreaked; the involucrum conſiſts of one leaf; and the petals are inflected. There are only two ſpecies of apium; the petroſelinum, or common parſley, a native of Sardinia; and the graveolens, or ſmallage, a native of Britain: the culture of both which are well known.

Medicinal Uſes, &c. The roots and ſeeds of the *petroſelinum* are uſed in medicine. The root of parſley is one of the five aperient roots, and in this intention is ſometimes made an ingredient in apozems and diet-drinks: If liberally uſed, it is apt to occaſion flatulencies; and thus, by diſtending the viſcera, produces a contrary effect to that intended by it: the taſte of this root is ſomewhat ſweetiſh, with a light degree of warmth and aromatic flavour. The ſeeds are an ingredient in the electuary of bay-berries.—The roots of *ſmallage* are alſo in the number of aperient roots, and have been ſometimes preſcribed as an ingredient in aperient apozems and diet-drinks, but are at preſent diſregarded. The ſeeds of the plant are moderately aromatic, and were formerly uſed as carminatives; in which intention they are, doubtleſs, capable of doing ſervice, though the other warm ſeeds, which the ſhops are furniſhed with, render theſe unneceſſary; and accordingly the Edinburgh college, which retains the roots, has expunged the ſeeds.

Beſides its medicinal virtues above mentioned, the common parſley is reckoned an effectual cure for the rot in ſheep, provided they are fed with it twice a-week for two or three hours each time: but hares and rabbits are ſo fond of this herb, that they will come from a great diſtance to feed upon it; and in the countries where theſe animals abound, they will deſtroy it if not very ſecurely fenced againſt them; ſo that whoever has a mind to have plenty of hares in their fields, may draw them from all parts of the country by cultivating parſley.

APIVORUS, in ornithology, a ſynonime of a ſpecies of falco. See FALCO.

APLUDA: A genus of the monœcia order, belonging to the polygamia claſs of plants; and in the natural method ranking under the 4th order, *Gramina*, The calyx is a bivalved gluma; the floſcules of the female are ſeſſile, and the male floſcules are furniſhed with pedunculi; the female has no calyx; the corolla has a double valve; there is but one ſtylus, and one covered ſeed. The male has three ſtamina. There are three ſpecies of apluda, viz. the mutica, ariſtata, and zengites, all natives of the Indies.

APOBATANA, the metropolis of Media, and where the kings kept their treaſure (Iſidorus Characenus); ſuppoſed to be the ſame with *Ecbatana*.

APOBATERION, in antiquity, a valedictory ſpeech, or poem made by a perſon on departing out of his own country, and addreſſed to his friends or relations.

APOBATHRA, a place near Seſtos (Strabo); the landing place where Xerxes ſhips were frozen and ſtuck in the ice (Euſtathius).

APOCALYPSE, REVELATION, the name of one of the ſacred books of the New Teſtament, containing revelations concerning ſeveral important doctrines of Chriſtianity. The word is Greek, and derived from αποκαλυπτω, to *reveal*, or *diſcover*.

This book, according to Irenæus, was written about the year 96 of Chriſt, in the iſland of Patmos, whither St. John had been baniſhed by the emperor Domitian. But Sir Iſaac Newton places the writing of it earlier, viz. in the time of Nero. Some attribute this book to the arch-heretic Cerinthus: but the ancients unanimouſly aſcribed it to John, the ſon of Zebedee, and brother to James; whom the Greek father call the *Divine*, by way of eminence, to diſtinguiſh him from the other Evangeliſts. This book has not, at all times, been eſteemed canonical. There were many churches in Greece, as St Jerome informs us, which did not receive it; neither is it in the catalogue of canonical books prepared by the council of Laodicea, nor in that of St Cyril of Jeruſalem; but Juſtin, Irenæus, Origin, Cyprian, Clemens of Alexandria, Tertullian, and all the fathers of the fourth, fifth, and the following centuries, quote the Revelations as a book then acknowledged to be canonical. The Alogians, Marcionites, Cerdonians, and Luther himſelf, rejected this book: but the Proteſtants have forſaken Luther in this particular; and Beza has ſtrongly maintained againſt his objections, that the Apocalypſe is authentic and canonical.

The Apocalypſe conſiſts of twenty-two chapters. The three firſt are an inſtruction to the biſhops of the ſeven churches of Aſia Minor. The fifteen following chapters contain the perſecutions which the church was to ſuffer from the Jews, heretics, and Roman emperors. Next, St. John propheſies of the vengeance of God, which he will exerciſe againſt thoſe perſecutors, againſt the Roman empire, and the city of Rome; which, as the Proteſtants ſuppoſe, he deſcribes under the name of Babylon, the great whore, ſeated upon ſeven hills. In the laſt place, the 19th, 20th, 21ſt, and 22d chapters, deſcribe the triumph of the church over its enemies, the marriage of the Lamb, and the happineſs of the church triumphant.

"It is a part of this prophecy (ſays Sir Iſaac Newton), that it ſhould not be underſtood before the laſt age of the world; and therefore it makes for the credit of the prophecy, that it is not yet underſtood. The folly of interpreters has been to foretel times and things by this prophecy, as if God deſigned to make them prophets. By this raſhneſs they have not only expoſed themſelves, but brought the prophecy alſo into contempt. The deſign of God was much otherwiſe: He gave this and the prophecies of the Old Teſtament, not to gratify mens curioſities, by enabling them to foreknow things: but that, after they were fulfilled, they might be interpreted by the events; and his own providence, not the interpreters, be then manifeſted thereby to the world. And there is already ſo much of the prophecy fulfilled, that as many as will take pains in this ſtudy, may ſee ſufficient inſtances of God's providence."

There have been ſeveral other works publiſhed under the title of *Apocalypſes*. Sozomen mentions a book uſed in the churches of Paleſtine, called the *Apocalypſe*, or *Revelation of St Peter*. He alſo mentions an Apocalypſe of St Paul; which the Cophtæ retain to this day. Euſebius alſo ſpeaks of both theſe Apocalypſes. St Epiphanius mentions an Apocalypſe of Adam; Nicephorus, an Apocalypſe of Eſdras; Gratian and Cedrenus, an Apocalypſe of Moſes, another of St Thomas, and another of St Stephen; St Jerom, an Apocalypſe of Elias. Porphyry, in his life of Plotin, makes mention of the Apocalypſe or Revelations of Zoroaſter, Zoſtrian, Nicothæus, Allogenes, &c.

APOCOPE, among grammarians, a figure which cuts off a letter or ſyllable from the end of the word; as *ingeni for ingenii.*

APOCRISARIUS, in eccleſiaſtical antiquity, a ſort of reſident in an imperial city, in the name of a foreign church or biſhop, whoſe office was to negociate, as proctor, at the emperor's court, in all eccleſiaſtical cauſes in which his principals might be concerned. The inſtitution of the office ſeems to have been in the time of Conſtantine, or not long after, when, the emperors being become Chriſtians, foreign churches had more occaſions to promote their ſuits at court than formerly. However, we find it eſtabliſhed by law in the time of Juſtinian. In imitation of this officer, almoſt every monaſtery had its Apocriſarius, or reſident, in the imperial city.

The title and quality of Apocriſary became at length appropriated to the Pope's agent, or *Nuncio*, as he is now called; who reſided at Conſtantinople, to receive the Pope's diſpatches, and the emperor's anſwers. The word is formed from Αποκρινειν, *to anſwer*.

APOCRUSTICS, in medicine, the ſame with repellents. See Repellents.

APOCRYPHA, or apocryphal books, ſuch books as are not admitted into the canon of ſcripture, being either not acknowledged as divine, or conſidered as ſpurious. The word is Greek; and derived from απο, and κρυφτω to *hide* or *conceal.*

When the Jews publiſhed their ſacred books, they gave the appellations of *canonical* and *divine* only to ſuch as they then made public: ſuch as were ſtill retained in their archives they called *apocryphal*, for no other reaſon but becauſe they were not public; ſo that they might be really ſacred and divine, though not promulged as ſuch.

Thus, in reſpect of the Bible, all books were called *apocryphal* which were not inſerted in the Jewiſh canon of ſcripture. Voſſius obſerves, that, with regard to the ſacred books, none are to be accounted apocryphal, except ſuch as had neither been admitted into the ſynagogue nor the church, ſo as to be added to the canon, and read in public.

The proteſtants do not only reckon thoſe books to be apocryphal which are eſteemed ſuch in the church of Rome, as the prayer of Manaſſeth king of Judah, the third and fourth books of Eſdras, St Barnabas's epiſtle, the book of Hermos, the addition at the end of Job, and the 151ſt pſalm; but alſo Tobit, Judith, Eſther, the book of Wiſdom, Jeſus the ſon of Sirach, Baruch the prophet, the Song of the Three Children, the hiſtory of Suſannah, the hiſtory of Bell and the Dragon, and the firſt and ſecond books of Maccabees.

It is now pretended that theſe books were not received by the Jews, or ſo much as known to them. None of the writers of the New Teſtament cite or mention them: neither Philo nor Joſephus ſpeak of them. The Chriſtian church was for ſome ages an utter ſtranger to theſe books. Origen, Athanaſius, Hilary, Cyril of Jeruſalem, and all the orthodox writers, who have given catalogues of the canonical books of ſcripture, unanimouſly concur in rejecting theſe out of the canon. And for the New Teſtament, they are divided in their opinions, whether the epiſtle to the Hebrews, the epiſtle of St James, and the ſecond epiſtle of St Peter, the ſecond and third epiſtles of John, the epiſtle of St Jude, and the Revelations, are to be acknowledged as canonical or not.

The Proteſtants acknowledge ſuch books of ſcripture only to be canonical as were ſo eſteemed to be in the firſt ages of the church; ſuch as are cited by the earlieſt writers among the Chriſtians as of divine authority, and after the moſt diligent enquiry were received and ſo judged to be by the council of Laodicea. The ſeveral epiſtles abovementioned, and the book of Revelations, whatever the ſentiments of ſome particular perſons are or may have been of them, are allowed by all the reformed churches to be parts of the canon of the New Teſtament.

The apocryphal books, however, according to the ſixth article of the church of England, are to be read for example of life and inſtruction of manners; but it doth not apply them to eſtabliſh any doctrine.

APOCYNUM, (Αποκυνον, of απο and κυνος, *a dog*, becauſe the ancients believed this plant would kill dogs), Dogsbane: A genus of the digynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 30th order *Contortæ*. The eſſential characters are: The corolla is bell-ſhaped; and the filaments are five, alternate with the ſtamina.

Species. Of this genus botanical writers enumerate 11 ſpecies; of which the following are the moſt remarkable: 1. The venetum, with an upright herbaceous ſtalk, grows on a ſmall iſland in the ſea near Venice, but is ſuppoſed to have been originally brought from ſome other country. There are two varieties of this; one with a purple, and the other with a white flower. The roots creep very much, and by them only it is propagated; for it ſeldom produces any ſeeds either in the gardens where it is cultivated, or in thoſe places where it grows naturally. Mr Miller tells us, that he had been aſſured by a very curious botaniſt, who reſided many years at Venice, and conſtantly went to the ſpot ſeveral times in the ſeaſon to procure the ſeeds, had any been produced, that he never could find any pods formed on the plants. The ſtalks riſe about two feet high, and are garniſhed with ſmooth oval leaves placed oppoſite; the flowers grow at the top of the ſtalks, in ſmall umbels, and make a very pretty appearance. The flowers appear in July and Auguſt. 2. The ſpecioſſimum, with large flowers, is a native of Jamaica in the ſavannahs, whence it has the name of *Savannah-flower*, by which it is generally known in that iſland. This ſort riſes three or four feet high, having woody ſtalks which ſend out a few lateral branches, garniſhed with ſmooth oval leaves placed by pairs oppoſite, of a ſhining green colour on their upper ſides, but pale and veined underneath. The flowers are produced from the ſides of the branches, upon long footſtalks: there are commonly four or five buds at the end of each; but there is ſeldom more than one of them which comes to the flower. The flower is very large, having a long tube which ſpreads open wide at the top, of a bright yellow, and makes a fine appearance, eſpecially in thoſe places where the plants grow, naturally, being moſt part of the year in flower. 3. Cordatum with a climbing ſtalk. 4. The villoſum, with hairy flowers and a climbing ſtalk. Theſe were diſcovered at La Vera Cruz in New Spain, by Dr William Houſton, who ſent their ſeeds to England. They are both climbers and mount to the tops of the talleſt trees. In England they have climbed over plants in the ſtoves, and riſen to upwards of 20 feet high. The third ſort has produced flowers ſeveral times: but the fourth never ſhowed an appearance of any.

Culture. The firſt ſort is hardy enough to live in England in the open air, provided it is planted in a warm ſituation and dry ſoil. It is propagated, as we have already obſerved, by its creeping roots; the beſt time for removing and planting which is in the ſpring, juſt before they begin to puſh out new ſtalks. The other ſorts are propagated by ſeeds, but are ſo tender as to require being kept conſtantly in a ſtove.

Properties. All the ſpecies of this plant abound with a milky juice, which flows out from any part of their ſtalks and leaves when they are broken: this is generally ſuppoſed to be hurtful if taken inwardly, but doth not bliſter the ſkin when applied to it as the juice of ſpurge and other acrid plants. The pods of all the ſorts are filled with ſeeds, which are for the moſt part compreſſed and lie over one another *imbricatim*, like the tiles of a houſe; theſe have each a long plume of a cottony down faſtened to their crowns, by which, when the pods are ripe and open, the ſeeds are wafted by the wind to a conſiderable diſtance, ſo that the plants become very troubleſome weeds. This down is in great eſteem in France, for ſtuffing of eaſy chairs, making quilts, &c. for it is exceedingly light and elaſtic. It is called by the French *delawad*; and might probably become a vendible commodity in England, were people attentive to the collecting of it in Jamaica where the plants are found in plenty.

APODECTÆ, in antiquity, a denomination given to ten general receivers appointed by the Athenians to receive the public revenues, taxes, debts, and the like. The apodectæ had alſo a power to decide controverſies ariſing in relation to money and taxes, all but thoſe of the moſt difficult nature and higheſt concern, which were reſerved to the courts of judicature.

APODECTÆI, in the Athenian government, officers appointed to ſee that the meaſures of corn were juſt.

APODES, in a general ſenſe, denotes things without feet. Zoologiſts apply the name to a fabulous ſort of birds, ſaid to be found in ſome of the iſlands of the New World, which, being entirely without feet, ſupport themſelves on the branches of trees by their crooked bills.

Apodes in the Linnæan ſyſtem, the name of the *firſt order* of fiſhes, or thoſe which have no belly-fins. See Zoology.

APODICTICAL, among philoſophers, a term importing a demonſtrative proof, or ſyſtematical method of teaching.

APODOSIS, in rhetoric, makes the third part of a complete exordium, being properly the application, or reſtriction of the *protaſis*. The apodoſis is the ſame with what is otherwiſe called *axioſis*; and ſtands oppoſed to *protaſis*: e. gr. *protaſis*, all branches of hiſtory are neceſſary for a ſtudent; *cateſceue*, ſo that, without theſe, he can never make any conſiderable figure; *apodoſis*, but literary hiſtory is of a more eſpecial uſe, which recommends it, &c.

APODYTERIUM, in the ancient baths, the apartments where perſons dreſſed and undreſſed.

APOGEE, in Astronomy, that point in the orbit of a planet, which is at the greateſt diſtance from the earth. The apogee of the ſun is that part of the earth's orbit which is at the greateſt diſtance from the ſun; and conſequently the ſun's apogee, and the earth's aphelion, are one and the ſame point.

APOLIDES, in antiquity, thoſe condemned for life to the public works, or exiled into ſome iſland, and thus diveſted of the privileges of Roman citizens.

APOLLINARIAN games, in Roman antiquity, were inſtituted in the year of Rome 542. The occaſion was a kind of oracle delivered by the prophet Marcus after the fatal battle at Cannæ, declaring, that to expel the enemy, and cure the people of an infectious diſeaſe which then prevailed, ſacred games were to be annually performed in honour of Apollo; the prætor to have the direction of them, and the decemviri to offer ſacrifices after the Grecian rite. The ſenate ordered that this oracle ſhould be obſerved the rather, becauſe another of the ſame Marcus, wherein he had foretold the overthrow at Cannæ, had come true; for this reaſon they gave the prætor 12,000 aſes out of the public caſh to defray the ſolemnity. There were ſacrificed an ox to Apollo, as alſo two white goats, and a cow to Latona; all with their horns gilt. Apollo had alſo a collection made for him, beſides what the people who were ſpectators gave voluntarily. The firſt prætor by whom they were held was P. Cornelius Sylla. For ſome time they were moveable or indictive; but at length were fixed, under P. Licinius Varus, to the fifth of July, and made perpetual. The men, who were ſpectators at theſe games, wore garlands on their heads;

the women performed their devotions in the temples at the ſame time, at laſt they carouſed together in the veſtibles of their houſes, the doors ſtanding open. The Apollinarian games were merely ſcenical; and at firſt only obſerved with ſinging, piping, and other ſorts of muſic; but afterwards there were alſo introduced all manner of mountebank-tricks, dances, and the like; yet ſo as that they ſtill remained ſcenical, no chariot races, wreſtling, or the like laborious exerciſes of the body, being ever practiſed at them.

APOLLINARIANS, Apollinarists, called alſo by Epiphanius *Dimaritæ*, ancient hereticks, who denied the proper humanity of Chriſt, and maintained that the body which he aſſumed was endowed with a ſenſitive, and not a rational, ſoul, but that the Divine Nature ſupplied the place of the intellectual principle in man. This ſect derived its name from Apollinaris, biſhop of Laodicea, in the fourth century.

The Apollinarians have been charged with other opinions, ſuch as, the Millenarian and Sabellian, the pre-exiſtence of the body of Chriſt, and the paſſion of his Deity: but eccleſiaſtical writers are not agreed with reſpect to theſe and other particulars. Their doctrine was firſt condemned by a council of Alexandria in the year 362, and afterwards in a more formal manner by a council at Rome in 375; and by another council in 378, which depoſed Apollinaris from his biſhopric. Notwithſtanding all, his doctrine ſpread through moſt of the churches of the eaſt; and his followers were ſubdivided into various ſects. In 388, the emperor Theodoſius enacted a law, forbidding them to hold aſſemblies, to have any eccleſiaſtics or biſhops, or to dwell in cities. The rigorous execution of this law, in concurrence with the decrees of different councils, reduced them to a very ſmall number, and their doctrine had no long duration.

APOLLINARIS (Caius Sulpicius), a very learned grammarian, born at Carthage, lived in the 2d century, under the Antonines; he is ſuppoſed to be the author of the verſes which are prefixed to the comedies of Terence, and contain the arguments of them. He had for his ſucceſſor in the profeſſion of grammar Helvius Pertinax, who had been his ſcholar, and was at laſt emperor.

Apollinaris Sidonius (Caius Lollius), an eminent Chriſtian writer and biſhop in the 5th century, was born of a noble family in France. He was educated under the beſt maſters, and made a prodigious progreſs in the ſeveral arts and ſciences, but particularly in poetry and polite literature. After he had left the ſchools, he applied himſelf to the profeſſion of war. He married Papianilla, the daughter of Avitus, who was conſul, and aftewards emperor, by whom he had three children. But Majorianus in the year 457 having deprived Avitus of the empire, and taken the city of Lyons, in which our author reſided, Apollinaris fell into the hands of the enemy. However, the reputation of his learning ſoftened Majorianus's reſentments, ſo that he treated him with the utmoſt civility, in return for which Apollinaris compoſed a panegyric to his honour; which was ſo highly applauded, that he had a ſtatue erected to him at Rome, and was honoured with the title of *Count*. In the year 467 the emperor Anthemius rewarded him for the panegyric, which he had written in honour of him, by raiſing him to the poſt of governor of Rome, and afterwards to the dignity of a patrician and ſenator, and erecting a ſtatue to him. But he ſoon quitted theſe ſecular employments for the ſervice of the church. The biſhopric of Clermont being vacant in 472 by the death of Eparchus, Apollinaris, who was then only a layman, was choſen to ſucceed him without any intereſt or ſolicitation on his part, in which ſee he acted with the greateſt integrity. Clermont being beſieged by the Goths, he animated the people to the defence of that city, and would never conſent to the ſurrender of it; ſo that, when it was taken about the year 480, he was obliged to retire; but he was ſoon reſtored by Evariges king of the Goths, and continued to govern the church as he had done before. He died in peace the 21ſt of Auguſt 487; and his feſtival is ſtill obſerved in the church of Clermont, where his memory is had in great veneration. He is eſteemed the moſt elegant writer of his age, both in proſe and verſe. He wrote a great many little pieces; but preſerved none but thoſe which he thought were worthy of being continued down to poſterity. He collected himſelf the nine books which we have remaining of his letters. His chief pieces in poetry are the three panegyrics upon the emperors Avitus, Majorianus, and Anthemius. The reſt of them are a collection of poems addreſſed to his friends upon particular ſubjects. His letters contain a variety of particulars relating to polite literature and profane hiſtory.

APOLLINARIUS (Claudius), a learned biſhop of Hierapolis, who, about the year 170, preſented to Marcus Aurelius an excellent Apology for the Chriſtians.

Apollinarius the Younger, thus called to diſtinguiſh him from his father, called *Apollinarius the Elder*, was at firſt lector or reader of Laodicea, and afterwards biſhop of that city. He was univerſally eſteemed the greateſt man of his age, both for learning and piety, and a moſt accurate and nervous defender of the faith againſt all it enemies: but notwithſtanding this on his advancing ſome opinions that were not approved, he was anathematized as an heretic by the ſecond general council of Conſtantinople in 381.

APOLLO, in mythology, a Pagan deity worſhipped by the Greeks and Romans. Cicero mentions four of his name: the moſt ancient of whom was the ſon of Vulcan; the ſecond a ſon of Corybas, and born in Crete; the third an Arcadian, called *Nomian*, from his being a great legiſlator; and the laſt, to whom the greateſt honour is aſcribed, the ſon of Jupiter and Latona.

Apollo had a variety of other names, either derived from his principal attributes, or the chief places where he was worſhipped. He was called the *Healer* from his enlivening warmth and cheering influence; *Pæan*, from the peſtilential heats: to ſignify the former, the antients placed the graces in his right hand; and for the latter, a bow and arrows in his left: *Nomius*, or the ſhepherd, from his fertilizing the earth, and thence ſuſtaining the animal creation: *Delius*, from his rendering all things manifeſt: *Pythius*, from his victory over Python; *Lycias*, *Phæbus*, and *Phaneta*, from his purity and ſplendor. As Apollo is almoſt always confounded by the Greeks with the ſun, it is no wonder that he ſhould be dignified with ſo many attributes. It was natural for the moſt glorious object in nature, whoſe influence is felt by all creation, and ſeen by every animated part of it, to be adored as the fountain of light, heat, and life. The power of healing diſeaſes being chiefly given by the ancients to medicinal plants and vegetable productions, it was natural to exalt into a divinity the viſible cauſe of their growth. Hence he was alſo ſtyled the *God of Phyſic*; and that external heat which cheers and invigorates all nature, being transferred from the human body to the mind, gave riſe to the idea of all mental efferveſcence coming from this god; hence, likewiſe, poets, prophets, and muſicians are ſaid to be *numine afflati*, inſpired by Apollo.

Whether Apollo was ever a real perſonage, or only the great luminary, many have doubted. Indeed, Voſſius has taken great pains to prove this god to be only a metaphorical being, and that there never was any other Apollo than the ſun. "He was ſtyled the *Son of Jupiter* (ſays this author), becauſe that god was reckoned by the ancients the author of the world. His mother was called *Latona*, a name which ſignifies *hidden*; becauſe, before the ſun was created, all things were wrapped up in the obſcurity of chaos. He is always repreſented as beardleſs and youthful, becauſe the ſun never grows old or decays. And what elſe can his bow and arrows imply, but his piercing beams?" And adds, "that all the ceremonies which were performed to his honour, had a manifeſt relation to the great ſource of light which he repreſented. Whence (he concludes) it is vain to ſeek for any other divinity than the ſun, which was adored under the name of Apollo." However, though this be in general true, yet it does appear, from many paſſages in ancient authors, that there was ſome illuſtrious perſonage named *Apollo*, who, after his apotheoſis, was taken for the ſun; as Oſiris and Orus in Egypt, whoſe exiſtence cannot be called in queſtion, were, after their death, confounded with the ſun, of which they became the ſymbols, either from the glory and ſplendor of their reigns, or from a belief that their ſouls had taken up their reſidence in that luminary.

Of the four Apollos mentioned by Cicero, it appears that the three laſt were Greeks, and the firſt an Egyptian; who according to Herodotus, was the ſon of Oſiris and Iſis, and called *Orus*. Pauſanias is of the ſame opinion as Herodotus, and ranks Apollo among the Egyptian divinities. The teſtimony of Diodorus Siculus is ſtill more expreſs; for in ſpeaking of Iſis, after ſaying that ſhe had invented the practice of medicine, he adds, that ſhe taught this art to her ſon Orus, named *Apollo*, who was the laſt of the gods that reigned in Egypt.

It is eaſy to trace almoſt all the Grecian fables and mythologies from Egypt. If the Apollo of the Greeks was ſaid to be the ſon of Jupiter, it was becauſe Orus the Apollo of the Egyptians had Oſiris for his father, whom the Greeks confounded with Jupiter. If the Greek Apollo was reckoned the god of eloquence, muſic, medicine, and poetry, the reaſon was, that Oſiris, who was the ſymbol of the ſun among the Egyptians, as well as his ſon Orus, had there taught thoſe liberal arts. If the Greek Apollo was the god and conductor of the muſes, it was becauſe Oſiris carried with him in his expedition to the Indies ſinging women and muſicians. This parallel might be carried on ſtill further; but enough has been ſaid to prove that the true Apollo was that of Egypt.

To the other perfections of this divinity the poets have added beauty, grace, and the art of captivating the ear and the heart, no leſs by the ſweetneſs of his eloquence, than by the melodious ſounds of his lyre. However, with all theſe accompliſhments, he had not the talent of captivating the fair, with whoſe charms he was enamoured. But the amours and other adventures related of this god during his reſidence on earth, are too numerous, and too well known, to be inſerted here. His muſical conteſts, however, being more connected with the nature of this work, muſt not be wholly unnoticed.

To begin, therefore, with the diſpute which he had with Pan, that was left to the arbitration of Midas.

Pan, who thought he excelled in playing the flute, offered to prove that it was an inſtrument ſuperior to the lyre of Apollo. The challenge was accepted; and Midas, who was appointed the umpire in this conteſt, deciding in favour of Pan, was rewarded by Apollo, according to the poets, with the ears of an aſs, for his ſtupidity.—This fiction ſeems founded upon hiſtory. Midas, according to Pauſanias, was the ſon of Gordias and Cybele; and reigned in the Greater Phrygia, as we learn from Strabo. He was poſſeſſed of ſuch great riches, and ſuch an inordinate deſire of increaſing them by the moſt contemptible parſimony, that, according to the poets, he converted whatever he touched into gold. However, his talent for accumulation did not extend to the acquirement of taſte and knowledge in the fine arts; and, perhaps, his dulneſs and inattention to theſe provoked ſome muſical poets to invent the fable of his deciſion in favour of Pan againſt Apollo. The ſcholiaſt upon Ariſtophanes, to explain the fiction of his long ears, ſays, that it was deſigned to intimate that he kept ſpies in all parts of his dominions.

Marſyas, another player on the flute, was ſtill more unfortunate than either Pan, or his admirer Midas. This Marſyas, having engaged in a muſical diſpute with Apollo, choſe the people of Nyſa for judges. Apollo played at firſt a ſimple air upon his inſtrument; but Marſyas, taking up his pipe, ſtruck the audience ſo much by the novelty of its tone, and the art of his performance, that he ſeemed to be heard with more pleaſure than his rival. Having agreed upon a ſecond trial of ſkill, it is ſaid that the performance of Apollo, by accompanying the lyre with his voice, was allowed greatly to excel that of Marſyas upon the flute alone. Marſyas, with indignation, proteſted againſt the deciſion of his judges; urging that he had not been fairly vanquiſhed according to the rules ſtipulated, becauſe the diſpute was concerning the excellence of their ſeveral inſtruments, not their voices; and that it was wholly unjuſt to employ two arts againſt one.

Apollo denied that he had taken any unfair advantages of his antagoniſt, ſince Marſyas had employed both his mouth and fingers in performing upon his inſtrument; ſo that, if he was denied the uſe of his mouth, he would be ſtill more diſqualified for the contention. The judges approved of Apollo's reaſoning, and ordered a third trial. Marſyas was again vanquiſhed; and Apollo, inflamed by the violence of the diſpute, flea'd him alive for his preſumption. See MARSYAS.

Pauſanias relates a circumſtance concerning this conteſt, that had been omitted by Diodorus, which is, that Apollo accepted the challenge from Marſyas, upon condition that the victor ſhould uſe the vanquiſhed as he pleaſed.

Diodorus informs us, that Apollo, ſoon repenting of the cruelty with which he had treated Marſyas, broke the ſtrings of the lyre, and by that means put a ſtop, for a time, to any farther progreſs in the practice of that new inſtrument.

The next incident to be mentioned in the hiſtory of Apollo is his defeat of the ſerpent Python.

The waters of Deucalion's deluge, ſays Ovid, which had overflowed the earth, left a ſlime, from whence ſprung innumerable monſters; and among others the ſerpent Python, which made great havoc in the country about Parnaſſus. Apollo, armed with his darts, put him to death; which, phyſically explained, implies, that the heat of the ſun having diſſipated the noxious ſteams, thoſe monſters ſoon diſappeared: or, if this fable be referred to hiſtory, the ſerpent was a robber, who haunting the country about Delphos, and very much infeſting thoſe who came thither to ſacrifice; a prince, who bore the name of Apollo, or one of the prieſts of that god put him to death.

This event gave riſe to the inſtitution of the Pythian games, ſo frequently mentioned in the Grecian hiſtory; and it was from the legend of Apollo's victory over the Python that the god himſelf acquired the name of *Pythius*, and his prieſteſs that of PYTHIA. The city of Delphos, where the famous oracles were ſo long delivered, was frequently ſtyled *Pytho.*

As Apollo was the god of the fine arts, thoſe who cultivated them were called *his ſons*. Of this number was Philammon of Delphos, whom the poets and mythologiſts make the twin-brother of Autolychus, by the nymph Chione, and Apollo and Mercury. It is pretended that both theſe divinities were favoured by the nymph on the ſame day, and that their ſires were known from their different talents. Philammon, a great poet and muſician, was reported to be the offspring of the god who preſides over thoſe arts; and Autolychus, from the craftineſs and ſubtility of his diſpoſition, was ſaid to have ſprung from Mercury, god of theft and fraud. Philammon is one of the firſt, after Apollo, upon fabulous record, as a vocal performer, who accompanied himſelf with the ſound of the lyre: his ſon was the celebrated Thamyris. See THAMYRIS.

There can be no doubt but that Apollo was more generally revered in the Pagan world than any other deity; having, in almoſt every region of it, temples, oracles, and feſtivals, as innumerable as his attributes: the wolf and hawk were conſecrated to him, as ſymbols of his piercing eyes; the crow and the raven, becauſe theſe birds were ſuppoſed to have by inſtinct the faculty of prediction; the laurel, from a perſuaſion that thoſe who ſlept with ſome branches of that tree under their heads received certain vapours, which enabled them to propheſy. The cock was conſecrated to him, becauſe by his crowing he announces the riſing of the ſun; and the graſshopper on account of his ſinging faculty, which was ſuppoſed to do honour to the god of muſic. Moſt of the ancient poets have celebrated this tuneful inſect, but none better than Anacreon, Ode 43.

Plato ſays that the graſshopper ſings all ſummer without food, like thoſe men who, dedicating themſelves to the muſes, forget the common concerns of life.

The ſwan was regarded by the ancients as a bird ſacred to Apollo in two capacities; firſt, as being, like the crow and raven, gifted with the ſpirit of prediction; and, ſecondly, for his extraordinary vocal powers. The ſweetneſs of his ſong, eſpecially at the approach of death, was not only extolled by all the poets of antiquity, but by hiſtorians, philoſophers, and ſages; and to call a great writer the *ſwan* of his age and nation, was a full acknowledgment of his ſovereignty*. Thus Horace calls Pindar *the Theban ſwan.*

Plutarch, who was himſelf a prieſt of Apollo, impreſſed with the higheſt reſpect and veneration for him and for muſic, in his dialogue upon that art, makes one of his interlocutors ſay, that an invention ſo uſeful and charming could never have been the work of man, but muſt have originated from ſome god, ſuch as Apollo, the inventor of the flute and lyre, improperly attributed to Hyagnis. Marſyas, Olympus, and others; and the proofs he urges in ſupport of this aſſertion, ſhow, if not its truth, at leaſt that it was the common and received opinion.

All dances and ſacrifices, ſays he, uſed in honour of Apollo, are performed to the ſound of flutes: the ſtatue of this god at Delos, erected in the time of Hercules, had in its right-hand a bow; and on the left ſtood the three graces, who were furniſhed with three kinds of inſtruments; the lyre, the flute, and the ſyrinx. The youth alſo, who carries the laurel of Tempe to Delphos, is accompanied by one playing on the flute; and the ſacred preſents formerly ſent to Delos by the Hyperboreans, were conducted thither to the ſound of lyres, flutes, and ſhepherds pipes. He ſupports theſe facts by the teſtimonies of the poets Alcæus, Alcmon, and Corinna.

It ſeems as if the account of Apollo could not be concluded by any thing that is left to offer on the ſubject, ſo properly, as by part of the celebrated hymn of Callimachus, which during many ages was performed and heard by the moſt poliſhed people on the globe, with the utmoſt religious zeal, at the feſtivals inſtituted to this god.

Ha! how the laurel, great APOLLO's tree,
And all the cavern, ſhakes! Far off, far off,
The man that is unhallow'd: for the god
Approaches. Hark! he knocks: the gates
Feel the glad impulſe; and the ſever'd bars
Submiſſive clink againſt their brazen portals.
Why do the Delian palms incline their boughs,
Self-mov'd; and hov'ring ſwans, their throats releas'd
From native ſilence, carol ſounds harmonious?
  Begin, young men, the hymn: let all your harps
Break their inglorious ſilence; and the dance,
In myſtic numbers trod, explain the muſic.
But firſt by ardent pray'r, and clear luſtration,
Purge the contagious ſpots of human weakneſs:
Impure no mortal can behold Apollo.
So may you flouriſh, favour'd by the god,
In youth with happy nuptials, and in age
With ſilver hairs, and fair deſcent of children;
So lay foundations for aſpiring cities,
And bleſs your ſpreading colonies' increaſe.
  Pay ſacred rev'rence to Apollo's ſong;
Leſt watchful the far-ſhouting god emit
His fatal arrows. Silent, Nature ſtands;
And ſeas ſubſide, obedient to the ſound
Of Io! Io Pæan! nor dares Thetis
Longer bewail her lov'd Achilles' death;

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* See the article *Anac*

For Phœbus was his foe. Nor muſt ſad Niobe
In fruitleſs ſorrow perſevere, or weep
Even thro' the Phrygian marble. Hapleſs mother!
Whoſe fondneſs could compare her mortal offspring
To thoſe which fair Latona bore to Jove.
Io! again repeat ye, Io Pæan!
Recite Apollo's praiſe till night draws on,
The ditty ſtill unfiniſh'd; and the day
Unequal to the godhead's attributes
Various, and matter copious of your ſongs.
Sublime at Jove's right-hand Apollo ſits,
And thence diſtributes honour, gracious king,
And theme of verſe perpetual. From his robe
Flows light ineffable! his harp, his quiver,
And Lactian bow, are gold: with golden ſandals
His feet are ſhod. How rich! how beautiful!
Beneath his ſteps the yellow min'ral riſes;
And earth reveals her treaſures. Youth and beauty
Eternal deck his cheek: from his fair head
Perfumes diſtil their ſweets; and cheerful Health,
His duteous hand-maid, through the air improv'd
With laviſh hand diffuſes ſcent ambroſial.
The ſpearman's arm by thee, great god, directed,
Sends forth a certain wound. The laurel'd bard,
Inſpir'd by thee, compoſes verſe immortal.
Taught by thy art divine, the ſage phyſician
Eludes the urn, and chains or exiles death.
Perpetual fires ſhine hallow'd on thy altars,
When annual the Carnean feaſt is held:
The warlike Libyans, clad in armour, lead
The dance; with clanging ſwords and ſhields they beat
The dreadful meaſure: In the chorus join
Their women; brown, but beautiful: ſuch rites
To thee well pleaſing ——————
—————— The monſtrous Python
Durſt tempt thy wrath in vain; for dead he fell,
To thy great ſtrength and golden arms unequal.
Io! while thy unerring hand elanc'd
Another and another dart, the people
Joyfully repeated *Io! Io Pæan!*
Elance the dart, Apollo; for the ſafety
And health of man, gracious thy mother bore thee!

Prior.

Apollo-Belvidere, one in the firſt claſs of the ancient ſtatues. The excellence of this ſtatue conſiſts in the expreſſion of ſomething divine, whereas the reſt excel only in things that are common to men. This ſtatue may perhaps juſtly enough claim the preference, even in the ſuperior and diſtinguiſhed claſs of the beſt remains of all antiquity. There are about twenty ancient ſtatues which the moderns have diſcovered that are referred to the firſt claſs, and conſidered each as the chief beauty in its kind.

APOLLODORUS, born at Damaſcus, a famous architect under Trajan and Hadrian. He had the direction of the bridge of ſtone which Trajan ordered to be built over the Danube in the year 104, which was eſteemed the moſt magnificent of all the works of that emperor. Hadrian, one day as Trajan was diſcourſing with this architect upon the buildings he had raiſed at Rome, would needs give his judgment, and ſhowed he underſtood nothing of the matter. Apollodorus turned upon him bluntly, and ſaid to him, Go paint citruls, for you are very ignorant of the ſubject we are talking upon. Hadrian at this time boaſted of his painting citruls well. This inſult coſt Apollodorus his life.

Apollodorus, a celebrated painter of Athens, about 408 years before the birth of Chriſt, was the firſt who invented the art of mingling the colours, and of expreſſing the lights and ſhades. He was admired alſo for his judicious choice of ſubjects, and for the beauty and ſtrength of colouring ſurpaſſed all the maſters that went before him. He excelled likewiſe in ſtatuary.

Apollodorus the Athenian, a famous grammarian, the ſon of Aſclepiades and diſciple of Ariſtarchus. He wrote many works not now extant; but his moſt famous production was his Bibliotheca, concerning the origin of the gods. This work conſiſted of 24 books, but only three are now in being. Several other pieces of his are to be found in Fabricius's *Bibliotheca Græca*. There were various other perſons of this name. Scipio Teſti, a Neapolitan, has written a treatiſe of the Apollodoruſes, which was printed at Rome in 1555; and Dr Thomas Gale publiſhed a work of the ſame kind in 1675.

APOLLONIA, the name of ſeveral ancient cities, particularly of a colony of the Mileſians in Thrace, from which Lucullus took away a coloſſus of Apollo, and placed in the capitol. The greateſt part of the town was ſituated in a ſmall iſland on the Euxine, in which was a temple of Apollo (Strabo). Pliny ſays the coloſſus was 30 cubits high, and coſt 500 talents. There was alſo an Apollonia at mount Parnaſſus, near Delphi. (Stephanus). Troezen was formerly called *Apollonia*.

Apollonia, feaſts ſacred to Apollo, inſtituted upon the following occaſion. Apollo, having vanquiſhed Python, went with his ſiſter Diana to Ægialea; but, being driven from thence, he removed to the iſland Crete. The Ægialeans were ſoon after viſited with a plague; upon which, conſulting the ſoothſayers, they were ordered to ſend ſeven young men and as many virgins, to appeaſe thoſe deities and bring them back into their country. Apollo and Diana being thus appeaſed, returned to Ægialea: in memory of which, they dedicated a temple to Pitho, the *goddeſs of perſuaſion*; whence a cuſtom aroſe of chooſing every year ſeven young men, and as many virgins, to go as it were in ſearch of Apollo and Diana.

Apollonia, in geography, a promontory of Africa, upon the coaſt of Guinea, near the mouth of the river Mancu.

APOLLONIUS, the author of the *Argonautics*, and ſurnamed *The Rhodian*, from the place of his reſidence, is ſuppoſed to have been a native of Alexandria, where he is ſaid to have recited ſome portion of his poem while he was yet a youth. Finding it ill received by his countrymen, he retired to Rhodes; where he is conjectured to have poliſhed and completed his work, ſupporting himſelf by the profeſſion of rhetoric, and receiving from the Rhodians the freedom of their city. He at length returned, with conſiderable honour, to the place of his birth; ſucceeding Eratoſthenes in the care of the Alexandrian library in the reign of Ptolemy Euergetes, who aſcended the throne of Egypt the year before Chriſt 246. That prince had been educated by the famous Ariſtarchus, and rivalled the preceding ſovereigns of his liberal family in the munificent encouragement of learning. Apollonius was a diſciple of the poet Callimachus; but their connection ended in the moſt violent enmity, which was probably owing to ſome degree of contempt expreſſed by Apollonius for the light compoſitions of his maſter. The learned have vainly endeavoured to diſcover the particulars of their quarrel.—The only work of Apollonius which has deſcended to modern times is his poem above-mentioned, in four books, on the Argonautic expedition. Both Longinus and Quintilian have aſſigned to this work the mortifying character of mediocrity: "But (ſays Mr Hayley) there lies an appeal from the ſentence of the moſt candid and enlightened critics to the voice of Nature; and the merit of Apollonius has little to apprehend from the deciſion of this ultimate judge. His poems abound in animated deſcription, and in paſſages of the moſt tender and pathetic beauty. How finely painted is the firſt ſetting forth of the Argo! and how beautifully is the wife of Chiron introduced, holding up the little Achilles in her arms, and ſhowing him to his father Peleus as he ſailed along the ſhore! But the chief excellence in our poet, is the ſpirit and delicacy with which he has delineated the paſſion of love in his Medea. That Virgil thought very highly of his merit in this particular, is ſufficiently evident from the minute exactneſs with which he has copied many tender touches of the Grecian poet. Thoſe who compare the third book of Apollonius with the fourth of Virgil, may, I think, perceive not only that Dido has ſome features of Medea, but that the two bards, however different in their reputation, reſembled each other in their genius; and they both excel in delicacy and pathos."—The ancient ſcholia upon his *Argonautics*, ſtill extant, are extremely uſeful, and full of learning.

APOLLONIUS of Perga, a city of Pamphylia, was a great geometrician, under the reign of Ptolemy Euergetes, which reaches from the 2d year of the 133d Olympiad to the 3d year of the 139th. He ſtudied a long time at Alexandria, under the diſciples of Euclid; and compoſed ſeveral works, of which that only of the Conics remains.

APOLLONIUS, a Pythagorean philoſopher, born at Tyana in Cappadocia, about the begining of the firſt century. At 16 years of age he became a ſtrict obſerver of Pythagoras's rules, renouncing wine, women and all ſorts of fleſh; not wearing ſhoes, letting his hair grow, and wearing nothing but linen. He ſoon after ſet up for a reformer of mankind, and choſe his habitation in a temple of Æſculapius, where he is ſaid to have performed many wonderful cures. Philoſtratus has wrote the life of Apollonius, in which there are numberleſs fabulous ſtories recounted of him. We are told that he went five years without ſpeaking; and yet during this time, that he ſtopped many ſeditions in Cicilia and Pamphylia: that he travelled, and ſet up for a legiſlator; and that he gave out he underſtood all languages, without having ever learned them: that he could tell the thoughts of men, and underſtood the oracles which birds gave by their ſinging. The Heathens were fond of oppoſing the pretended miracles of this man to thoſe of our Saviour; and by a treatiſe which Euſebius wrote againſt one Hierocles, we find that the drift of the latter, in the treatiſe which Euſebius refutes, ſeems to have been to draw a parallel betwixt Jeſus Chriſt and Apollonius, in which he gives the preference to this philoſopher. Mr Du Pin has wrote a confutation of Philoſtratus's life of Apollonius.

Apollonius wrote ſome works; viz. four books of Judicial aſtrology; a treatiſe upon the ſacrifices, ſhowing what was proper to be offered to each diety; and a great number of letters; all of which are now loſt.

APOLLOS, in Scripture-hiſtory, a Jew of Alexandria, who came to Epheſus during the abſence of St Paul, who was gone to Jeruſalem (Acts xviii. 24.) Apollos was an eloquent man, and well verſed in the Scriptures; and as he ſpoke with zeal and fervour, he taught diligently the things of God: but knowing only the baptiſm of John, he was no more than a catechumen, or one of the loweſt order of Chriſtians, and did not as yet diſtinctly know the myſteries of the Chriſtian doctrine. However, he knew that Jeſus Chriſt was the Meſſiah, and declared himſelf openly to be his diſciple. When therefore he was come to Epheſus, he began to ſpeak boldly in the ſynagogue, and to ſhow that Jeſus was the Chriſt. Aquila and Priſcilla having heard him, took him home with them; inſtructed him more fully in the ways of God; and baptized him, probably in the name of Jeſus Chriſt.

Some time after this he had a mind to go into Achaia; and the brethren having exhorted him to undertake this journey, they wrote to the diſciples, deſiring them to receive him. He arrived at Corinth; and was there very uſeful in convincing the Jews out of the Scriptures, and demonſtrated to them that Jeſus was the Chriſt. Thus he watered what St Paul had planted in this city (1 Cor. iii. 6.): but the great fondneſs which his diſciples had for his perſon had like to have produced a ſchiſm; ſome "ſaying, I am of Paul; others, I am of Apollos, I am of Cephas." However, this diviſion, which St Paul ſpeaks of in the chapter laſt quoted, did not prevent that apoſtle and Apollos from being cloſely united by the bands of charity. Apollos hearing that the Apoſtle was at Epheſus, went to meet him, and was there when St Paul wrote the firſt epiſtle to the Corinthians; wherein he teſtifies, that he had earneſtly entreated Apollos to return to Corinth, but hitherto had not been able to prevail with him; that, nevertheleſs, he gave him room to hope that he would go when he had an opportunity. St Jerom ſays, that Apollos was ſo diſſatisfied with the diviſion which had happened upon his account at Corinth; that he retired into Crete with Zena, a doctor of the law; and that this diſturbance having been appeaſed by the letter which St Paul wrote to the Corinthians, Apollos returned to this city, and was biſhop thereof. The Greeks make him biſhop of Duras; others ſay, he was biſhop of Iconium in Phrygia; and others, that he was biſhop of Cæſarea.

APOLLYON, a Greek word that ſignifies *the deſtroyer*, and anſwers to the Hebrew *Abaddon*. St John in the Revelations (ix. 11.) ſays, that an angel having opened the bottomleſs pit, a thick ſmoke iſſued out of it; and with this ſmoke locuſts, like horſes, prepared for battle, and commanded by the angel of the bottomleſs pit, called in Hebrew *Abaddon*, but in the Greek *Apollyon*.

APOLOGETIC, APOLOGETICAL, ſomething ſaid or written, by way of excuſe or apology, for any action or perſon.

The Apologetic of Tertullian is a work full of ſtrength and ſpirit. He there vindicates the Chriſtians from all that had been objected to them; particularly from the abominable crimes ſaid to be perpetrated at their meetings, and their want of love and fidelity to their country. The ground of this laſt accuſation was, their refuſing to take the accuſtomed oaths, and ſwear by the tutelary gods of the empire.—Tertullian addreſſes

dreſſes his Apologetic to the magiſtrates of Rome, the emperor Severus being then abſent.

APOLOGUE, in matters of literature, an ingenious method of conveying inſtruction by means of a feigned relation called a *moral fable*.

The only difference between a parable and an apologue is, that the former, being drawn from what paſſes among mankind, requires probability in the narration; whereas the apologue, being taken from the ſuppoſed actions of brutes, or even of things inanimate, is not tied down to the ſtrict rules of proprobability. Æſop's fables are a model of this kind of writing.

APOLOGY, a Greek term, literally importing an excuſe or defence of ſome perſon or action.

APOMELI, among ancient phyſicians, a decoction of honey and vinegar, much uſed as a detergent, promoter of ſtool, urine, &c.

APOMYOS DEUS, (*απο*, and *μυια fly*,) in the Heathen mythology, a name under which Jupiter was worſhipped at Elis, and Hercules as well as Jupiter at the Olympic games. Theſe deities were ſupplicated under this name, to deſtroy or drive away the vaſt number of flies which always attended at the great ſacrifices; and in thoſe which accompanied the Olympic games, the firſt was always to the Apomyos, or Myiagrus, Deus, that he might drive away the flies from the reſt. The uſual ſacrifice was a bull.

APONEUROSIS, among phyſicians, a term ſometimes uſed to denote the expanſion of a nerve or tendon in the manner of a membrane; ſometimes for the cutting off a nerve; and, finally, for the tendon itſelf.

APONO (Peter d'), one of the moſt famous philoſophers and phyſicians of his age, born in the year 1250, in a village about four miles from Padua. He ſtudied ſome time at Paris, and was there promoted to the degree of doctor in philoſophy and phyſic. When he came to practiſe as a phyſician, he is ſaid to have inſiſted on very large ſums for his viſits: we are not told what he demanded for the viſits he made in the place of his reſidence; but it is affirmed, that he would not attend the ſick in any other place under 150 florins a-day; and when he was ſent for by Pope Honorius IV. he demanded 400 ducat's for each day's attendance. He was ſuſpected of magic, and proſecuted by the Inquiſition on that account. "The common opinion of almoſt all authors (ſays Naude) is, that he was the greateſt magician of his age; that he had acquired the knowledge of the ſeven liberal arts, by means of the ſeven familiar ſpirits, which he kept incloſed in a cryſtal; and that he had the dexterity to make the money he had ſpent come back into his purſe." The ſame author adds, that he died before the proceſs againſt him was finiſhed, being then in the 80th year of his age; and that, after his death, they ordered him to be burnt in effigy, in the public place of the city of Padua: deſigning thereby to ſtrike a fear into others of incurring the like puniſhment; and to ſuppreſs the reading three books which he had wrote; the firſt being the Heptameron, which is printed at the end of the firſt volume of Agrippa's work; the ſecond, that which is called by Trithemius, *Elucidarium necromanticum Petri de Albano*; and the laſt, that which is intitled by the ſame author, *Liber experimentorum mirabilium de annulis ſecundum xxviii. manſiones lunæ.* His body being ſecretly taken up by his friends, eſcaped the vigilance of the inquiſitors, who would have burnt it. It was removed ſeveral times, and was at laſt placed in the church of St Auguſtin, without an epitaph or any mark of honour. The moſt remarkable book which Apono wrote, was that which procured him the ſirname of *Conciliator*; he wrote alſo a piece intitled *De medicina omnimoda*. There is a ſtory told of him, that, having no well in his houſe, he cauſed his neighbour's to be carried into the ſtreet by devils, when he heard they had forbidden his maid fetching water there. He had much better (ſays Mr Bayle) have employed the devils to make a well in his own houſe, and have ſtopped up his neighbour's; or, at leaſt, tranſported it into his houſe, rather than into the ſtreet.

APONOGETON: A genus of the digynia order, belonging to the heptandria claſs of plants, which has no Engliſh name. The calyx is an oblong omentum; there is no corolla; and the capſulæ are three-ſeeded. There are two ſpecies, natives of the Indies.

APONUS, a hamlet near Patavium, with warm baths. It was the birth-place of Livy, (Martial); and is now called *Albano*. E. Long. 10. N. Lat. 45. 15.

APOPEMPTIC, in the ancient poetry, a hymn addreſſed to a ſtranger on his departure from a place to his own country. The ancients had certain holidays, wherein they took leave of the gods with *apopemptic* ſongs, as ſuppoſing them returning each to his own country. The deities having the patronage of divers places, it was but juſt to divide their preſence, and allow ſome time to each. Hence it was, that among the Delians and Mileſians we find feaſts of Apollo, and among the Argians feaſts of Diana, called *Epidemiæ*, as ſuppoſing theſe deities then more peculiarly reſident among them. On the laſt day of the feaſt they diſmiſſed them, following them to the altars with *apopemptic* hymns.

APOPHASIS, a figure in rhetoric, by which the orator, ſpeaking ironically, ſeems to wave what he would plainly inſinuate: as, *Neither will I mention thoſe things, which, if I ſhould, you notwithſtanding could neither confute nor ſpeak againſt them.*

APOPHLEGMATIZANTS, in pharmacy, medicines proper to clear the head from ſuperfluous phlegm, whether by ſpitting or by the noſe.

APOPHTHEGM, a ſhort, ſententious, and inſtructive remark, pronounced by a perſon of diſtinguiſhed character. Such is that of Cyrus: *He is unworthy to be a magiſtrate, who is not better than his ſubjects.* Or this: *He that will not take care of his own buſineſs, will be forced to take care of that of others.* Or that of Artaxerxes Mnemon, when reduced to hunger by the loſs of his baggage: *How much pleaſure have I hitherto lived a ſtranger to?* Or that of Cato, *Homines nihil agendo diſcunt male agere.* Or, finally, that of Auguſtus, *Feſtina lente.* The apophthegms of Plutarch are well known.

APOPHYGE, in architecture, a concave part or ring of a column, lying above or below the flat member. The French call it *le congé d'en bas*, or *d'en haut*: the Italians, *cavo di baſſo*, or *di ſopra*; and alſo *il vivo di baſſo*. The apophyge originally was no more than the ring or ferril, at firſt fixed on the extremities of wooden pillars, to keep them from ſplitting; which afterwards was imitated in ſtone.

APOPHYSIS, in anatomy, a proceſs or protuberance of a bone. See ANATOMY.

APOPLEXY, a diſtemper in which the patient is ſuddenly deprived of all his ſenſes, and of voluntary motion. See MEDICINE-*Index.*

APORIA, is a figure in rhetoric, by which the ſpeaker ſhows, that he doubts where to begin for the multitude of matter, or what to ſay in ſome ſtrange and ambiguous thing; and doth, as it were, argue the caſe with himſelf. Thus Cicero ſays, *Whether he took them from his fellows more impudently, gave them to a harlot more laſciviouſly, removed them from the Roman people more wickedly, or altered them more preſumptuouſly, I cannot well declare.*

APORON, or APORIME, a problem difficult to reſolve, and which has never been reſolved, though it be not, in itſelf, impoſſible.

The word is derived from αϖορος, which ſignifies ſomething very difficult, and impracticable; being formed from the privative α and ϖορος, *paſſage.* Such we conceive the quadrature of the circle; the duplicature of the cube; the triſection of an angle, &c. When a queſtion was propoſed to any of the Greek philoſophers, eſpecially of the ſect of Academiſts; if he could not give a ſolution, his anſwer was, Αϖορεω, *I cannot ſee through it.*—This word is alſo uſed by ſome law writers for an inexplicable ſpeech or diſcourſe.

APOSIOPESIS, in rhetoric, otherwiſe called *reticency*, and *ſuppreſſion;* a figure, by which a perſon really ſpeaks of a thing, at the ſame time that he makes a ſhow as if he would ſay nothing of it. The word comes from αϖοσιωϖαω, *I am ſilent.*—It is commonly uſed to denote the ſame with ELLIPSIS. Jul. Scaliger diſtinguiſhes them. The latter, according to him, being only the ſuppreſſion of a word; as, *me, me; adſum qui feci:* the former: the omitting to relate ſome part of the action; as,

> *Dixerat, atque illam media inter talia ferro*
> *Collapſam adſpiciunt*——————

where the poet does not mention how Dido killed herſelf.—This figure is of uſe to keep up the grandeur and ſublimity of a diſcourſe.

APOSPHRAGISMA, (from αϖω σφραγιζω, *I ſeal,*) in antiquity, the figure and impreſſion of a ſeal.—It was forbid among the ancients to have the figure or image of God on their rings and ſeals. To this purpoſe the precept of Pythagoras, Εν δακτυλιω εικονα Θεȣ μη ϖεριφερειν! But in proceſs of time, this was little regarded; it was uſual enough to have the figures of Egyptian and other deities, as well as of heroes, monſters, friends, anceſtors, and even brutes, on their *dactyli*, or ring-ſeals. Thus Cæſar had the image of Venus, Pollio of Alexander, Auguſtus of the *ſphinx*, Pompey of a frog, Lentulus of his grandfather, &c.

APOSTACY, the abandoning the true religion. The primitive Chriſtian church diſtinguiſhed ſeveral kinds of apoſtacy. The firſt, of thoſe who went over entirely from Chriſtianity to Judaiſm; the ſecond, of thoſe who mingled Judaiſm and Chriſtianity together; and the third, of thoſe who complied ſo far with the

Jews as to communicate with them in many of their unlawful practices, without making a formal profeſſion of their religion. But the fourth ſort was of thoſe who, after having been ſome time Chriſtians, voluntarily relapſed into Paganiſm.

The perverſion of a Chriſtian to Judaiſm, Paganiſm or other falſe religions, was puniſhed by the emperors Conſtantius and Julian with confiſcation of goods, to which the emperors Theodoſius and Valentinian added capital puniſhment, in caſe the apoſtate endeavoured to pervert others to the ſame iniquity. A puniſhment too ſevere for any temporal laws to inflict; and yet the zeal of our anceſtors imported it into this country; for we find by Bracton, that in his time apoſtates were to be burnt to death. Doubtleſs the preſervation of Chriſtianity, as a national religion, is, abſtracted from its own intrinſic truth, of the utmoſt conſequence to the civil ſtate: which a ſingle inſtance will ſufficiently demonſtrate. The belief of a future ſtate of rewards and puniſhments, the entertaining juſt ideas of the moral attributes of the ſupreme Being, and a firm perſuaſion that he ſuperintends and will finally compenſate every action in human life (all which are clearly revealed in the doctrines and forcibly inculcated by the precepts, of our ſaviour Chriſt), theſe are the grand foundation of all judicial oaths; which call God to witneſs the truth of thoſe facts, which perhaps may be only known to him and the party atteſting: all moral evidence therefore, all confidence in human veracity, muſt be weakened by apoſtacy, and overthrown by total infidelity. Wherefore all affronts to Chriſtianity, or endeavours to depreciate its efficacy, in thoſe who have once profeſſed it, are highly deſerving of cenſure. But yet the loſs of life is a heavier penalty than the offence, taken in a civil light, deſerves; and, taken in a ſpiritual light, our laws have no juriſdiction over it. This puniſhment, therefore, has long ago become obſolete; and the offence of apoſtacy was for a long time the object only of the eccleſiaſtical courts, which corrected the offender *pro ſalute animæ.* But about the cloſe of the laſt century, the civil liberties to which we were then reſtored being uſed as a cloke of malicionſneſs, and the moſt horrid doctrine ſubverſive of all religion being publicly avowed both in diſcourſe and writings, it was thought neceſſary again for the civil power to interpoſe, by not admitting thoſe miſcreants to the privileges of ſociety, who maintained ſuch principles as deſtroyed all moral obligation. To this end it was enacted by ſtatute 9 and 10 W. III. c. 32. That if any perſon educated in, or having made profeſſion of, the Chriſtian religion, ſhall by writing, printing teaching, or adviſed ſpeaking, deny the Chriſtian religion to be true, or the holy Scriptures to be of divine authority, he ſhall upon the firſt offence be rendered incapable to hold any office or place of truſt; and, for the ſecond, be rendered incapable of bringing any action, or of being guardian, executor, legatee, or purchaſer of lands, and ſhall ſuffer three years impriſonment without bail. To give room however for repentance, if, within four months after the firſt conviction, the delinquent will in open court publicly renounce his error, he is diſcharged for that once from all diſabilities.

APOSTASIS, in medicine, the ſame with abſceſs.

APOSTATE, one who deſerts his religion. Among the Romaniſts, it ſignifies a man who, without a legal diſpenſation, forſakes a religious order of which he had made profeſſion. Hence,

APOSTATA capiendo, in the Engliſh law, a writ that formerly lay againſt a perſon who, having entered into ſome order of religion, broke out again, and wandered up and down the country.

A POSTERIORI, or demonſtration *à poſteriori*. See Demonstration.

APOSTIL, in matters of literature, the ſame with a marginal note.

APOSTLE properly ſignifies a meſſenger or perſon ſent by another upon ſome buſineſs; and hence, by way of eminence, denotes one of the diſciples commiſſioned by Jeſus Chriſt to preach the goſpel.

Our bleſſed Lord ſelected twelve out of the number of his diſciples to be inveſted with the apoſtleſhip. Their names were Simon Peter, Andrew, James the greater, John, Philip, Bartholomew, Thomas, Matthew, James the leſs, Jude ſirnamed Lebbeus or Thaddeus, Simon the Canaanite, and Judas Iſcariot. Of theſe Simon, Andrew, James the greater, and John, were fiſhermen; and Matthew a publican, or receiver of the public revenues: of what profeſſion the reſt were, we are not told in ſcripture; though it is probable they were fiſhermen.

There are various conjectures as to the reaſon of our Saviour's making choice of *twelve* apoſtles. The moſt probable is, that it might be an alluſion to the twelve patriarchs, as the founders of their ſeveral tribes; or to the twelve chief heads or rulers of thoſe tribes, of which the body of the Jewiſh nation conſiſted. This opinion ſeems to be countenanced by what our Saviour tells his apoſtles, that "when the Son of man ſhall ſit in the throne of his glory, *they* alſo ſhall ſit upon twelve thrones judging the twelve tribes of Iſrael."

Our Lord's firſt commiſſion to his apoſtles was in the third year of his public miniſtry, about eight months after their ſolemn election; at which time he ſent them out by two and two. They were to make no proviſion of money for their ſubſiſtence in their journey, but to expect it from thoſe to whom they preached. They were to declare, that the kingdom of heaven, or the Meſſiah, was at hand; and to confirm their doctrine by miracles. They were to avoid going either to the Gentiles or to the Samaritans, and to confine their preaching to the people of Iſrael. In obedience to their Maſter, the apoſtles went into all the parts of Paleſtine inhabited by the Jews, preaching the goſpel, and working miracles. The evangelical hiſtory is ſilent as to the particular circumſtances attending this firſt preaching of the apoſtles; and only informs us, that they returned, and told their Maſter of all that they had done.

Their ſecond commiſſion, juſt before our Lord's aſcenſion into heaven, was of a more extenſive and particular nature. They were now not to confine their preaching to the Jews, but to "go and teach ALL nations, baptizing them in the name of the Father, and of the Son, and of the Holy Ghoſt." Accordingly they began publicly, after our Lord's aſcenſion, to exerciſe the office of their miniſtry, working miracles daily in proof of their miſſion, and making great numbers of coverts to the Chriſtian faith. This alarmed the Jewiſh Sanhedrim; whereupon the apoſtles were apprehended, and, being examined before the high prieſt and elders, were commanded not to preach any more in the name of Chriſt. But this injunction did not terrify them from perſiſting in the duty of their calling; for they continued daily, in the temple, and in private houſes, teaching and preaching the goſpel.

After the apoſtles had exerciſed their miniſtry for twelve years in Paleſtine, they reſolved to diſperſe themſelves in different parts of the world, and agreed to determine by lot what parts each ſhould take. According to this diviſion, St Peter went into Pontus, Galatia, and thoſe other provinces of the Leſſer Aſia. St Andrew had the vaſt northern countries of Scythia and Sogdiana allotted to his portion. St John's was partly the ſame with Peter's, namely, the Leſſer Aſia. St Philip had the Upper Aſia aſſigned to him, with ſome parts of Scythia and Colchis. Arabia Felix fell to St Bartholomew's ſhare. St Matthew preached in Chaldæa, Perſia, and Parthia. St Thomas peached likewiſe in Parthia; as alſo to the Hyrcanians, Bactrians, and Indians. St James the leſs continued in Jeruſalem, of which church he was biſhop. St Simon had for his portion Egypt, Cyrene, Libya, and Mauritania; St Jude Syria and Meſopotamia; and St Matthias, who was choſen in the room of the traitor Judas, Cappadocia and Colchis. Thus, by the diſperſion of the apoſtles, Chriſtianity was very early planted in a great many parts of the world. We have but very ſhort and imperfect accounts of their travels and actions.

In order to qualify the apoſtles for the arduous taſk of converting the world to the Chriſtian religion, they were in the firſt place, miraculouſly enabled to ſpeak the languages of the ſeveral nations to whom they were to preach: and, in the ſecond place, were endowed with the power of working miracles, in confirmation of the doctrines they taught; gifts which were unneceſſary, and therefore ceaſed, in the after ages of the church, when Chriſtianity came to be eſtabliſhed by the civil power.

St Paul is frequently called the *apoſtle*, by way of eminence; and the *apoſtle of the Gentiles*, becauſe his miniſtry was chiefly made uſe of for the converſion of the Gentile world, as that of St Peter was for the Jews, who is therefore ſtiled the *apoſtle of the circumciſion*. The ſeveral apoſtles are uſually repreſented with their reſpective badges or attributes; St Peter with the keys; St Paul with a ſword; St Andrew with a croſs or ſaltier; St James minor with a fuller's pole; St John with a cup, and winged ſerpent flying from it; St Bartholomew with a knife; St Philip with a long ſtaff, whoſe upper end is formed into a croſs; St Thomas with a lance; St Matthew with a hatchet; St Matthias with a battle-ax; St James major with a pilgrim's ſtaff and a gourd-bottle; St Simon with a ſaw; and St Jude with a club.

This appellation was alſo given to the ordinary travelling miniſters of the church.—Thus St Paul, in the epiſtle to the Romans, xvi. 7. ſays, "Salute Andronicus and Junia, my kinſmen and fellow priſoners, who are of note among the apoſtles." It was likewiſe a title given to thoſe ſent by the churches to carry their alms to the poor of other churches. This uſage they borrowed from the ſynagogues, who called thoſe whom they ſent on this meſſage by the ſame name; and the function or office itſelf αποϛολη, *apoſtole*, q. d. *miſſion.* Thus St. Paul, writing to the Philippians, tells them, that Epaphroditus their apoſtle had miniſtered to his wants, ch. ii. 25.

The appellation is given in like manner to thoſe perſons who firſt planted the Chriſtian faith in any place. Thus Dionyſius of Corinth is called the *apoſtle of France;* Xavier, the *apoſtle of the Indies*, &c. In the Eaſt Indies the Jeſuit miſſionaries are alſo called *apoſtles.*

Apostle is alſo uſed among the Jews for a kind of officer anciently ſent into the ſeveral parts and provinces in their juriſdiction, by way of viſitor or commiſſary, to ſee that the laws were duly obſerved, and to receive the monies collected for the reparation of the temple, and the tribute payable to the Romans. The Theodoſian code, lib. xiv. *De Judæis*, calls thoſe *apoſtoli, qui ad exigendum aurum atque argentum a patriarcha certo tempore diriguntur.* Julian the apoſtate remitted the Jews the *apoſtole*, αποϛολη; that is, as he himſelf explains it, the tribute they had been accuſtomed to ſend him. Theſe apoſtles were a degree below the officers of the ſynagogues called *patriarchs*, and received their commiſſions from them. Some authors obſerve, that St Paul had borne this office; and that it is this he alludes to in the beginning of the epiſtle to the Galatians: as if he had ſaid, Paul, no longer an apoſtle of the ſynagogue, nor ſent thereby to maintain the law of Moſes, but now an apoſtle and envoy of Jeſus Chriſt, &c. St Jerom, though he does not believe that St Paul had been an apoſtle of this kind, yet imagines that he alludes to it in the paſſage juſt cited.

Apostle, in the Greek liturgy, is particularly uſed for a book containing the epiſtles of St Paul, printed in the order wherein they are to be read in churches, through the courſe of the year. Another book of the like kind, containing the Goſpels, is called Ευαγγελιον, *Goſpel.*—The apoſtle, of late days, has alſo contained the other canonical epiſtles, the Acts of the Apoſtles, and the Revelations. Hence it is alſo called *Acts of the Apoſtles*, Πραξαποϛολος; that being the firſt book in it.

Apostle is alſo thought by many to have been the original name for biſhops, before the denomination *biſhop* was appropriated to their order. Thus Theodoret ſays expreſsly, the ſame perſons were anciently called promiſcuouſly both biſhops and preſbyters, whilſt thoſe who are now called biſhops were called *apoſtles.* In the arſenal of Bremen, there are twelve pieces of cannon called the *Twelve Apoſtles*, on a ſuppoſition that the whole world muſt be convinced, and acquieſce in the preaching of ſuch apoſtles.

Apostles' Creed: A *formula*, or ſummary, of the Chriſtian faith, drawn up, according to Ruffinus, by the apoſtles themſelves; who, during their ſtay at Jeruſalem, ſoon after our Lord's aſcenſion, agreed upon this *creed*, as a rule of faith, and as a *word of diſtinction* by which they were to know friends from foes. Baronius, and ſome other authors, conjecture, that they did not compoſe it till the ſecond year of the reign of Claudius, a little before their diſperſion. As to their manner of compoſing it, ſome fancy, that each apoſtle pronounced his article, which is the reaſon of its being called *ſymbolum apoſtolicum* it, being made up of ſentences jointly contributed, after the manner of perſons paying each their club (*ſymbolum*) or ſhare of a reckoning.

But there are reaſons which may induce us to queſtion whether the apoſtles compoſed any ſuch creed as this. For, firſt, neither St Luke in the Acts, nor any other eccleſiaſtical writer before the 5th century, make any mention of an aſſembly of the apoſtles in order to the compoſing of a creed. Secondly, the fathers of the three firſt centuries, in diſputing againſt heretics, endeavour to prove that the doctrine contained in this creed was the ſame which the apoſtles taught; but they never pretend that the apoſtles compoſed it. Thirdly, if the apoſtles had made this creed, it would have been the ſame in all churches, and in all ages; and all authors would have cited it after the ſame manner. But the caſe is quite otherwiſe. In the ſecond and third ages of the church, there were as many creeds as authors, and one and the ſame author ſets down the creed after a different manner in ſeveral places of his works; which is an evidence that there was not at that time any creed which was reputed to be the apoſtles'. In the 4th century, Ruffinus compares together the three ancient creeds of the churches of Aquileia, Rome, and the Eaſt, which differ very conſiderably in the terms. Beſides, theſe creeds differed not only in the terms and expreſſions, but even in the articles, ſome of which were omitted in one or other of them; ſuch as thoſe of the *deſcent into hell*, the *communion of the ſaints*, and the *life everlaſting.* From theſe reaſons it may be gathered, that tho' this creed may be ſaid to be that of the apoſtles in regard to the doctrines contained therein, yet it is not to be referred to them as the authors and firſt compoſers of it. Who was the true author of it, is not ſo eaſy to determine; though its great antiquity may be inferred from hence, that the whole form, as it now ſtands in the Engliſh liturgy, is to be found in the works of St Ambroſe and Ruffinus, the former of whom flouriſhed in the 3d century, and the latter in the 4th century.

The primitive Chriſtians, in regard they always concealed this and their other myſteries, did not publicly recite the creed, except at the times of baptiſm; which, unleſs in caſes of neceſſity, were only at Eaſter and Whitſuntide. The conſtant repeating it was not introduced into the church till the end of the 5th century; about which time Petrus Gnapheus, biſhop of Antioch, preſcribed the recital of it every time divine ſervice was performed.

APOSTOLARE, Apostolicare, *apoſtolizing*, in ſome middle-age writers, denotes the being preferred to the dignity of pope.

APOSTOLATE, in a general ſenſe, is uſed for miſſion. In this ſenſe, Olearius has a diſcourſe concerning the apoſtolate of Chriſt.

Apostolate more properly denotes the dignity or office of an apoſtle of Chriſt; but it is alſo uſed, in ancient writers, for the office of a biſhop. In this ſenſe we meet with ſeveral letters, petitions, requeſts, &c. directed to biſhops under the title of your *apoſtolate*, or *apoſtalatus veſter.* But as the title *apoſtolicus* had been appropriated to the pope, ſo that of *apoſtolate* became at length reſtrained to the ſole dignity of the popedom. Every biſhop's ſee was anciently dignified with the title of *ſedes apoſtolica*, an apoſtolical ſee, which is now the peculiar denomination of the ſee of Rome.

APOSTOLI, in a law, denote thoſe letters miſſive which are demanded in caſes of appeal.

APOSTOLIC, Apostolical, ſomething that relates to the apoſtles, or deſcends from them. Thus we ſay, the *apoſtolical* age, *apoſtolical* doctrine, *apoſtolical* character, conſtitutions, traditions, &c.

Apostolic, in the primitive church, was an appellation given to all ſuch churches as were founded by the apoſtles; and even to the biſhops of thoſe churches, as being the reputed ſucceſſors of the apoſtles. Theſe were confined to four, viz. Rome, Alexandria, Antioch, and Jeruſalem. In after-times, other churches aſſumed the ſame quality, on account, principally, of the conformity of their doctrine with that of the churches which were apoſtolical by foundation, and becauſe all biſhops held themſelves ſucceſſors of the apoſtles, or acted in their dioceſes with the authority of apoſtles.

The firſt time the term *apoſtolical* is attributed to biſhops, as ſuch, is in a letter of Clovis to the council of Orleans, held in 511, though that king does not there expreſsly denominate them *apoſtolical*, but (*apoſtolica ſede digniſſimi*) highly worthy of the apoſtolical ſee. In 581, Guntram calls the biſhops, met at the council of Maſon, *apoſtolical* pontiffs, *apoſtolici pontifices*.

In progreſs of time, the biſhop of Rome growing in power above the reſt, and the three patriarchates of Alexandria, Antioch, and Jeruſalem, falling into the hands of the Saracens, the title *apoſtolical* was reſtrained to the pope and his church alone. Though ſome of the popes, and St Gregory the Great, not contented to hold the title by this tenure, began, at length, to inſiſt, that it belonged to them by another peculiar right, as being the ſucceſſors of St Peter. The country of Rheims in 1049, declared that the pope was the ſole apoſtolical primate of the univerſal church. And hence a great number of apoſtolicals; *apoſtolical* ſee, *apoſtolical* nuncio, *apoſtolical* notary, *apoſtolical* brief, *apoſtolical* chamber, *apoſtolical* vicar, &c.

Apostolical Conſtitutions. See Constitution.

Apostolical Traditions. See Tradition.

Apostolical Fathers is an appellation uſually given to the writers of the firſt century who employed their pens in the cauſe of Chriſtianity. Of theſe writers, Cotelerius, and after him Le Clerc, have publiſhed a collection in two volumes, accompanied both with their own annotations and the remarks of other learned men.

APOSTOLIANS, a ſect of the Mennonites, which firſt ſprung up in the year 1664, and derived its name from Apoſtool, one of the Mennonite miniſters at Amſterdam. They concurred with them in doctrine, and admitted to their communion thoſe only who profeſſed to believe all the ſentiments which are contained in their public confeſſion of faith.

APOSTOLICI, or Apostolics, was a name aſſumed by three different ſects, on account of their pretending to imitate the manner and practice of the apoſtles. The firſt apoſtolici, otherwiſe called *Apotactitæ* and *Apotactici*, roſe out of the Encratitæ, and Cathari, in the third century. They made profeſſion of abſtaining from marriage, and the uſe of wine, fleſh, money, &c.

Gerhard Sagarelli was the founder of the ſecond ſect; he obliged his followers to go from place to place as the apoſtles did, to wander about cloathed in white, with long beards, diſhevelled hair, and bare heads, accompanied with women, whom they called their ſpiritual ſiſters. They likewiſe renounced all kinds of property and poſſeſſions, inveighed againſt the growing corruption of the church of Rome, predicted its overthrow, and the eſtabliſhment of a purer church on its ruins. Sagarelli was burnt alive at Parma in the year 1300, and was afterwards ſucceeded by Dulcinus, who added to the character of an apoſtle thoſe of a prophet and a general, and carried on a bloody and dreadful war for the ſpace of more than two years againſt Raynerius, biſhop of Vercelli; he was at length defeated, and put to death in a barbarous manner in the year 1307. Nevertheleſs, this ſect ſubſiſted in France, Germany, and in other countries, till the beginning of the fifteenth century, when it was totally extirpated under the pontificate of Boniface IX.

The other branch of apoſtolici were of the twelfth century. Theſe alſo condemned marriage, preferring celibacy, and calling themſelves the chaſte brethren and ſiſters; though each was allowed a ſpiritual ſiſter, with whom he lived in a domeſtic relation; and on this account they have been charged with concubinage: they held it unlawful to take an oath; they ſet aſide the uſe of baptiſm; and in many things imitated the Manichees. Bernard wrote againſt this ſect of apoſtolici.

APOSTOLICUM is a peculiar name given to a kind of ſong or hymn, anciently uſed in churches. The apoſtilicum is mentioned by Greg. Thaumaturgus as uſed in his time. Voſſius underſtands it as ſpoken of the apoſtles creed: Suicer thinks this impoſſible, for that this creed was then unknown in the churches of the eaſt.

APOSTROPHE, in rhetoric, a figure by which a perſon who is either abſent or dead is addreſſed as if he were preſent, and attentive to us. This figure is, in boldneſs, a degree lower than the addreſs to perſonified objects (ſee Personification); ſince it requires a leſs effort of imagination to ſuppoſe perſons preſent who are dead or abſent, than to animate inſenſible beings and direct our diſcourſe to them. The poems of Oſſian abound with the moſt beautiful inſtances of this figure. “Weep on the rocks of roaring winds, O maid of Iniſtore! Bend thy fair head over the waves, thou fairer than the ghoſt of the hills when it moves in a ſun-beam at noon over the ſilence of Morven! He is fallen! Thy youth is low; pale beneath the ſword of Cuchullin!”

Apostrophe, in grammar, the contraction of a word by the uſe of a comma: as *call'd* for *called*, *tho'* for *though*.

APOTACTITÆ, or Apotactici, an ancient ſect, who affecting to follow the evangelical counſels of poverty, and the examples of the apoſtles and primitive Chriſtians, renounced all their effects and poſſeſſions. It does not appear that they gave into any errors during their firſt ſtate; ſome eccleſiaſtical writers aſſure us they had divers holy virgins and martyrs under the perſecution of Diocleſian, in the fourth century; but they afterwards fell into the opinions of the Encratitæ, and taught that the renouncing of all riches was not only a matter of counſel and advice, but of precept and neceſſity. And hence the ſixth law in the Theodoſian code joins the Apotactitæ with the Eunomians and Arians.

APOTEICHISMUS, in the ancient military art, a kind of line of circumvallation drawn round a place in order to beſiege it. This was alſo called *periteichiſmus*. The firſt thing the ancients went about, when they deſigned to lay cloſe ſiege to a place, was the Apoteichiſmus; which ſometimes conſiſted of a double wall or rampart, raiſed of earth; the innermoſt to prevent ſudden ſallies from the town, the outermoſt to keep off foreign enemies from coming to the relief of the beſieged. This anſwered to what are called *lines of contravallation* and *circumvallation* among the moderns.

APOTHECARY, one who practiſes the art of pharmacy. In London, the apothecaries are one of the city-companies. They were incorporated by a charter from king James. I. procured at the ſolicitation of Dr Mayerne and Dr Aitkens: till that time they only made a part of the grocers company; plums, ſugar, ſpice, Venice treacle, mithridate, &c. were ſold in the ſame ſhop and by the ſame perſon. The reaſon of ſeparating them was, that medicines might be be better prepared, and in oppoſition to divers perſons who impoſed unwholeſome remedies on the people. By an act which was made perpetual in the ninth year of George I. they are exempted from ſerving upon juries, or in ward and pariſh offices. They are obliged to make up their medicines according to the formulas preſcribed in the college diſpenſatory; and are liable to have their ſhops viſited by the cenſors of the college, who are empowered to deſtroy ſuch medicines as they think not good.

They have a hall in Black Friars, where there are two fine elaboratories, out of which all the ſurgeons cheſts are ſupplied with medicines for the royal Britiſh navy.

To his majeſty belong two apothecaries: the ſalary to the firſt, 320l. to the ſecond, 275l.—To the houſehold belong alſo two.

The charitable diſpenſation of medicines by the Chineſe is well deſerving notice. They have a ſtone, which is ten cubits high, erected in the public ſquares of their cities: on this ſtone are engraved the names of all ſorts of medicines with the price of each; and when the poor ſtand in need of any relief from phyſic, they go to the treaſury, where they receive the price each medicine is rated at.

APOTHECARY, *Apothecarius*, in writers of the middle age, denotes a ſhop-keeper, or ware-houſe keeper.

APOTHECARIUS is alſo uſed to denote a ſtore-keeper, or officer appointed to have the direction of a magazine, granary, &c. in which ſenſe *apothecarii* is ſometimes rendered by *horearii* and *rationarii*.

APOTHEOSIS, in antiquity, an heathen ceremony, whereby their emperors and great men were placed among the gods. The word is derived from απο, and Θεος, *God*.

After the apotheoſis, which the alſo called *deification* and *conſecration*, temples, altars, and images were erected to the new deity; ſacrifices, &c. were offered, and colleges of prieſts inſtituted.

It was one of the doctrines of Pythagoras which he had borrowed from the Chaldees, that virtuous perſons after their death were raiſed into the order of the gods. And hence the ancients deified all the inventors of things uſeful to mankind; and thoſe who had done any important ſervice to the commonwealth.—Tiberius propoſed to the Roman ſenate the apotheoſis of Jeſus Chriſt, as is related by Euſebius, Tertullian, and Chryſoſtom.

Juvenal rallying the frequent apotheoſes, introduces poor Atlas, complaining that he was ready to ſink under the burden of ſo many new gods as were every day added to the heavens. Seneca ridiculed the apotheoſis of Claudius with admirable humour.

The ceremony, according to Herodian's deſcription, was as follows: after the body of the deceaſed had been burnt with the uſual ſolemnities, an image of wax, exactly reſembling him, was placed on an ivory couch, where it lay for ſeven days, attended by the ſenate and ladies of the higheſt quality in mourning; and then the young ſenators and knights bore the bed of ſtate through the via ſacra to the old forum, and from thence to the campus martius, where it was depoſited upon an edifice built in form of a pyramid. The bed being thus placed amidſt a quantity of ſpices and other combuſtibles, and the knights having made a ſolemn proceſſion round the pile, the new emperor, with a torch in his hand, ſet fire to it, whilſt an eagle, let fly from the top of the building, and mounting in the air with a firebrand, was ſuppoſed to convey the ſoul of the deceaſed to heaven; and thenceforward he was ranked among the gods.

We often meet with the conſecration or apotheoſis of emperors repreſented on medals; where we ſee the pyramids of ſeveral ſtories, each growing leſs and leſs; we ſee alſo the eagles flying away with the ſouls of the deceaſed emperors. A gem in the muſæam of Brandenburg, repreſents the apotheoſis of Julius Cæſar, mounted upon the celeſtial globe, and holding an helm in his hand, as if he were now the governor of heaven, as before of the earth. See DEIFICATION.

APOTHERAPIA, (from αποθεραπευω, *I cure*), in phyſic, properly denotes a complete or finiſhed cure.

APOTHERAPIA is alſo uſed, in the gymnaſtic art, for the laſt part of all regular exerciſe, viz. friction or unction with oil, before as well as after bathing. The deſign of this was partly to cleanſe the ſkin from any filth or duſt it might have contracted during the exerciſe, and partly to remove wearineſs.

APOTOME, in geometry, the difference between two incomenſurable lines.

APOTOME, in muſic, the difference between a greater and leſſer ſemi-tone; expreſſed by the ratio, 128; 125.

APOTROPÆA, (from αποτρεπω, *I avert*), in the ancient poetry, verſes compoſed for averting the wrath of incenſed deities; and the deities invoked for averting any threatened misfortune were called *Apotrepeans*: they were alſo called *Alexicaci*, from αλεξω, *I drive away*; and *Averrunci* from *averrunco*, which denotes the ſame.

APOZEM, in medicine, the ſame with decoction. See DECOCTION.

APPARATUS, a term uſed to denote a complete ſet of inſtruments, or other utenſils, belonging to any artiſt or machine.

APPARATUS is frequently uſed for the operation of cutting for the ſtone. For this there are three ſorts of apparatus, viz. the ſmall, great, and high apparatus. See SURGERY.

APPARATUS is alſo uſed as a title of ſeveral books compoſed in form of catalogues, bibliothecas, dictionaries, &c. for the eaſe and convenience of ſtudy. The apparatus to Cicero is a kind of concordance, or collection of Ciceronian phraſes, &c. The apparatus ſacer of Poſſevin, is a collection of all kinds of eccleſiaſtical authors printed in 1611, in three volumes.—Gloſſaries, comments, &c. are alſo frequently called *Apparatuſes*.

APPARENT, in a general ſenſe, ſomething that is viſible to the eyes, or obvious to the underſtanding.

APPARENT, among mathematicians and aſtronomers, denotes things as they appear to us, in contradiſtinction from real or true; thus we ſay, the apparent diameter, diſtance, magnitude, place, figure, &c. of bodies.

APPARENT Heir, in law. No inheritance can veſt, nor can any perſon be the actual complete heir of another, till the anceſtor is previouſly dead. *Nemo eſt hæres viventis*. Before that time the perſon who is next in the line of ſucceſſion is called an *heir apparent*, or *heir preſumptive*. Heirs *apparent* are ſuch, whoſe right of inheritance is indefeaſible, provided they outlive the anceſtor; as the eldeſt ſon or his iſſue, who muſt by the courſe of the common law be heirs to the father whenever he happens to die. Heirs *preſumptive* are ſuch, who, if the anceſtor ſhould die immediately, would in the preſent circumſtances of things be his heirs: but whoſe right of inheritance may be defeated by the contingency of ſome nearer heir being born; as a brother or nephew, whoſe preſumptive ſucceſſion may be deſtroyed by the birth of a child; or daughter, whoſe preſent hopes may be hereafter cut off by the birth of a ſon. Nay, even if the eſtate hath deſcended, by the death of the owner, to ſuch a brother, or nephew, or daughter; in the former caſes, the eſtate ſhall be diveſted and taken away by the birth of a poſthumous child; and, in the latter, it ſhall be alſo totally diveſted by the birth of a poſthumous ſon.

APPARITION, in a general ſenſe, denotes ſimply the appearance of a thing. In a more limited ſenſe, it is uſed for ſpectre or ghoſt.—Several inſtances of apparitions occur in the Bible; that of Samuel, raiſed by the witch of Endor, has occaſioned great diſputes. We find great controverſies among authors, in relation to the reality, the exiſtence or non-exiſtence, the poſſibility or impoſſibility, of apparitions. The Chaldeans, the Jews, and other nations, have been the ſteady aſſerters of the belief of apparitions. The denial of ſpirits and apparitions is by ſome made one of the marks of infidelity, if not of atheiſm. Many of the apparitions we are told of in writers, are doubtleſs mere deluſions of the ſenſe; many others are fictitious, contrived merely to amuſe, or anſwer ſome purpoſe. Apparitions, it is certain, are machines that on occaſion have been of good ſervice both to generals, to miniſters of ſtate, to prieſts and others.

Partial darkneſs, or obſcurity, are the moſt powerful means by which the ſight is deceived: night is therefore the proper ſeaſon for apparitions. Indeed the ſtate of the mind, at that time, prepares it for the admiſſion of theſe deluſions of the imagination. The fear and caution which muſt be obſerved in the night; the opportunity it affords for ambuſcades and aſſaſſinations; depriving us of ſociety, and cutting off many pleaſing trains of ideas, which objects in the light never fail to introduce, are all circumſtances of terror: and perhaps, on the whole, ſo much of our happineſs depends upon our ſenſes, that the deprivation of any one may be attended with proportionable horror and uneaſineſs. The notions entertained by the ancients reſpecting the ſoul, may receive ſome illuſtration from theſe principles. In dark or twilight, the imagination frequently transforms an inanimate body into a human figure; on approaching, the ſame appearance is not to be found: hence they ſometimes fancied they ſaw their anceſtors; but not finding the reality, diſtinguiſhed theſe illuſions by the name of *ſhades*.

Many of theſe fabulous narrations might originate from dreams. There are times of ſlumber when we are not ſenſible of being aſleep. On this principle, Hobbes has ingeniouſly accounted for the ſpectre which is ſaid to have appeared to Brutus. “We read,” ſays he, “of M. Brutus, that at Philippi, the night before he gave battle to Auguſtus Cæſar, he ſaw a fearful apparition, which is commonly related by hiſtorians as a viſion; but, conſidering the circumſtances, one may eaſily judge it to have been but a ſhort dream. For ſitting in his tent, penſive and troubled with the horror of his raſh act, it was not hard for him, ſlumbering in the cold, to dream of that which moſt affrighted him; which fear, as by degrees it made him wake, ſo it muſt needs make the apparition by degrees to vaniſh: and having no aſſurance that he ſlept, he could have no cauſe to think it a dream, or any thing but a viſion.”—The well-known ſtory told by Clarendon, of the apparition of the Duke of Buckingham's father, will admit of a ſimilar ſolution. There was no man in the kingdom ſo much the ſubject of converſation as the duke; and from the corruptneſs of his character, he was very likely to fall a ſacrifice to the enthuſiaſm of the times. Sir George Villiers is ſaid to have appeared to the man at midnight: therefore there is the greateſt probability that the man was aſleep; and the dream affrighting him, made a ſtrong impreſſion, and was likely to be repeated.

APPARITOR, among the Romans, a general term to comprehend all attendants of judges and magiſtrates appointed to receive and execute their orders. *Apparitor*, in England, is a meſſenger that ſerves the proceſs of a ſpiritual court, or a beadle in an univerſity who carries the mace.

APPAUMEE, in heraldry, denotes one hand extended, with the full palm appearing, and the thumb and fingers at full length.

APPEAL, in law, the removal of a cauſe from an inferior to a ſuperior court, or judge, when a perſon thinks himſelf aggrieved by the ſentence of the inferior judge. Appeals lie from all the ordinary courts of juſtice to the Houſe of Lords. In eccleſiaſtical caſes, if an appeal is brought before a biſhop, it may be removed to the archbiſhop; if before an archdeacon, to the court of arches, and thence to the archbiſhop; and from the archbiſhop's court to the king in chancery.

APPEAL, in common law, denotes an accuſation by a private ſubject againſt another, for ſome heinous crime; demanding puniſhment on account of the particular injury ſuffered, rather than for the offence againſt the public.

This private proceſs, for the puniſhment of public crimes, had probably its original in thoſe times, when a private pecuniary ſatisfaction, called a *weregild*, was conſtantly paid to the party injured, or his relations, to expiate enormous offences. This was a cuſtom derived to the Engliſh, in common with other northern nations, from their anceſtors the ancient Germans; among whom, according to Tacitus, *luitur homicidium certo armentorum ac pecorum numero; recipitque ſatisfactionem univerſa domus.* In the ſame manner, by the Iriſh Brehon law, in caſe of murder, the brehon or judge was uſed to compound between the murderer and the friends of the deceaſed who proſecuted him, by cauſing the malefactor to give unto them, or to the child or wife of him that was ſlain, a recompence which they called an *eriach.* And this we find in the Anglo-Saxon laws (particularly thoſe of king Athelſtan) the ſeveral weregilds for homicide eſtabliſhed in progreſſive order, from the death of the ceorl or peaſant, up to that of the king himſelf. And in the laws of Henry I. we have an account of what other offences were redeemable by weregild, and what were not ſo. As therefore, during the continuance of this cuſtom, a proceſs was certainly given, for recovering the weregild by the party to whom it was due; it ſeems that, when theſe offences by degrees grew no longer redeemable, the private proceſs was ſtill continued, in order to inſure the infliction of puniſhment upon the offender, though the party injured was allowed no pecuniary compenſation for the offence.

But though appeals were thus, in the nature of proſecutions for ſome attrocious injury, committed more immediately againſt an individual, yet it alſo was anciently permitted, that any ſubject might appeal another ſubject of high-treaſon, either in the courts of common law, or in parliament, or (for treaſons committed beyond the ſeas) in the court of the high conſtable and marſhal. The cognizance of appeals in the latter ſtill continues in force; and ſo late as 1631, there was a trial by battle awarded in the court of chivalry, on ſuch an appeal of treaſon; but that in the firſt was *virtually* aboliſhed by the ſtatutes 5 Edw. III. c. 9. and 2 Edw. III. c. 24. and in the ſecond *expreſsly* by ſtatute 1 Hen. IV. c. 14. So that the only appeals now in force, for things done within the realm, are appeals of felony and mayhem.

An appeal of felony may be brought for crimes committed either againſt the parties themſelves or their relations. The crimes againſt the parties themſelves are *larceny*, *rape*, and *arſon*. And for theſe, as well as for mayhem, the perſons robbed, raviſhed, maimed, or whoſe houſes are burnt, may inſtitute this private proceſs. The only crime againſt one's relation, for which an appeal can be brought, is that of *killing* him, by either murder or manſlaughter. But this cannot be brought by every relation; but only by the wife for the death of her huſband, or by the heir-male for the death of his anceſtor; which heirſhip was alſo confined by an ordinance of Henry I. to the four neareſt degrees of blood. It is given to the wife, on account of the loſs of her huſband: therefore, if ſhe marries again, before or pending her appeal, it is loſt and gone; or, if ſhe marries after judgment, ſhe ſhall not demand execution. The heir, as was ſaid, muſt alſo be heir-male, and ſuch a one as was the next heir by the courſe of the common law at the time of the killing of the anceſtor. But this rule has three exceptions: 1. If the perſon killed leaves an innocent wife, ſhe only, and not the heir, ſhall have the appeal: 2. If there be no wife, and the heir be accuſed of the murder, the perſon, who next to him would have been heir-male, ſhall bring the appeal: 3. If the wife kills her huſband, the heir may appeal her of the death. And, by the ſtatute of Glouceſter, 6 Ed. I. c. 9. all appeals of death muſt be ſued within a year and a day after the completion of the felony by the death of the party: which ſeems to be only declaratory of the old common law; for in the Gothic conſtitutions we find the ſame "*preſcriptio annalis, quæ currit adverſus actorem, ſi de homicida ei non conſtat intra annum a cæde facta, nec quenquam interea arguat et accuſet.*"

Theſe appeals may be brought previous to any indictment; and, if the appellee be acquitted thereon, he cannot be afterwards indicted for the ſame offence. In like manner as by the old Gothic conſtitution, if any offender gained a verdict in his favour, when proſecuted by the party injured, he was alſo underſtood to be acquitted of any crown-proſecution for the ſame offence: but, on the contrary, if he made his peace with the king, ſtill he might be proſecuted at the ſuit of the party. And ſo, in England, if a man be acquitted on an indictment of murder, or found guilty, and pardoned by the king, ſtill he ought not (in ſtrictneſs) to go at large, but be impriſoned or let to bail till the year and day be paſt, by virtue of the ſtatute 3 Hen. VIII. c. 1. in order to be forthcoming to anſwer any appeal for the ſame felony, not having as yet been puniſhed for it: though, if he hath been found guilty of manſlaughter on an indictment, and hath had the benefit of clergy, and ſuffered the judgment of the law, he cannot afterwards be appealed; for it is a maxim in law, "that *nemo bis punitur pro eodem delicto.*" Before this ſtatute was made, it was not uſual to indict a man for homicide within the time limited for appeals, which produced very great inconvenience.

If the appellee be acquitted, the appellor (by virtue of the ſtatute of Weſtm. 2. 13 Edw. I. c. 12.) ſhall ſuffer one year's impriſonment, and pay a fine to the king, beſides reſtitution of damages to the party for the impriſonment and infamy which he has ſuſtained: and, if the appellor be incapable to make reſtitution, his abettors ſhall do it for him, and alſo be liable to impriſonment. This proviſion, as was foreſeen by the author of Fleta, proved a great diſcouragement to appeals; ſo that thenceforward they ceaſed to be in common uſe.

If the apellee be found guilty, he ſhall ſuffer the ſame judgment, as if he had been convicted by indictment: but with this remarkable difference, than on an indicment, which is at the ſuit of the king, the king may pardon and remit the execution; on an appeal, which is at the ſuit of a private ſubject, to make an atonement for the private wrong, the king can no more pardon it, than he can remit the damages recovered on an action of battery. In like manner as, while the weregild continued to be paid as a fine for homicide, it could not be remitted by the king's authority. And the ancient uſage was, ſo late as Henry IV.'s time, that all the relations of the ſlain ſhould drag the appellee to the place of execution: a cuſtom, founded upon that ſavage ſpirit of family-reſentment which prevailed univerſally through Europe after the irruption of the northern nations, and is peculiarly attended to in their ſeveral codes of law; and which prevails even now among the wild and untutored inhabitans of America: as if the finger of nature had pointed it out to mankind, in their rude and uncultivated ſtate. However, the puniſhment of the offender may be remitted and diſcharged by the concurrence of all parties intereſted; and as the king by his pardon may fruſtrate an indictment, ſo the appellant by his releaſe may diſcharge an appeal: "*nam quilibet poteſt renunciare juri pro ſe introducto.*"

APPEARANCE, in a general ſenſe, the exterior ſurface of a thing, or that which immediately ſtrikes the ſenſes.

APPEARANCE, in law, ſignifies a defendant's filing a common or ſpecial bail, on any proceſs iſſued out of a court of judicature.

APPELLANT, in a general ſenſe, one who appeals. See APPEAL.

APPELLANTS, in church hiſtory, an appellation given to ſuch of the catholic clergy as appeal from the conſtitution unigenitus to a general council.

APPELLATION, the name by which any thing is known or diſtinguiſhed when ſpoken of. See NAME.

Nothing can be more foreign to the original meaning of many words and proper names, than their preſent appellations, frequently owing to the hiſtory of thoſe things being forgotten, or an ignorance of the language in which they were expreſſed. Who, for example, when the crier of a court bawls out, "O yes, O yes," would dream that it was a proclamation commanding the talkers to become hearers, being the French word *Oyez*, "liſten," retained in our courts ever ſince the pleadings were held in law French? Or would any perſon ſuppoſe that the head-land on the French coaſt, near Calais, called by our ſeamen Blackneſs, could be ſo titled from its French name of *Blanc Nez*, or, the *White Head-land*?

King Henry the Eighth having taken the town of Bullogne in France, the gates of which he brought to Hardes in Kent, where they are ſtill remaining, the flatterers of that reign highly magnified this action, which, Porto Bello like, became a popular ſubject for ſigns; and the port or harbour of Bullogne, called *Bullogne mouth*, was accordingly ſet up at a noted inn in Holburn; the name of the inn long out-living the ſign and fame of the conqueſt, an ignorant painter employed by a no leſs ignorant landlord, to paint a new one, repreſented it by a bull and a large gaping human mouth (anſwering to the vulgar pronunciation of *Bull and mouth*). The ſame piece of hiſtory gave being to the *bull and gate*, originally meant for Bullogne gate, and repreſented by an embattled gate or entrance into a fortified town.

The *barber's pole* has been the ſubject of many conjectures; ſome conceiving it to have originated from the world *poll*, or head, with ſeveral other conceits as far-fetched and as unmeaning: but the true intention of that party-coloured ſtaff was to ſhow that the maſter of the ſhop practiſed ſurgery, and could breathe a vein as well as mow a beard; ſuch a ſtaff being to this day, by every village-practitioner, put into the hand of a patient undergoing the operation of phlebotomy. The white band which encompaſſes the ſtaff, was meant to repreſent the fillet, thus elegantly twined about it.

Nor were the *Chequers* (at this time a common ſign of a public-houſe) leſs expreſſive, being the repreſentation of a kind of draught-board called *tables*, and ſhowed that there that game might be played. From their colour which was red, and the ſimiliarity to a lattice, it was corruptly called the *red lettuce*, which word is frequently uſed by ancient writers to ſignify an alehouſe.

The Spectator has explained the ſign of the *bell ſavage inn* plauſibly enough, in ſuppoſing it to have been originally the figure of a beautiful female found in the woods, called in French *la belle ſauvage*. But another reaſon has ſince been aſſigned for that appellation, namely, that the inn was once the property of Lady Arabelle ſavage, and familiarly called Bell Savage's inn, probably repreſented, as at preſent, by a bell and a ſavage or wild man, which was a rebus for her name; rebuſſes being much in faſhion in the 16th century, of which the bolt and tun is an inſtance.

The *three blue balls* prefixed to the doors and windows of pawn-brokers ſhops, by the vulgar humorouſly enough ſaid to indicate that it is two to one that the things pledged are ever redeemed, was in reality the arms of a ſet of merchants from Lombardy, who were the firſt that publicly lent money on pledges. They dwelt together in a ſtreet, from them named Lombard-ſtreet, in London, and alſo gave their name to another at Paris. The appellation of Lombard was formerly all over Europe conſidered as ſynonimous to that of uſurer.

At the inſtitution of yeomen of the guards, they uſed to wait at table on all great ſolemnities, and were ranged near the buffets; this procured them the name of *buffetiers*, not very unlike in ſound to the jocular appellation of *beef-eaters*, now given them; though probably it was rather the voluntary miſnomer of ſome wicked wit, than an accidental corruption ariſing from ignorance of the French language.

The opprobious title of *bum-bayliffe*, ſo conſtantly beſtowed on the ſheriffs officers, is, according to Judge Blackſtone, only the corruption of *bound bayliffe*, every ſheriff's officer being obliged to enter into bonds and to give ſecurity for his good behaviour, previous to his appointment.

A *cordwainer* ſeems to have no relation to the occugation it is meant to expreſs, which is that of a ſhoemaker. But *cordonier*, originally ſpelt *cordaunier*, is the French word for that trade; the beſt leather uſed for ſhoes coming originally from Cordua in Spain. Spaniſh-leather ſhoes were once famous in England.

APPELLATIVE NAMES, in grammar, in contradiſtinction to proper names, are ſuch as ſtand for univerſal ideas, or a whole rank of beings, whether general or ſpecial. Thus fiſh, bird, man, city, river, are common or appellative names; and ſo are trout, eel, lobſter; for they all agree to many individuals, and ſome to many ſpecies. See NAME.

APPELLEE, among lawyers, the perſon againſt whom an appeal is brought. See APPEAL.

APPENDIX, in literature, a treatiſe or ſupplement added at the end of a work, to render it more complete.

APPERCEPTION, or ADPERCEPTION, a term uſed by Leibnitz and his followers for conſciouſneſs.

APPETITE, in a general ſenſe, the deſire of enjoying ſome object, ſuppoſed to be conducive to our happineſs. When this inclination is guided by reaſon, and proportioned to the intrinſic value of the object, it is called *rational appetite*; as, on the other hand, it is denominated *ſenſitive appetite*, when we have only a blind propenſity to a thing, without determinate ideas of the good qualities for which we deſire it.

Appetites are paſſions directed to general objects, in contradiſtinction to paſſions directed to particular objects, which retain their proper name. Thus we ſay, an *appetite* for fame, for glory, for conqueſt, for riches; but we ſay the *paſſion* of love, of gratitude, of envy, &c. Appetite may be alſo diſtinguiſhed from paſſion, ſince the latter has no exiſtence till a proper object be preſented; whereas the former exiſts firſt, and then is directed to an object.

APPETITE, in medicine, a certain painful or uneaſy ſenſation, always accompanied with a deſire to eat or drink.—An exceſſive appetite is called by phyſicians *bulimy* or *fames canina*; a defect or loſs of it, *anorexy*; and that after things improper for food, *pica*.

APPIA VIA, a way reaching from Rome through Capua to Brunduſium, between 330 and 350 miles long. Appius Claudius, ſurnamed *Cæcus*, in the year of the city 441, carried it from the Porta Capena to Capua (Livy, Frontinus). It was afterwards carried on to Brunduſium; but by whom, or when, is uncertain. It was laid with very hard ſtone, brought from a great diſtance, large and ſquared (Diodorus); and it was ſo wide, that ſeveral waggons could go abreaſt. Statius calls it *the queen of roads*. Its courſe is deſcribed by Horace, Strabo, and Antonine.

APPIAN, an eminent writer of the Roman hiſtory in Greek, under the reign of Trajan and Hadrian. He was of a good family in Alexandria in Egypt; whence he went to Rome, and there diſtinguiſhed himſelf ſo well as an advocate, that he was choſen one of the procurators of the empire, and the government of a province was committed to him. He did not complete the Roman hiſtory in a continued ſeries; but wrote diſtinct hiſtories of all nations that had been conquered by the Romans, in which he placed every thing relating to thoſe nations in the proper order of time. His ſtyle is plain and ſimple: in the opinion of Phocius, he has ſhown the greateſt knowledge of military affairs, and the happieſt talent at deſcribing them, of any of the hiſtorians; for while we read him, we in a manner ſee the battles which he deſcribes. Of all this voluminous work there remains only what treats of the Punic, Syrian, Parthian, Mithridatic, and Spaniſh wars, with thoſe againſt Hannibal, the civil wars, and the wars in Illyricum, and ſome fragments of the Celtic or Gallic wars.

APPIUS CLAUDIUS, a Sabine by birth, one of the principal inhabitants of Regillum: his ſhining merit having drawn the envy of his fellow-citizens upon him, he retired to Rome with all his family. Appius was admitted into the ſenate, and was made conſul, with Publius Servilius Priſcus, in 258 from the building of Rome: but he was hated by the Plebeians, being an auſtere oppoſer of their clamours and ſeditions. The Claudian family continued long one of the moſt illuſtrious of the patrician families in Rome; and ſeveral in ſucceſſion of the name of Appius ſupported the ſame ſtern character that diſtinguiſhed their firſt founder.

APPLAUSE, an approbation of ſomething, ſignified by clapping the hands, ſtill practiſed in theatres.—Applauſe, in antiquity, differed from ACCLAMATION, as the latter was articulate and performed with the voice, the former with the hands. Among the Romans, applauſe was an artificial muſical kind of noiſe, made by the audience or ſpectators to expreſs their ſatisfaction. There were three ſpecies of applauſe, denominated from the different noiſes made in them, viz. *Bombus*, *Imbrices*, and *Teſtæ*; the firſt a confuſed din, made either by the hands or the mouth; the ſecond and third, by beating on a ſort of ſounding veſſels placed in the theatres for this purpoſe. Perſons were inſtructed to give applauſe with ſkill; and there were even maſters who profeſſed to teach the art. The proficients in this way let themſelves out for hire to the vain-glorious among the poets, actors, &c. and were properly diſpoſed to ſupport a loud applauſe. Theſe they called *Laudicœni*, and Σοφοκλεις. At the end of the play, a loud peal of applauſe was expected, and even aſked of the audience, either by the chorus or the perſon who ſpoke laſt. The formula was, *Spectatores plaudite*, or *Valete et plaudite*. The *plauſores*, or applauders, were divided into chori, and diſpoſed in theatres oppoſite to each other like the choriſters in cathedrals, ſo that there was a kind of concert of applauſes.

APPLE, the fruit of the pyrus malus. See PYRUS.

Apple of the eye, a name not unfrequently given to the pupil. See ANATOMY.

Apples of Love. See LYCOPERSICON.

Mad Apples. See MELONGENA.

APPLEBY, the county-town of Weſtmoreland, where the aſſizes are held, is ſeated on the banks of the river Eden, which almoſt ſurrounds it. It was formerly a very conſiderable town, and had great privileges; but it is long ago gone to decay, and now only conſiſts of mean houſes in one broad ſtreet, which runs with an eaſy aſcent from north to ſouth; at the head of which is the caſtle, almoſt entirely ſurrounded by the river. It has two churches; a town hall, in which the aſſizes are held: a county jail; and an hoſpital for a governeſs and twelve widows, founded in 1651 by a daughter of lord Clifford. It is governed by a mayor, twelve aldermen, a common council, and two ſergeants at mace, &c. Here is ſaid to be the beſt corn-market in theſe northern parts. It ſends two members to parliament. W. Long. 3. 52. N. Lat. 54. 30.

APPLICATION, in a general ſenſe, is the laying two things together, in order to diſcover their agreement or diſagreement.

APPLICATION, in geometry, is uſed either for diviſion, for applying one quantity to another, whoſe areas, but not figures, ſhall be the ſame; or, for transferring a given line into a circle, or other figure, ſo that its ends ſhall be in the perimeter of the figure.

APPLICATION, in theology, is particularly uſed, by ſome divines, for the act whereby our Saviour transfers, or makes over to us, what he had earned or purchaſed by his holy life and death. Accordingly it is by this application of the merits of Chriſt that we are to be juſtified, and entitled to grace and glory. The ſacraments are the ordinary means or inſtruments whereby this application is effected.

APPOGIATURA, in muſic, a ſmall note inſerted by the practical muſician, between two others, at ſome diſtance.

APPOINTEE, a foot-ſoldier in the French army, &c. who for his long ſervice and bravery receives pay above private ſentinels. Theſe have been ſuppreſſed in

France, except in the regiment of French guards, where forty appointees are ſtill retained to each company of 150 men.

Till the year 1670, they had alſo captains and lieutenants under the appellation of *appointees*, who, without reſiding in the regiment, received their pay.

Appointee, in heraldry, the ſame as *aguiſée*: Thus we ſay, a croſs appointée, to ſignify that with two angels at the end cut off, ſo as to terminate in points.

APPOINTMENT, in a general ſenſe, the ſame as Assignation.

Appointment, in a particular ſenſe, denotes a penſion or ſalary given by great lords and princes to perſons of worth and parts, in order to retain them in their ſervice. The term is chiefly uſed among the French. The king of France gives large appointments to ſeveral of the officers in his ſervice. Appointments differ from wages, in that the latter are fixed and ordinary, being paid by the ordinary treaſurers; whereas appointments are annual gratifications granted by *brevet* for a time uncertain, and are paid out of the privy purſe.

APPOSER ſignifies an examiner. In the court of exchequer, there is an officer called the *foreign appoſer*. In the office of confirmation, in the firſt liturgy of Edward VI. the rubric directs the biſhop, or ſuch as he ſhall appoint, to appoſe a child; and a biſhop's examining chaplain was anciently called his *poſer*.

APPOSITION, in grammar, the placing two or more ſubſtantives together in the ſame caſe, without any copulative conjunction between them; as, *Ardebat Alexim, delicias domini*.

APPRAISER (from *ad*, "to," and *pretium*, "value") one who rates or ſets a value upon gooods, &c. He muſt be a ſkilful and honeſt perſon. It is not a buſineſs of itſelf, but is practiſed by brokers of houſehold-furniture; to which ſet of men the word is chiefly applied: Yet upholſterers and other brokers are employed, or even any perſon or perſons who are ſuppoſed to be ſkilled in the commodities to be appraiſed or valued. They are employed in caſes of death, executions brought in upon goods, or of ſtock to be turned over from one perſon to another, or divided between copartners; and are called *ſworn appraiſers*, from their taking an oath to do juſtice between party and party. They ſometimes appraiſe on behalf of both ſides, each party agreeing to have the ſame appraiſer or appraiſers; ſometimes in oppoſition, each party chooſing one or more of a ſide; and ſometimes by commiſſion or deputation of truſtees, maſters in chancery, &c.

APPRAISING, the act of rating, valuing, or ſetting a price on goods, by a perſon who is a competent judge, and is authoriſed thereto. See Appraiser.

APPREHENSION, in logic, denotes the ſimple attention of the mind to an object preſented either to our ſenſe or our imagination, without paſſing a judgement or making any inference.

Apprehension is likewiſe uſed to expreſs an inadequate and imperfect idea: and thus it is applied to our knowledge of God, in contradiſtinction to comprehenſion.

Apprehension, in law, ſignifies the ſeizing a criminal, in order to bring him to juſtice.

APPRENTICE, (from *apprendre*, "to learn,") one who is bound by covenant to ſerve a tradeſman or artificer a certain time, upon condition of the maſter's inſtructing him in his art or myſtery.

Apprentices may likewiſe be bound to huſbandmen, or even to gentlemen; and they, as well as tradeſmen, in England, are compellable to take the children of the poor, whom the overſeers, with the conſent of two juſtices, may bind till the age of twenty-four years. Apprentices may be diſcharged on reaſonable cauſe; but if any, whoſe premium has been leſs than ten pounds, run away from their maſters, they are compellable to ſerve out the time of abſence, or give ſatisfaction for it, at any period within ſeven years after expiration of the original contract. Apprentices gain a ſettlement in that pariſh where they laſt ſerved forty days; and by the 5th of Elizabeth, c. 4. they have an excluſive right to exerciſe the trade in which they have been inſtructed, in any part of England. However, the reſolutions of the courts have in general rather confined than extended the reſtriction of this ſtatute. See Blackſtone's Com. Vol. I. p. 426, &c.

In France, the ſons of tradeſmen, living in their father's houſe till ſeventeen years of age, are reputed to have ſerved an apprenticeſhip. In that country, the times of ſerving are different in the differet profeſſions, from three years to eight. After ſerving out an apprenticeſhip, the perſon becomes what they call an *aſpirant*, or candidate for maſterſhip, and is to be examined by proper officers as to his ſkill and proficiency, and alſo to exhibit a *chef d'oeuvre* or maſterpiece in the art he has been bred to, before he be ſuffered to ſet up to practiſe for himſelf. And the cuſtom of France in regard to apprentices, is not unworthy the imitation of other nations.

Anciently, benchers in the inns of court were called *apprentices of the law*, in Latin *apprenticii juris nobiliores*; as appears by Mr Selden's note on Forteſcue: and ſo the learned Plowden ſtyles himſelf. Sir Henry Finch, in in his *Nomotechnia*, writes himſelf, *apprentice de ley*: Sir Edward Coke in his *Inſt.* ſays, *Apprenticii legis*, in pleading, are called *homines conſiliarii et in lege periti*; and in another place, *apprentices* and other counſellors of law.

Apprentices indentures and articles of clerkſhip, pay of duty ſix ſhillings. Pariſh indentures are excepted, and pay ſixpence only, by 5 W. 3. c. 21. For fees given with apprentices, clerks, or ſervants, bound or articled by indentures, from 1 l. to 50 l. maſters pay for every pound ſixpence; and for fees above 50 l. one ſhilling in the pound. 8 Ann. c. 9.

APPRENTICESHIP, the ſervitude of an apprentice, or the duration of his indenture.

Seven years ſeem anciently to have been, all over Europe, the uſual term eſtabliſhed for the duration of apprenticeſhips in the greater part of incorporated trades. All ſuch incorporations were anciently called *univerſities*; which, indeed, is the proper Latin name for any incorporation whatever. The univerſity of ſmiths, the univerſity of taylors, &c. are expreſſions which we commonly meet with in the old charters of ancient towns. When thoſe particular incorporations which are now peculiarly called *univerſities* were firſt eſtabliſhed, the term of years which it was neceſſary to ſtudy, in order to obtain the degree of maſter of arts, appears evidently to have been copied from the term of apprenticeſhip in common trades, of which the incorporations were much more ancient. As to have wrought ſeven years under a maſter properly qualified was neceſſary in order to intitle any perſon to become a maſter, and to have himſelf apprentices in a common trade; ſo to have ſtudied ſeven years under a maſter properly qualified was neceſſary to intitle him to become a maſter, teacher, or doctor (words anciently ſynonimous), in the liberal arts, and to have ſcholars or apprentices (words likewiſe originally ſynonimous) to ſtudy under him.

By the 5th of Elizabeth, commonly called the *ſtatute of apprenticeſhip*, it was enacted, that no perſon ſhould for the future exerciſe any trade, craft or myſtery, at that time exerciſed in England, unleſs he had previouſly ſerved to it an apprenticeſhip of ſeven years at leaſt; and what before had been the bye-law of many particular corporations, became in England the general and public law of all trades carried on in market-towns. For though the words of the ſtatute are very general, and ſeem plainly to include the whole kingdom, by interpretation its operation has been limited to market-towns; it having been held, that in country villages a perſon may exerciſe ſeveral different trades, though he has not ſerved a ſeven years apprenticeſhip to each, they being neceſſary for the conveniency of the inhabitants, and the number of people frequently not being ſufficient to ſupply each with a particular ſet of hands.

By a ſtrict interpretation of the words, too, the operation of this ſtatute has been limited to thoſe trades which were eſtabliſhed in England before the 5th of Elizabeth, and has never been extended to ſuch as have been introduced ſince that time. This limitation has given occaſion to ſeveral diſtinctions which, conſidered as rules of police, appear as fooliſh as can well be imagined. It has been adjudged, for example, that a coachmaker can neither himſelf make, nor employ journeymen to make, his coach-wheels, but muſt buy them of a maſter wheel-wright; this latter trade having been exerciſed in England before the 5th of Elizabeth. But a wheelwright, though he has never ſerved an apprenticeſhip to a coachmaker, may either himſelf make, or employ journeymen to make, coaches; the trade of a coachmaker not being within the ſtatute, becauſe not exerciſed in England at the time when it was made. The manufactures of Mancheſter, Birmingham, and Wolverhampton, are many of them upon this account not within the ſtatute; not having been exerciſed in England before the fifth of Elizabeth.

In France, the duration of apprenticeſhips is different in different towns and in different trades. In Paris, five years is the term required in a great number; but before any perſon can be qualified to exerciſe the trade as a maſter, he muſt in many of them, ſerve five years more as a journeyman. During this latter term he is called the *companion* of his maſter, and the term itſelf is called his *companionſhip*.

In Scotland there is no general law which regulates univerſally the duration of apprenticeſhips. The term is different in different corporations. Where it is long, a part of it may generally be redeemed by paying a ſmall fine. In moſt towns, too, a very ſmall fine is ſufficient to purchaſe the freedom of any corporation. The weavers of linen and hempen cloth, the principal manufactures of the country, as well as all other artificers ſubſervient to them, wheelmakers, reelmakers, &c. may exerciſe their trades in any town corporate, without paying any fine. In all towns corporate, all perſons are free to ſell butcher's meat upon any lawful day of the week. Three years is in Scotland a common term of apprenticeſhip, even in ſome very nice trades; and in general there is no country in Europe in which corporation laws are ſo little oppreſſive.

Apprenticeſhips were altogether unknown to the ancients. The reciprocal duties of maſter and apprentice make a conſiderable article in every modern code. The Roman law is perfectly ſilent with regard to them. There is no Greek or Latin word which expreſſes the idea we now annex to the word apprentice; a ſervant bound to work at a particular trade for the benefit of a maſter during a term of years, upon condition that the maſter ſhall teach him that trade.

Wealth of Nations, Vol. i. p. 162 Philad. Edition.

Long apprenticeſhips Dr Smith conſiders as altogether unneceſſary. The arts, which are much ſuperior to common trades, ſuch as thoſe of making clocks and watches, contain no ſuch myſtery as to require a long courſe of inſtruction. The firſt invention of ſuch beautiful machines, indeed, and even that of ſome of the inſtruments employed in making them, muſt, no doubt, have been the work of deep thought and long time, and may juſtly be conſidered as among the happieſt efforts of human ingenuity: But when both have been fairly invented and are well underſtood; to explain to any young man, in the compleateſt manner, how to apply the inſtruments and how to conſtruct the machines, cannot well require more than the leſſons of a few weeks; perhaps thoſe of a few days might be ſufficient. In the common mechanic trades, thoſe of a few days might certainly be ſufficient. The dexterity of hand, indeed, even in common trades cannot be acquired without much practice and experience. But a young man would practiſe with much more diligence and attention, if from the beginning he wrought as a journeyman, being paid in proportion to the little work which he could execute, and paying in his turn for the materials which he might ſometimes ſpoil though aukwardneſs and inexperience. His education in this way generally would be more effectual, and always leſs tedious and expenſive. The maſter, indeed, would be a loſer; he would loſe all the wages of the apprentice, which he now ſaves, for ſeven years together. In the end, perhaps, the apprentice himſelf would be a loſer. In a trade ſo eaſily learnt he would have more competitors: and his wages, when he came to be a complete workman, would be much leſs than at preſent. The ſame increaſe of competition would reduce the profits of the maſters as well as the wages of the workmen. The trades, the crafts, the myſteries, would be all loſers: but the public would be a gainer; the work of all artificers coming in this way much cheaper to market.

APPRISING, in Scots law, the name of that action by which a creditor formerly carried off the eſtate of his debtor for payment. It is now aboliſhed, and adjudications are appointed in place of it.—Adjudications, charter, reſignation, clare conſtat, cognition of heirs, heritable right, confirmation, novodamus, principal and original inſtrument of ſurrender, retour, ſeiſin, and ſervice, in Scotland, pay by different acts 4s. 9d. duty.

APPROACH, or Approaching, in a general ſenſe, the acceding or coming together of two or more things.

Approaches, in fortification, the works thrown up by the beſiegers, in order to get nearer a fortreſs, without being expoſed to the enemy's cannon.

APPROACHING, in fowling, a term uſed to expreſs ſuch devices as are contrived for the getting within ſhot of ſhy birds. It is principally uſed in marſhy low places. The beſt method of approaching is by means of three hoops tied together at proper diſtances, according to the height of the man that is to uſe it, and having boughs of trees tied all round it, with cords to hang it over his ſhoulders; a man getting into this, conceals himſelf, and approaches by degrees towards his game in the form of a moving buſh. Geeſe, ducks, and teal, quit the waters in the evening, and paſs the night in the fields; but at the approach of morning they return to the water again, and even when on the water they will retire to great diſtances, on the approach even of a horſe or cow, ſo that the buſineſs of the ſtalking-horſe is of little uſe; but this device of approaching by the moving buſh ſucceeds tolerably well with them.

Aproaching, in gardening, the inoculating or ingrafting the ſprig of one tree into another, without cutting it off the parent tree.

APPROBATION, a ſtate or diſpoſition of the mind, wherein we put a value upon, or become pleaſed with, ſome perſon or thing. Moraliſts are divided on the principle of approbation or the motive which determines us to approve and diſapprove. The Epicureans will have it to be only ſelf-intereſt: according to them, that which determines any agent to approve his own action, is its apparent tendency to his private happineſs; and even the approbation of another's action flows from no other cauſe but an opinion of its tendency to the happineſs of the approver, either immediately or remotely. Others reſolve approbation into a moral ſenſe, or a principle of benevolence by which we are determined to approve every kind affection either in ourſelves or others, and all publicly uſeful actions, which we imagine to flow from ſuch affection, without any view therein to our own private happineſs.

Approbation, is more particularly uſed, in ſpeaking of recommendations of books, given by perſons qualified or authoriſed to judge of them. Thoſe appointed to grant licences and imprimatures, frequently expreſs their approbations of books. Books were formerly ſubjected to a licenſer in England (ſee 13th Car. II. c. 33), which act is long ſince expired; and being incompatible with the noble principles of the Revolution, has never ſince been, and it is hoped never will be, revived.

APPROPRIATION, in the canon law, a ſevering of a benefice eccleſiaſtical to the proper and perpetual uſe of ſome religious houſe. See the article Parson.

The contrivance of appropriations ſeems to have ſprung from the policy of the monaſtic orders, who have never been deficient in ſubtile inventions for the increaſe of their own power and emoluments. At the firſt eſtabliſhment of parochial clergy, the tithes of the pariſh were diſtributed in a fourfold diviſion; one for the uſe of the biſhop, another for maintaining the fabric of the church, a third for the poor, and the fourth to provide for the incumbent. When the fees of the biſhops became otherwiſe amply endowed, they were prohibited from demanding their uſual ſhare of theſe tithes, and the diviſion was into three parts only. And hence it was inferred by the monaſteries, that a ſmall part was ſufficient for the officiating prieſt; and that the remainder might well be applied to the uſe of their own fraternities (the endowment of which was conſtrued to be a work of the moſt exalted piety), ſubject to the burden of repairing the church and providing for its conſtant ſupply. And therefore they begged and bought, for maſſes and obits, and ſometimes even for money, all the advowſons within their reach, and then appropriated the benefices to the uſe of their own corporation. But, in order to complete ſuch approbriation effectually, the king's licence, and conſent of the biſhop, muſt firſt be obtained; becauſe both the king and the biſhop may ſome time or other have an intereſt by lapſe, in the preſentation to the benefice; which can never happen if it be appropriated to the uſe of a corporation, which never dies: and alſo becauſe the law repoſes a confidence in them, that they will not conſent to any thing that ſhall be to the prejudice of the church. The conſent of the patron alſo is neceſſarily implied, becauſe the appropriation can be originally made to none but to ſuch ſpiritual corporation as is alſo the patron of the church; the whole being indeed nothing elſe but an allowance for the patrons to retain the tithes and glebe in their own hands, without preſenting any clerk, they themſelves undertaking to provide for the ſervice of the church. When the appropriation is thus made, the appropriators and their ſucceſſors are perpetual parſons of the church; and muſt ſue and be ſued, in all matters concerning the rights of the church, by the name of *parſons*.

This appropriation may be ſevered, and the church become diſappropriate, two ways; as, firſt, if the patron or appropriator preſents a clerk, who is inſtituted and inducted to the parſonage: for the incumbent ſo inſtituted and inducted is to all intents and purpoſes complete parſon; and the appropriation being once ſevered, can never be reunited again, unleſs by a repetition of the ſame ſolemnities. And, when the clerk ſo preſented is diſtinct from the vicar, the rectory thus veſted in him becomes what is called a *ſine-cure;* becauſe he hath no cure of ſouls, having a vicar under him to whom that cure is committed. Alſo, if the corporation which has the appropriation is diſſolved, the parſonage becomes diſappropriate at common law: becauſe the perpetuity of perſon is gone, which is neceſſary to ſupport the appropriation.

In this manner, and ſubject to theſe conditions, may appropriations be made at this day: and thus were moſt if not all of the appropriations at preſent exiſting originally made; being annexed to biſhopricks, prebends, religious houſes, nay, even to nunneries, and certain military orders, all of which were ſpiritual corporations. At the diſſolution of monaſteries, by ſtatutes 27 Hen. VIII. c. 28. and 31 Hen. VIII. c. 13. the appropriations of ſeveral parſonages, which belonged to thoſe reſpective religious houſes, (amounting to more than one third of all the pariſhes of England), would have been by the rules of common law diſappropriated;

priated; had not a clauſe in thoſe ſtatutes intervened, to give them to the king in as ample a manner as the abbots, &c. formerly held the ſame at the time of their diſſolution. This, though perhaps ſcarcely defenſible, was not without example: for the ſame was done in former reigns, when the alien priores (that is, ſuch as were filled by foreigners only) were diſſolved and given to the crown. And from theſe two roots have ſprung all the lay-appropriations or ſecular parſonages which we now ſee in the kingdom; they having been afterwards granted out from time to time by the crown. See the article *PARSON and Vicar*.

APPROVER, in law, one who, confeſſing felony in himſelf, appealeth or impeacheth another or more of his accomplices. He is ſo called from the French *approuver, comprobare*, becauſe he muſt prove what he hath alleged in his appeal. This proof was anciently either by battle, or by the country, at the choice of the appellee: and the form of this accuſation may be found in Crompt. Juſt. 250.

APPROVERS of the king, are thoſe who have the letting of the king's demenſnes in ſmall manors, &c. In the ſtatute of the 1ſt of Ed. 3. c. 8. ſheriffs are called the king's *approvers*.

It being in the diſcretion of the court to ſuffer one to be an approver, this method of late hath ſeldom been practiſed. But we have in caſes of burglary and robbery on the highway, what ſeems to amount to the ſame by ſtatute; it being ordained, that where perſons charged with ſuch crimes out of priſon, diſcover two others concerned in the crime, they ſhall have a pardon, &c. Stat. 5th Anne, c. 31.

APPROVER is particularly uſed in ancient law writers, for a baliff or land-ſteward, appointed to have the care of a manor, franchiſe, or the like, and improve and make the moſt of it for the benefit of his maſter. In this ſenſe, the word is alſo written *appruare*.

APPROXIMATION, in arithmetic and algebra, the coming nearer and nearer to a root, or other quantity ſought, without expecting to be ever able to find it exactly.

APPUI, in the manege, (*q. d.* reſt or ſtay upon the hand), is the reciprocal effort between the horſe's mouth and the bridle-hand, or the ſenſe of the action of the bridle on the hand of the horſeman.

A juſt appui of the hand, is the nice bearing up or ſtay of the bridle, ſo that the horſe, being awed by the ſenſibility and tenderneſs of his mouth, dares not reſt too much upon the bit-mouth, nor check or beat upon the hand to withſtand it. A horſe is ſaid to have no appui, when he is too apprehenſive of the hand, and cannot bear the bit. He is ſaid to have too much appui, when he reſts or throws himſelf too much upon the bit. Horſes deſigned for the army ought to have a full appui upon the hand. To give a horſe a good appui, he ſhould be galloped, and put often back.

APPULSE, in aſtronomy, the approach of any planet to a conjunction with the ſun, or a ſtar. It is a ſtep towards a tranſit, occultation, conjunction, eclipſe, &c. M. Flamſted, M. de la Hire, and others, have given obſervations of the moon's appulſes to the pleiades. *Philſ. Tranſ.* N° 76. p. 361. *M. Acad. Science. an.* 1708.

APRICOT, in botany. See PRUNUS.

APRIES, ſon of Pſammis, king of Egypt; the ſame with Pharaoh Hophrah in Jeremiah and Ezekiel. He ruined Sidon, and ſome ſay he put Jeremiah to death. He thought neither God nor man could dethrone him; which yet was eaſily done by Amaſis, and he himſelf was ſtrangled by the Egyptians.

APRIL, the fourth month of the year, according to the common computation, but the ſecond, according to that of the aſtronomers. It contains 30 days.—The word is derived from *aprilis*, of *aperio*, "I open;" becauſe the earth, in this month, begins to open her boſom for the production of vegetables. In this month the ſun travels through the ſign Taurus.

A PRIORI, a kind of demonſtration. See DEMONSTRATION.

APRON, in naval architecture, is a piece of curved timber fixed behind the lower part of the ſtern, immediately above the foremoſt end of the keel.

APRON is alſo a name given to a platform or flooring of plank, raiſed at the entrance of a dock, againſt which the dock-gates are ſhut.

APRON, in gunnery, a piece of lead which caps or covers the vent or touch-hole of a great gun.

APSIS or ABSIS, ſignifies the bowed or arched roof of a houſe, room, or oven, &c. as alſo the ring or compaſs of a wheel.

APSIS in eccleſiaſtical writers, denotes an inner part in the ancient churches, wherein the clergy ſat, and where the altar was placed. It is ſuppoſed to have been thus called, becauſe covered with an arch or vault of its own, by the Greeks called αψις, by the Latins *abſis*. Apſis, in this ſenſe, amounts to the ſame with what is otherwiſe called *choir, concha, camera*, and *preſbyterium*; and ſtands oppoſite to the *nave* or body of the church.

APSIS is more particularly uſed for the biſhop's ſeat, or throne, in ancient churches. This was peculiarly called *apſis gradata*, becauſe raiſed on ſteps above the ordinary ſtalls.—It was alſo denominated *exedra*, and in latter times *tribune*.

APSIS is alſo uſed for a reliquary, or caſe, wherein the relics of ſaints were anciently kept. It took the name *apſis*, from its being round, or arched at the top; or perhaps from the place where it was kept. The *apſis* was commonly placed on the altar: it was uſually of wood, ſometimes alſo of gold and ſilver, with ſculptures, &c.

APSIS, in aſtronomy, a term uſed indifferently for either of the two points of a planet's orbit, where it is at greateſt or leaſt diſtance from the ſun or earth; and hence the line connecting thoſe points is called the line of the *apſides*. The word is Greek, and derived from απτω, to *connect*. The apſis at the greateſt diſtance from the ſun is called the *aphelion*, and at the greateſt diſtance from the earth the *apogee*; while that at the leaſt diſtance from the ſun is termed the *perihelion*, and at the leaſt diſtance from the earth the *perigee*.

APSIRTIDES. See ABSORUS.

APTA, or APTA JULIA, (Pliny); now *Apte*, in Provence, on the river Calavon, ſeven leagues to the north of Aix, and nine to the north of Avignon. In the Notitiæ it is called *Civitas Aptenſium*: Pliny reckons it among the Latin towns. That it was a colony, appears from an inſcription on a ſtone found at Arles, (Sirmond). E. Long. 5. 56. Lat. 43. 23.

APTERA, (Strabo, Stephanus); APTERON, (Pliny); APTERIA, (Ptolemy): An inland town of Crete, whoſe port was Ciſamus, on the weſt ſide of the iſland, (Strabo); 12 miles to the ſouth of Sydonia towards the Montes Leuci, and as many from the Sinus Amphimales. So called from the Sirens, who, being there vanquiſhed in ſong by the Muſes, ſtript themſelves of their wings, and out of grief leaped into the ſea, (Stephanus). There was a town of Lycia of the ſame name. E. Long. 25. N. Lat. 35. 50.

APTERA, a term uſed by Linnæus for his ſeventh order of inſects, comprehending ſuch as have no wings.

APTHANE, a title anciently given to the higher degrees of nobility in Scotland. See THANE.

APTITUDE, (from *aptus* "fit"), the natural diſpoſition any thing hath to ſerve for ſuch or ſuch a purpoſe.—Thus, oil hath an *aptitude* to burn, and water to extinguiſh fire.

APTITUDE, or APTNESS, is often uſed, in ſpeaking of the talents of the mind, for a promptitude, or diſpoſition to learn things with eaſe and expedition. In which ſenſe *aptneſs* amounts to the ſame with what the Greeks call ευμαθια, *bona indoles*, and we ſometimes *docility*. Charlton divides *aptneſs* into theſe parts, viz. *acuteneſs*, *ſagacity* and *memory*.

APTOTE, among grammarians, an undeclinable noun, or one which has no variation of caſes.

APULEIUS (Lucius), a Platonic philoſopher, univerſally known by his performance of the Golden Aſs. He lived in the ſecond century, under the Antonines; and was born at Madaura, a Roman colony in Africa. He ſtudied firſt at Carthage, then at Athens, and afterwards at Rome, where he learned the Latin tongue without the help of a maſter. He was a man of a curious and inquiſitive diſpoſition, eſpecially in religious matters: this prompted him to take ſeveral journies, and to enter into ſeveral ſocieties of religion. He ſpent his whole fortune almoſt in travelling; ſo that, at his return to Rome, when he was about to dedicate himſelf to the ſervice of Oſiris, he had not money enough to defray the expence attending the ceremonies of the reception, and was obliged to pawn his clothes to raiſe the neceſſary ſum. He ſupported himſelf afterwards by pleading cauſes; and as he was a great maſter of eloquence, and of a ſubtile genius, many conſiderable cauſes were truſted to him. But he availed himſelf more by a good marriage than by his pleadings: a widow, named *Pudentilla*, who was neither young nor handſome, but wanted a huſband and was very rich, took a great fancy to him. This marriage drew upon him a troubleſome law-ſuit. The lady's relations, pretending he made uſe of ſorcery to gain her heart and money, accuſed him of being a magician before Claudius Maximus proconſul of Africa. Apuleius was under no great difficulty of making his defence. As Pudentillo was determined from conſiderations of health, to enter upon a ſecond marriage, even before ſhe had ſeen this pretended magician, the youth, deportment, pleaſing converſation, vivacity, and other agreeable qualities of Apuleius, were charms ſufficient to engage her heart. He had the moſt favourable opportunities too of gaining her friendſhip, for he lodged ſome time at her houſe: Pudentilla's eldeſt ſon having a great friendſhip for him, was likewiſe deſirous of the match, and ſolicited him in favour of Pudentilla. "Do you make a wonder (ſaid Apuleius, in his defence) that a woman ſhould marry again, after having lived a widow 13 years? it is much more wonderful that ſhe did not marry again ſooner. You think that magic muſt have been employed to prevail with a widow of her age, to marry a young man; on the contrary, this very circumſtance ſhows how little occaſion there was for magic." He offered to prove by his marriage-contract, that he got nothing of Pudentilla but a promiſe of a very moderate ſum, in caſe he ſurvived her and had children by her. He was alſo obliged to make ſuch confeſſions in court as Pudentilla would gladly have excuſed. He ſaid ſhe was neither handſome nor young, nor ſuch as could any ways tempt him to have recourſe to enchantments; moreover, he added, that Pontianus her ſon propoſed the marrying his mother to him only as a burden, and the action of a friend and philoſopher. He alſo took notice of many inconveniences which attend the marrying of widows, and ſpoke highly of the advantages of a maid above a widow: "A handſome virgin (ſaid he, let her be ever ſo poor, is abundantly portioned; ſhe brings to her huſband a heart quite new, together with the flower and firſt-fruits of her beauty. It is with great reaſon that all huſbands ſet ſo great a value upon the flower of virginity: all the other goods which a woman brings her huſband are of ſuch a nature, that he may return them again, if he has a mind to be under no obligation her; that alone cannot be reſtored, it remains in the poſſeſſion of the firſt huſband. If you marry a widow, and ſhe leaves you, ſhe carries away all that ſhe brought you." Upon which paſſage Mr Bayle makes a very coarſe remark, *viz.* "That this good which is never taken back out of the hands of a huſband, is very chimerical; and that there is never a baker nor a butcher, who would lend ſixpence upon this unperiſhable poſſeſſion." The apology is ſtill extant, and is reckoned a very fine piece. Apuleius was extremely indefatigable in his ſtudies; and compoſed ſeveral books, ſome in verſe, and others in proſe; but moſt of them have been loſt. He took great pleaſure in declaiming, and was heard generally with great applauſe: When he declaimed at Oeca, the audience cried out with one voice, that they ought to confer upon him the honour of citizen. The citizens of Carthage heard him with great ſatisfaction, and erected a ſtatue to him; and ſeveral other cities did him the ſame honour. Several critics have publiſhed notes on Apuleius's Golden Aſs, and there have been tranſlations of it into different languages.

APULIA, now PUGLIA, a territory of Italy, bordering on the Adriatic, and extending from the river Frento to Tarentum in length, and from the Adriatic to the Lucani in breadth. *Apuli* the people, (Horace); divided into the *Apulia Daunia*, now called *Puglia Pinna*, or the *Capitanata*; and into the *Apulia Peucetia*, now *Terra di Barri*, (Pliny, Ptolemy.) Apulia abounded in ſheep, which yielded the fineſt wool, (Martial). It is now the eaſt ſide of the kingdom of Naples.

APUS, *Avis Indica*, in aſtronomy, a conſtellation of the ſouthern hemiſphere placed near the pole, between the triangulum auſtrale and the chameleon, ſuppoſed to repreſent the bird of paradiſe.

Apycni
‖
Aqua.

APYCNI SUONI, in muſic, ſounds diſtant one or more octaves, and yet concord.

APYCNOS, in muſic, is ſaid of the diatonic genus, on account of its having ſpacious intervals, in compariſon of the chromatic and enharmonic.

APYREXY, among phyſicians, denotes the intermiſſion of a fever.

APYROUS, a word applied to denote that propertty of ſome bodies, by which they reſiſt the moſt violent fire without any ſenſible alteration. Apyrous bodies ought to be diſtinguiſhed from thoſe which are refractory. Refractory ſubſtances are thoſe which cannot by violent heat be fuſed, whatever other alteration they may ſuſtain. But a body, properly ſpeaking, apyrous, can neither be fuſed by heat, nor can undergo any other change. Diamonds were long thought to be poſſeſſed of this property. But ſome late experiments have ſhown, that diamonds may be entirely diſſipated or evaporated by heat, and are therefore not intitled to be ranked among apyrous ſubſtances. Perhaps there is no body in nature eſſentially and rigorouſly apyrous. But it is ſufficient that there be bodies apyrous relatively to the degree of fire which art can produce, to intitle them to that name.

AQUA, a term frequently met with in the writings of phyſicians, chemiſts, &c. for certain medicines, or menſtruums, in a liquid form, diſtinguiſhed from each other by peculiar epithets, as *AQUA Alexiteria*, *AQUA Aluminoſa*, *AQUA Mirabilis*, *&c.* for which ſee PHARMACY.

AQUA Extincta, or *Extinguiſhed Water*, is aquafortis into which ſome river-water has been poured, in order to qualify it, and render it leſs corroſive. Its uſe is to get the ſilver from the aquafortis that ſerved to part gold from it.

AQUA Fortis, a name given by artiſts to nitrous acid of a certain ſtrength, from its diſſolving power: that which is concentrated and ſmoking, is called *ſpirit of nitre*. The aquafortis uſed by dyers, braſs-founders, &c. is not only weaker than ſpirit of nitre, but contains a portion of vitriolic acid. It may be made by diſtilling crude nitre with calcined vitriol, equal parts. The nitrous acid, expelled by the vitriolic, will riſe in red fumes, and paſs into the receiver. The vitriolic acid, uniting with the alkaline baſis of the nitre, forms vitriolated tartar; but, there being more vitriolic acid than is requiſite to ſaturate the alkali, the ſurplus riſes with the nitrous acid: aquafortis, therefore, is a mixture of theſe two acids. It may alſo be made by diſtilling crude nitre with ſomewhat more than half its weight of oil of vitriol; or by mixing one part of oil of vitriol with nine parts pure ſpirit of nitre. See CHEMISTRY-*Index*.

AQUA Marina, a name by which the jewellers call the beryl, on account of its ſea-green colour. See BERYL.

AQUA Regia, a compound of nitrous and marine acid, in different proportions according to the purpoſe for which it is intended. It is uſually made by diſſolving, in nitrous acid, ſal ammoniac, or common ſalt, both which are combinations of marine acid with alkali. When made with ſal ammoniac, the common proportion is one part of this ſalt to four parts of nitrous acid; but to diſſolve platina, equal parts are requiſite. A purer aqua regia may be made by ſimply mixing the two acids.

Aqua.

Aqua regia is particularly uſed as a menſtruum for gold; it likewiſe diſſolves all other metals, except ſilver. The gold diſſolved in aqua regia is, in fact, diſſolved in the dephlogiſticated marine acid only, which, being deprived of its phlogiſton by the nitrous acid, recovers it from the gold, and thus renders gold ſoluble; for metals are not ſoluble in acids until they loſe a part of their phlogiſton. See CHEMISTRY-*Index*.

AQUA Secunda, aquafortis diluted with much pure water. It is employed in ſeveral arts, to clean the ſurface of metals and certain ſtones, and for various other purpoſes.

AQUA Vitæ, is commonly underſtood of what is otherwiſe called *brandy*, or ſpirit of wine, either ſimple, or prepared with aromatics. Some, however, diſtinguiſh between them; appropriating the term *brandy* to what is drawn from wine, or the grape; and *aqua vitæ* to that drawn after the ſame manner, from malt, &c.

AQUÆ Auguſtæ, (Ptolemy); *Aquæ Tarbellicæ*, (Antonine); *Aquenſis Civitas*, in the Notitia. Now *Acqs*, or *Dax*, a town in Gaſcony, on the river Adour, famous for its baths. W. Long. 1. 40. N. Lat. 43. 56.

AQUÆ Bilbilitanæ, (Antonine); baths 24 miles to the weſt of Bilbilis. Now *Banos de Alhama*, in Arragon.

AQUÆ Calidæ, (Ptolemy); *Aquæ Solis*, (Antonine); a place of the Belgæ in Britain, famous for its hot waters. Now *Bath*, in Somerſet-ſhire. W. Long. 1. 5. Lat. 51. 20.

AQUÆ Calidæ, (Ptolemy); *Aquicaldenſis*, (Pliny); formerly in great repute, and a public bath; whoſe ruins ſtill remain teſtimonies of the Roman grandeur. Now *Orenſe*, in Gallicia, ſtill famous for its baths; on the river Minho, 54 miles ſouth-eaſt of Compoſtella. W. Long. 8. 30. Lat. 42. 30. Alſo a place in the bay of Carthage, (Strabo). Other *Aquicaldenſes*, to the north of Gerundia in Catalonia, (Ptolemy).

AQUÆ Calidæ, a colony between the rivers Serbetes and Savus, in Mauritania Cæſarienſis, (Ptolemy).

AQUÆ Celeniæ, (Ptolemy); or *Cilinæ*, (Antonine). Now *Caldas*, a hamlet on the Minho, in Gallicia.

AQUÆ Convenarum, a hamlet of Gaul, in Aquitaine, (Antonine), and on the borders of the Convenae, or le Cominge, at the foot of the Pyrenees, near the ſource of the Garonne. Now Bagneres. W. Long. 3. 39. Lat. 42. 20.

AQUÆ Cutiliæ, a lake of the Sabines, in the territory of Reate (Pliny); *Lacus Cutilienſis*, (Varro); with a moveable iſland in it, (Seneca, Pliny); ſuppoſed to be the centre of Italy, (Varro). The waters were medicinal, and extremely cold, good for a weak ſtomach and in weak nerves; they ſeemed to act by a kind of ſuction, which approached to a bite, (Pliny). Veſpaſian uſed them every ſummer; and there he died, (Sueton, Xiphilin from Dio). Now *Lago di Contigliano*.

AQUÆ Flaviæ, a town on the confines of Gallicia and Portugal, ſo called from Veſpaſian and Titus. The inhabitants are called *Aquiflavienſes*, coins. Now called *Chiavas*, a mean hamlet: but the ruins of its bridge teſtify its former grandeur. W. Long. 6. 6. Lat. 41. 40.

AQUÆ Helvetiæ, deſcribed by Tacitus as a municipal town, and much frequented for its excellent water; and though he does not mention its name, Cluverius ſuppoſes it to be Baden, in Switſerland, on the rivulet Limat, which ſoon after falls into the Aar. It is called the Upper, to diſtinguiſh it from another called the Lower Baden in Alſace. E. Long. 8. 49. Lat. 47. 55.

AQUÆ Merom (Joſhua), famous for the defeat of Jabin; ſuppoſed to be the lake called *Samachonitis*, or *Semechonitis*, by Joſephus; into which the river Jordon falls, before it comes to the ſea of Geneſereth, or Galilee.

AQUÆ Pannoniæ, famous baths of Auſtria, now called *Baden*, 28 miles to the ſouth of Vienna.

AQUÆ Patavinæ, are baths in the territory of Venice near Padua, (Pliny); called *Fontus Aponi* (Livy, Martial). Now *Bagni d'Abano*. E. Long. 31. 48. Lat. 45. 15.

AQUÆ Quintianæ, put by Ptolemy in room of the *Aquæ Cilinæ* of Antonine. Now ſuppoſed to be *Sarria*, a town of Gallicia, on a rivulet of the ſame name, three leagues to the ſouth of Lugo.

AQUÆ Sextiæ, a colony to the north of Marſeilles, ſo called, both from the founder Sextius Calvinus, and from its quantity of water, and number of cold and hot ſprings; built after the defeat of the Salyes, or Salvii, whoſe territorry in the ſouth of Provence reached from the Rhone to the borders of Italy, (Livy, Velleius, Strabo, Ptolemy). By an inſcription the colony appears to have been either increaſed or renewed by Auguſtus. In the Notitia it is called *Civitas Aquenſis*. Now *Aix*. Here the Teutones and Cimbri were defeated with a great ſlaughter by Marius. E. Long. 6. 4. Lat. 48. 4.

AQUÆ Statiellæ or *Statiellorum*, (Pliny), a town in Liguria, on the river Bormia. Now *Acquic*, a town of Montſerrat. E. Long. 8. 40. Lat. 44. 45.

AQUÆ Tauri, hot waters or baths in Tuſcany, at the diſtance of three miles from the ſea, ſaid to be diſcovered by a bull, hence the appellation. There are ſtill to be ſeen the ruins of theſe baths. Now *Acquapendente*, in Orvieto. E. Long. 12. 40. Lat. 42. 40.

AQUÆDUCT, in hydraulics and architecture, a ſtructure formed for conveying water from one place to another, over grounds that are unequal. The word is compounded of the Latin ſubſtantive *aqua* water, and *ductus* a channel by which that water may be conducted.

Architects diſtinguiſh two kinds of aquæducts, the *viſible*, and the *ſubterraneous*.—The *viſible* are conſtructed in valleys or marſhes, and protracted in longitude or latitude as the ſituation requires. They are compoſed of adminicula for ſupporting the arches and confining the ſtream, and of arcades.—The *ſubterraneous* are formed, by piercing the mountains, and conducting them below the ſurface of the earth. They are built of ſtone, hewn or rough; and covered above with vaults, or with flat ſtones, which may be termed *flags*: theſe flags ſhelter the waters from the heat of the ſun.

They divide them ſtill into *double* and *triple* aquæducts; that is to ſay, ſuch as are ſupported either by two or by three ranges of arcades. Such was the aqæduct which Procopius records to have been built by Coſroës king of the Perſians, for the city of Petra in Mingrelia: It had three conduits upon the ſame line, each elevated above the other.

Frequently aquæducts are paved. Sometimes the waters flow through a natural channel of clay. Frequently they are conveyed by pipes of lead into reſervoirs of the ſame metal, or into troughs of hewn ſtone. The channels are cut with an imperceptible deſcent, that the current may be accelerated by its own weight. Parallel to its courſe, on each ſide, is cut a narrow foot path, where people may walk when neceſſary. By conduits, or grooves, the waters are conveyed into large ciſterns, but not forced above their original level. To make them riſe and iſſue from their apertures with force, they muſt be confined in tubes of a ſmall diameter, and abruptly fall from a conſiderable declivity.

Aquæducts of every kind were long ago the wonders of Rome; the vaſt quantity of them which they had; the prodigious expence employed in conducting waters over arcades from one place to another, at the diſtance of 30, 40, 60, and even 100 miles, which were either continued or ſupplied by other labours, as by cutting mountains and piercing rocks; all this ought to ſurpriſe us; nothing like this is undertaken in our times: we dare not even think of purchaſing public conveniency at ſo dear a rate. Appias the cenſor adviſed and conſtructed the firſt aquæduct. His example gave the public luxury a hint to cultivate theſe objects; and the force of prodigious and indefatigable labour diverted the courſe of rivers and floods to Rome. Agrippa, in that year when he was ædile, put the laſt hand to the magnificence of theſe works. It is chiefly in this reſpect that the modern ſo much reſembles the ancient city of Rome. For this advantage, ſhe is peculiarly indebted to Sextus V. and to Paul V. who for grandeur and magnificence emulated the maſters of the univerſe*. There are ſtill to be ſeen, in different places contiguous to Rome, ſtriking remains of theſe aquæducts; arches continued thro' a long ſpace, over which were extended the canals which carried the water to the city. The arches are ſometimes low, ſometimes raiſed to a vaſt height, to humour the tumidities or depreſſions of the ground. There are ſome which have two arcades, one conſtructed above the other; and this precaution was obſerved, leſt the height of a ſingle arcade, if extended as far as the ſituation required, might render the ſtructure leſs firm and permanent. They are commonly of bricks; which by their cement cohere ſo ſtrongly, that the parts are not ſeparated without the utmoſt difficulty.—When the elevations of the ground were enormous, it became neceſſary to form *ſubterraneous* aquæducts. Theſe carried the waters to ſuch aquæducts as were raiſed above ground, in the declivity or at the foot of mountains. If the artificial channel of the water was not ſuſceptible of a downward bias but by paſſing through a rock, through this they cut a paſſage at the ſame height with the ſuperior aquæduct: ſuch an one may be ſeen above the city of Tivoli, and at the place called *Vicavaro*. The canal which formed the courſe of the aquæduct is hewn out of the rock to the extent of more than a mile, about five feet in height and four in breadth.

There is one thing, however, which deſerves to be remarked. It is, that the aquæducts, which might have been directed in a ſtraight line to the city, did not arrive at it but by frequent and winding mazes. Some have ſaid that this oblique tract was purſued to avoid the expence which muſt attend the building of arcades to an extraordinary height: others, that it was their intention to diminiſh the impetuoſity of the current; which,

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* See *New Memoirs of Italy*, vol. i.

which rolling in a ſtraight line through an immenſe ſpace, muſt always have increaſed its velocity, muſt have worn the canals by perpetual and forcible attrition, and of conſequence afforded an impure and unwholeſome draught to the inhabitants. But ſince there was ſo great a deſcent between the caſcade of Tivoli and Rome, it is demanded why they ſhould go to draw water from the ſame river at the diſtance of more than 20 miles higher; nay, of more that 30 miles, if we reckon the curvatures of its direction through that mountainous country? It is replied, the motive of obtaining the water more ſalubrious, and more limpid, was ſufficient to make the Romans think their labour neceſſary, and their expence properly beſtowed; and to thoſe who reflect that the waters of this river were impregnated with mineral particles, and by no means wholeſome, the anſwer will appear ſatisfactory.

Vol. IV. If any one will caſt his eyes upon plate 128th of the Antiquities of Father Montfaucon, he will ſee with how much care theſe immenſe works were conſtructed. From diſtance to diſtance ſpiramenta were left, that, if the water ſhould happen to be ſtopped by any accident, it might gradually diſemboge, till they could clear its ordinary paſſage. There were likewiſe, even in the very canals which conveyed the water, cavities conſiderably deeper than its internal ſurface, into which the ſtream was precipitated, and where it remained ſtagnant till it was refined from mud and feculence; and ponds, where it might expand itſelf till it was purified.

The aquæduct of the *aqua Marcia* had an arch of 16 feet in diameter. The whole was compoſed of three different kinds of ſtone; one of them reddiſh, another brown, and a third of an earth colour. Above, there appeared two canals; of which the higheſt was fed by the new waters of the Tiverone, and the lower by what they call the *Claudian* river. The entire edifice is 70 Roman feet high. Near this aquæduct, we have in Father Montfaucon the plan of another with three canals; the higheſt ſupplied by the water called *Julia*, that in the middle from Tepula, and the loweſt from the aqua Marcia.

The arch of the aquæduct of the aqua Claudia is of hewn ſtone, very beautiful; that of the aquæduct of the aqua Neronia is of bricks: they are each of them 72 Roman feet in height.

The canal of the aquæduct which was called the *aqua Appia*, deſerves to be mentioned for a ſingularity which is obſerved in it; for it is not, like the others plain, nor gradual in its deſcent; but much narrower at the lower than the higher end.

The conſul Frontinus, who ſuperintended the aquæducts under the emperor Nerva, mentions nine of them which had each 13,594 pipes of an inch in diameter. Vigerus obſerves, that, in the ſpace 24 hours, Rome received 500,000 hogſheads of water.

We might likewiſe have mentioned the aquæduct of Druſus, and that of Riminius: but we ſhall ſatisfy ourſelves with obſerving here, that Auguſtus cauſed all the aquæducts to be repaired; and afterwards paſs to other monuments of the ſame kind, and ſtill more important, which give the moſt ſtriking ideas of Roman magnificence.

One of theſe monuments is the aquæduct of Metz, of which a great number of arcades ſtill remain. Theſe arcades croſſed the Moſelle, a river which is broad and vaſt at that place. The copious ſources of Gorze furniſhed water for the repreſentation of a ſea-fight. This water was collected in a reſervoir: from thence it was conducted by ſubterraneous canals formed of hewn ſtone, and ſo ſpacious that a man could walk erect in them: it traverſed the Moſelle upon its ſuperb and lofty arcades, which may ſtill be ſeen at the diſtance of two leagues from Metz; ſo nicely wrought and ſo firmly cemented, that, except thoſe parts in the middle which have been carried away by the ice, they have reſiſted, and will ſtill reſiſt, the ſevereſt ſhocks of the moſt violent ſeaſons. From theſe arcades, other aquæducts conveyed the waters to the baths, and to the place where the naval engagement was mimicked.

If we may truſt Colmenarus, the aquæduct of Segovia may be compared with the moſt admired labours of antiquity. There ſtill remain 159 arcades, wholly conſiſting of ſtones enormouſly large, and joined without mortar. Theſe arcades, with what remains of the edifice, are 102 feet high; there are two ranges of arcades, one above another. The *aquæduct* flows thro' the city, and runs beneath the greateſt number of houſes which are at the lower end.

After theſe exorbitant ſtructures, we may be in ſome degree believed when we ſpeak of the *aquæduct* which Lewis XIV. cauſed to be built near Maintenon, for carrying water from the river Bucq to Verſailles: it is perhaps the greateſt aquæduct which now ſubſiſts in the world; it is 7000 fathoms in length, above 2560 in height, and contains 242 arcades.

AQUAMBOE, one of the greateſt monarchies on the coaſt of Guinea in Africa, ſtretching 20 miles in breadth, and ten times that ſpace in length from eaſt to weſt. According to Boſman, the coaſt is divided into a great number of petty royalties, but all of them ſubject to the king of Aquamboe, who indiſcrimately uſes an unlimited authority over them and the meaneſt of his ſubjects. His deſpotiſm gave riſe to a proverbial ſaying, that "there are only two ranks of men at Aquamboe; the royal family, and ſlaves." The natives of this country are haughty, turbulent, and warlike; and their power is formidable to all the neighbouring nations. They grievouſly infeſt ſuch nations as are tributaries to the king of Aquamboe, entering their territories by troops, and carrying off from the inhabitants whatever they think proper; nor do they ever meet with any oppoſition from the inhabitants, as they are ſenſible the king would not fail to reſent this as an indignity offered to him.

AQUARIANS, Chriſtians in the primitive church who conſecrated water in the euchariſt inſtead of wine. This they did under pretence of abſtinence and temperance; or, becauſe they thought it univerſally unlawful to eat fleſh or drink wine. Epiphanius calls them *Encratites*, from their abſtinence; St Auſtin, *Aquarians*, from their uſe of water; and Theodoret, who ſays they ſprang from Tatian, *Hydroporaſtatæ*, becauſe they offered water inſtead of wine.

Beſides theſe, there was another ſort of Aquarians, who did not reject the uſe of wine as unlawful; for they adminiſtered the euchariſt in wine at evening ſervice: but, in their morning aſſemblies, they uſed water, for fear the ſmell of wine ſhould diſcover them to the heathens.

AQUARIUS, the WATER-CARRIER, in aſtronomy, the 11th ſign is the zodiac, reckoning from Aries; from which alſo the 11th part of the ecliptic takes its name. —The ſun moves through Aquarius in the month of January; it is marked thus, ♒.

The poets feign, that Aquarius was Ganymede, whom Jupiter raviſhed under the ſhape of an eagle, and carried away into heaven, to ſerve as a cup-bearer, in the room of Hebe and Vulcan; whence the name.—Others hold, that the ſign was thus called, becauſe, when it appears in the horizon, the weather uſually proves rainy.

The ſtars in the conſtellation Aquarius, in Ptolemy's catalogue, are 45; in Tycho's 41; in Hevelius's 47; in Flamſtead's 108.

AQUARTIA, in botany, a genus of the tetrandria monogynia claſs. The calyx is campanulated; the corolla is rotated, with linear diviſions; and the berry is four-ſeeded. There is but one ſpecies, the *aculeata*, a native of America.

AQUATIC, in natural hiſtory, an appellation given to ſuch things as live or grow in the water.

AQUATINTA, a method of etching on copper, lately invented, by which a ſoft and beautiful effect is produced, reſembling a fine drawing in water-colours or Indian ink.

Previous to the operation upon the plate, the following powder muſt be prepared.—Take of aſphaltum and fine tranſparent roſin, equal parts, ſuppoſe two ounces of each, and pound them ſeparately. Through a muſlin ſieve (which may be formed with part of a chip-box of three or four inches diameter) ſift upon a ſheet of paper a thin ſtratum of the aſphaltum, above which ſift a ſimilar layer of the roſin, and upon this another layer of aſphaltum, continuing theſe alternate layers till both of the powders are exhauſted: then paſs the mixture through the ſame ſieve upon the paper once or twice, or till both appear to be ſufficiently incorporated; when the powder is ready for uſe. Some, inſtead of the above mixture, uſe gum ſandarach pounded.

The main proceſs is as follows.—A copper-plate being poliſhed in the uſual way, lay the etching ground upon it, and etch the outlines of your deſign in the manner directed under the article ETCHING: The ground is then to be ſoftened with a little greaſe, and wiped off with a piece of rag; leaving, however, as much greaſe upon the plate as juſt to dim the copper. You now ſift your powder upon the ſurface of the plate; after which, ſtrike the other ſide of it pretty ſmartly againſt the edge of the table, in order to diſcharge it of the looſe powder: This done, with a hand-vice hold the back of the plate over a chaffing-diſh of charcoal fire, till it become ſo hot as to give pain upon being touched with the back of the hand; and the powder which adhered to the greaſe will now be fixed to the plate. The plate being then ſuffered to cool, take turpentine varniſh, mixed with ivory black; and with a hair-pencil dipt in it, cover all the lights or places where there is no work or ſhades. A rim or border of bees-wax is now to be raiſed round the plate: Then having reduced the aquafortis to a proper ſtrength by vinegar or water, you pour it on, and let it ſtand five minutes for the firſt or lighteſt ſhade: after which, pour it off; and having waſhed the plate with water, ſet it on edge to dry: Then with the varniſh ſtop up your light ſhades, pour on the aquafortis for the ſecond tint, and let it ſtand five minutes more; proceeding in the ſame manner for every tint till you produce the darkeſt ſhades. If a bold open ground is wanted in any part, this requires an after-operation: The ground muſt be laid as the other, by ſifting on the powder; only this powder is much coarſer, and the plate muſt be much more heated in order that the particles of the powder may ſpread, and form ſmall circles: even good clean roſin will do by itſelf.

In etching landſkips, the ſky and diſtant objects are alſo performed by a ſecond operation, and the powder is ſifted upon the plate with a finer ſieve. If the trees or any part of the fore-ground require to be higher finiſhed, the plate muſt be entirely cleanſed from greaſe with bread, and a ground laid in the common way of etching; when you may finiſh as highly and neatly as you pleaſe with the needle or point, by ſtippling with dots, and biting up thoſe parts, or by a rolling-wheel.

The preceding is the method for prints of one ſingle tint. But if different colours are to be expreſſed, there will be requied as many different plates, each plate having only the part etched upon it which is deſigned to be charged with its proper colour: unleſs (as many happen in particular ſubjects) ſome of the colours are ſo diſtant from each other as to allow the printer room to fill them in with his rubber without blending them; in which caſe, two or more different colours may be printed from the ſame plate at once.—Where different plates are neceſſary, a ſeparate one, having a pin in each corner, muſt be provided as a ſole or bottom to the aquatinta plates; and theſe again muſt be exactly fitted, having each a ſmall hole in their corners for paſſing over the pins of the ſole: the ſaid pins ſerving the double purpoſe of retaining the plates ſucceſſively in their due poſition, and of directing the printer in placing the paper exactly on each plate ſo as not to ſhift: by which means each tint or colour will be exactly received on its proper place.—This is the method practiſed at Paris. A landſcape or ſimilar ſubject, however may be printed off at once in the different proper colours, by painting theſe upon the plate. In this caſe, the colours muſt be pretty thick in their conſiſtence; and the plate muſt be carefully wiped in the uſual way after the laying on of each tint, as well as receive a general wipe upon its being charged with all the tints.

This art is kept as ſecret as poſſible by thoſe who practiſe it; and it is believed that no particular explanation or directions, before the preſent, have been communicated to the public. In order to ſucceed, however, great care and judgment are requiſite; and much depends upon a certain nicety of management, which is only attainable by practice.

AQUAVIVA, a town of the kingdom of Naples, and province of Barri.

AQUEDUCT. See AQUÆDUCT.

AQUEOUS, in a general ſenſe, ſomething partaking of the nature of water, or that abounds with it.

AQUEOUS Humour. See ANATOMY, p. 767.

AQUILA, in ornithology, a ſynonime of the eagle. See FALCO.

AQUILA, the EAGLE, in aſtronomy, a conſtellation of the northern hemiſphere; uſually joined with Antinous.

The ſtars in the conſtellation Aquila and Antinous, in Ptolemy's catalogue, are 15; in Tycho's, 19; in Hevelius's, 42; in the Britannic catalogue, 71.

AQUILA, a fine large city of Italy, and the capital of Abruzzo, ſeated on a hill, on the banks of the river Peſcara, near its ſource. It has an ancient caſtle, and is a biſhop's ſee immediately under the pope. The land about it produces great plenty of ſaffron. It was very near being all deſtroyed by an earthquake, in February 1703. The firſt ſhock was ſo terrible, that the inhabitants abandoned the city; but returning to veſpers, it being Candlemas-day, the ſhocks followed one another with ſuch violence, that 24,000 people periſhed, and great numbers were wounded; 800 were killed in one ſingle church: many other churches, monaſteries, noble buildings, and the town-houſe, were either ſwallowed up or overturned, together with the greater part of the city and its walls. Aquila ſtands 30 miles from the ſea, and about 16 from the confines of the pope's dominions. E. Long. 14. 20. N. Lat. 42. 20.

AQUILEGIA, COLUMBINE: A genius of the pentagynia order, belonging to the polyandria claſs of plants; and, in the natural method, ranking under the 26th order, *Multiſiliquæ*. It has no calyx; the petals are five, with a horn-like nectarium inſerted between each; and there are five ſeparate capſules.

Species. 1. The vulgaris, or wild columbine, with blue flowers, is found growing wild in ſome woods of England. 2. The alpina, with long oval flowers, grows naturally near Ingleborough-hill in Yorkſhire. The flowers are much larger than thoſe of the garden columbine. 3. The inverſa, or garden columbine. Of this there are great varieties, not only in the colour and fulneſs of their flowers, but alſo in their form. Theſe are commonly called *roſe-columbines*; the colours are cheſnut, blue, red, and white, and ſome are finely variegated with two colours. There are others with ſharp-pointed petals in form of a ſtar, and of theſe there are ſingle and double flowers of the ſame colours with the former. 4. The canadenſis, or Canada columbine, flowers almoſt a month before the other ſorts, and therefore is preſerved in the gardens of the curious, though not at all remarkable for its beauty. There is a variety of this with taller flower-ſtems.

Culture. Theſe plants are all propagated by ſowing the ſeeds, or parting the old roots; but the former method is chiefly practiſed, for the old roots are very apt to degenerate. The ſeeds ſhould be ſown in a nurſery-bed in Auguſt or September; for thoſe which are kept till the ſpring ſeldom grow well, or at leaſt remain in the ground a whole year. The ſpring following the plants will appear above ground, and ſhould be kept clear of weeds; and if the ſeaſon proves dry, they muſt be watered. In the middle or latter end of May they will be ſtrong enough to tranſplant; for which purpoſe, ſome beds of good undunged earth ſhould be prepared, planting them therein at eight or nine inches diſtance from each other. In the following autumn, by which time the plants will have acquired ſtrength enough to flower the year following, the roots ſhould be carefully taken up and planted in the borders of the flower-garden: but where their roots are deſigned to be preſerved in perfection, all the flower-ſtalks muſt be cut off as ſoon as the flowers are paſt. In order to keep up a ſucceſſion of good flowers, freſh ſeeds ſhould be ſown every year; and it will likewiſe be advantageous to exchange the ſeeds with ſome brought from a diſtant place.

Medicinal Uſes. Columbine has been looked upon as aperient; and was formerly in great eſteem among the common people for throwing out the ſmall-pox and meaſles. A diſtilled water, medicated vinegar, and conſerve, were prepared from the flowers; but they have long given place to medicines of greater efficacy.

AQUILEIA, a large city of the Carni, or Veneti, and a noble Roman colony, which was led thither between the firſt and ſecond Macedonian wars, (Livy). It is waſhed by two rivers, the Natiſo aud Turrus, (Pliny.) The reaſon of leading this colony was, in order to be a bulwark againſt the neighbouring barbarians. The colony was afterwards increaſed with 1500 families by a decree of the ſenate, (Livy); from which it became a very famous port-town, (Herodian). The emperor Julian aſcribes the appellation to the augury of an eagle at the time of building it; but Iſaac Voſſius on Mela, to the great plenty of water, as if the town were called *Aquilegia*. The harbour, at the mouth of the Natiſo, is diſtant 60 ſtadia from the city; ſo that ſhips of burden are towed up the river, (Strabo). In 452 it was beſieged by Attila with an innumerable hoſt of barbarians. The walls were aſſaulted by a formidable train of battering rams, moveable turrets, and engines, that threw ſtones, darts, and fire; and the monarch of the Huns employed the forcible impulſe of hope, fear, emulation, and intereſt, to ſubvert the only barrier which delayed the conqueſt of Italy. Aquileia was at that period one of the richeſt, the moſt populous, and the ſtrongeſt of the maritime cities of the Hadriatic coaſt. Three months were conſumed without effect in the ſiege; till the want of proviſions and the clamours of his army compelled Attila to relinquiſh the enterpriſe, and reluctantly to iſſue his orders that the troops ſhould ſtrike their tents the next morning and begin their retreat. But as he rode round the walls, penſive, angry, and diſappointed, he obſerved a ſtork preparing to leave her neſt in one of the towers, and to fly with her infant family towards the country. He ſeized, with the ready penetration of a ſtateſman, this trifling incident which chance had offered to ſuperſtition; and exclaimed, in a loud and cheerful tone, that ſuch a domeſtic bird, ſo conſtantly attached to human ſociety, would never have abandoned her ancient ſeats, unleſs thoſe towers had been devoted to impending ruin and ſolitude. The favourable omen inſpired an aſſurance of victory; the ſiege was renewed and proſecuted with freſh vigour; a large breach was made in the part of the wall from whence the ſtork had taken her flight; the Huns mounted to the aſſault with irreſiſtible fury; and the ſucceeding generation could ſcarcely diſcover the ruins of Aquileia. The place, however, which is ſtill called Aquileia, there are ſeveral inſcriptions and antiquities to be ſeen in it, which are worthy of a traveller's notice; and, though dwindled into a poor village, it gives a title to the patriarch of Aquileia. The patriarch is named by the Venetians, and reſides at Udino, becauſe the town of Aquileia belongs to the Houſe of Auſtria. E. Long. 13. 30. Lat. 46. 20.

ACQUILICIUM, or Acquiliciana, in Roman antiquity, ſacrifices performed in times of exceſſive drought, to obtain rain of the gods.

AQUILINE, ſomething belonging to or reſembling an eagle: Thus, an aquiline noſe is one bent ſomewhat like an eagle's beak.

AQUILO, is uſed by Vitruvius for the north-eaſt wind; or that which blows 45° from the north towards the eaſt point of the horizon.—The poets gave the name *aquilo* to all ſtormy winds dreaded by the mariner.

AQUILUS, among the ancients, a dark or duſky colour approaching to black.—Hence ſome of the Heathen gods were called *dii aquili,* q. d. *nigri.*

AQUIMINARIUM, in antiquity, a kind of luſtral veſſel, wherein the Romans carried their holy water for expiation, and other religious offices.

AQUINAS (St Thomas), ſtyled the *Angelical Doctor,* was of the ancient and noble family of the counts of Aquino, deſcended from the kings of Sicily and Arragon; and was born in the caſtle of Aquino, in the Terra di Lavora in Italy, in the year 1224 or 1225. He entered into the order of the Dominicans; and, after having taught ſchool-divinity in moſt of the univerſities of Italy, at laſt ſettled at Naples: where he ſpent the reſt of his life in ſtudy, in reading of lectures, and in acts of piety; and was ſo far from the views of ambition or profit, that he refuſed the archbiſhoprick of that city, when it was offered him by Pope Clement IV. He died in 1274, leaving an amazing number of writings, which were printed at Venice in 17 vols. folio, in the year 1490. He was canonized by Pope John XXII. in the year 1323; and Pius V. who was of the ſame order with him, gave him, in 1567, the title of the Fifth Doctor of the church, and appointed his feſtival to be kept with the ſame ſolemnity as thoſe of the other four doctors. His authority has always been of great importance in the ſchools of the Roman Catholics. Lord Herbert, in his life of Henry VIII. tells us, that one of the principal reaſons which induced that king to write againſt Luther was, that the latter had ſpoken contemptuouſly of Aquinas.

AQUINO (Philip d'), in Latin *Aquinas* or *Aquinius,* having turned from Judaiſm, had a penſion from the clergy of France; and acquired much reputation by his knowledge of the Hebrew language, which he taught at Paris, in the reign of Lewis XIII. and by the books he publiſhed, among which is his *Dictionarium Hebræo-Chaldæo-Thalmudico-Rabbinicum.* His grandſon, Anthony D'Aquin, was firſt phyſician to Lewis XIV.

Aquino, a town of Italy, in the kingdom of Naples, and Terra di Lavora; a biſhop's ſee, but ruined by the emperor Conrade, and now conſiſting of about 35 houſes. It was the birth-place of the poet Juvenal, and of Thomas Aquinas. E. Long. 14. 30. N. Lat. 41. 32.

AQUINUM, (anc. geog.) a large municipal town, and a Roman colony on the borders of the Samnites, waſhed by the river Melpha (Strabo). The birthplace of Juvenal, as he himſelf teſtifies. The inhabitants are called *Aquinates;* now *Aquino,* but almoſt in ruins, in the territory of Lavoro. E. Long. 17. 11. Lat. 41. 35.

AQUITANIA (anc. geog.), one of the three principal diviſions of Gallia Comata (Cæſar); bounded by the Garonne, the Pyrenees, and the Ocean: this is the *Aquitania Cæſariana,* or *Vetus.* Auguſtus ſet different boundaries, viz. the Loire, the Cevennes, the Pyrenees, and the Ocean (Strabo). It was called *Gallia Aquitanica* (Pliny); and in the old Notitiæ, *Provincia Aquitanica.* The people are called *Aquitani* (Cæſar). Now compriſing Guienne (which ſeems to be a corruption of Aquitania) and Gaſcony.

AR (anc. geog.), the metropolis of Moab, in Arabia Petræa (Moſes); and the royal reſidence ſituate on the eaſt ſide of the river Arnon. It was called alſo *Rabba* (Joſhua;) and to diſtinguiſh it from Rabba of the Ammonites, *Rabbat Moab,* and on coins *Rabbath Moma* (Reland.) Euſebius ſays it was called *Areopolis* in his time, from *Ar* and *Polis.* The inhabitants are called *Areopolitæ.* St Jerom ſays that this city was entirely deſtroyed by an earthquake when he was a young man.

ARA thuribuli, the altar of incenſe, in aſtronomy, a ſouthern conſtellation, not viſible in our hemiſphere, conſiſting, according to Ptolemy, of ſeven ſtars; and according to Sharp's catalogue, annexed to that of Mr Flamſtead, of nine ſtars.

Ara, in aſtronomy, a ſouthern conſtellation, containing eight ſtars.

ARAB, or Arabian horse. See Equis.

ARABESQUE, or Arabesk, ſomething done after the manner of the Arabians. *Arabeſque, Groteſque,* and *Moreſque,* are terms applied to ſuch paintings, ornaments of freezes, &c. wherein there are no human or animal figures but which conſiſt wholly of imaginary foliages, plants, ſtalks, &c. The words take their riſe from hence, that the Moors, Arabs, and other Mahometans, uſe theſe kinds of ornaments; their religion forbidding them to make any images or figures of men or other animals.

ARABIA, a country of Aſia, famous from the remoteſt antiquity for the independency of its inhabitants during the vaſt conqueſts of the Aſſyrians, Perſians, Greeks, and Romans, and, in latter times, for being the centre of an empire equal, if not ſuperor, in extent to any that ever exiſted.

1
Whence named.

This country, or at leaſt the greateſt part of it, was in the earlieſt ages called *Arabah.* Concerning the etymology of which word there are various conjectures. It has moſt generally been derived from the Hebrew word ארב, ſignifying, *the weſt, mixture,* or *traffic;* but, according to M. Volney, *Arab,* in the ancient language of theſe countries, ſignifies a *ſolitude* or *deſart.*

2
Boundaries &c.

In its largeſt extent, Arabia lies between the 12th and 35th degrees of N. Lat. and the 36th and 61ſt of E. Long. It greateſt length from north to ſouth is about 1430 miles, and its breadth from eaſt to weſt is 1200. It is bounded on the weſt by Paleſtine, part of Syria, the iſthmus of Suez, and the Red ſea, called by the Arabs the ſea *Al Kolzom;* on the eaſt by the Euphrates, the Perſian gulf, and bay of Ormos; on the north, by part of Syria, Diyar-Becr, Irak, and Khuzeſtan: and on the ſouth by the ſtraits of Babel-Mandel and the Indian ocean. It grows narrower as we approach the frontiers of Syria and Diyar-Becr; and, by reaſon of the proximity of the Euphrates to the Mediterranean, may be looked upon as a peninſula,

ninſula, and that one of the largeſt in the whole world. —Arabia Proper, however, is much narrower, including little more than what was comprehended by the ancients under the name of Arabia Felix, which we ſhall preſently deſcribe; and here the Arabs have been ſettled almoſt ſince the flood.

3 Diviſion.

The firſt diviſion of the peninſula of Arabia was into *Arabah* and *Kedem*, as we learn from ſcripture; the firſt of which implied the weſt, and the other the eaſt, denoting the ſituation of the two countries.—Ptolemy was the firſt who divided the peninſula we ſpeak of into three parts, Arabia Petræa, Arabia Deſerta, and Arabia Felix, which diviſion has generally prevailed ſince his time.

Arabia Petræa, on the eaſt, was bounded by Syria and Arabia Deſerta; on the weſt, by Egypt, or rather the iſthmus of Suez which ſeparates Aſia from Africa, and the Heroopolitan gulph or weſtern arm of the Red Sea; on the north, by Paleſtine, the lake Aſphaltites, and Cœloſyria; and on the ſouth by Arabia Felix. This tract did not admit of much cultivation, the greateſt part being covered with dry ſands, or riſing into rocks, interſperſed here and there with ſome fruitful ſpots. Its metropolis was Petra, which by the Syrians was ſtiled *Rakam*, and in ſcripture *Joktheel*. Several other cities of Arabia Petræa are mentioned by Ptolemy; but as it is very improbable ſuch a barren country ſhould abound with large cities, we muſt look upon them as inconſiderable places.

Arabia Deſerta was bounded on the north by the Euphrates, which ſeparated it from Meſopotamia; on the weſt, by Syria, Judæi, and Arabia Petræa; on the eaſt by a ridge of mountains which ſeparated it from Babylonia and Chaldæa; on the ſouth, by Arabia Felix, from which it was likewiſe ſeparated by ſeveral ridges of hills. By far the greateſt part of this kingdom, as well as the former, was a loneſome deſart, diverſified only with plains covered with ſand, or mountains conſiſting of naked rocks and precipices; nor were they ever, unleſs ſometimes at the equinoxes, refreſhed with rain. The few vegetables which they produced were ſtinted by a perpetual drought, and the nouriſhment afforded them by the nocturnal dews was greatly impaired by the heat of the ſun in the day time. Throughout the deſarts were found huge mountains of ſand, formed by the violence of the winds that continually blew over them in the day-time, though they ceaſed in the night. Wells and fountains were for the moſt part exceedingly rare; however, notwithſtanding the ſterility of theſe countries, the vaſt plains of ſand juſt now mentioned were interſperſed with fruitful ſpots, which appeared here and there like ſo many iſlands in the midſt of the ocean. Theſe being rendered extremely delightful by their verdure, and the more ſo by the neighbourhood of thoſe frightful deſarts, the Arabs encamped upon them: and having conſumed every thing they found upon one, removed to another, as is the cuſtom of their deſcendants the Bedoweens at this day. Theſe fruitful ſpots were likewiſe frequent in Lybia, and by the Egyptians called *auaſes* or *abaſes*, as we learn from Strabo. The barren part of Arabia Felix bordering upon the Red Sea, was in like manner interſperſed with abaſes; which probably gave the name of *Abaſeni* to a nation ſettled there, and in the adjacent fertile region. A body of theſe, it is ſaid, croſſing the ſtraits of Babel-Mandel, paſſed into Ethiopia, which from them received the name of *Abaſſia*. From this account of Arabia Deſerta, we may reaſonably conclude, that the towns ſaid by Ptolemy to have been ſituated in it were places of very little conſequence.

Arabia Felix was bounded on the north by the two kingdoms juſt deſcribed; on the ſouth, by the Red Sea; on the eaſt and weſt, by part of that ſea, together with the Arabian and Perſian gulfs. In Strabo's time, it was divided into five provinces, by the oriental hiſtorians called *Yaman*, *Hejaz*, *Tehâma*, *Najd*, and *Yamana*. In this diſtrict ſtood ſeveral towns, particularly Nyſa, famous for being the birth-place of Bacchus; and Muſa, or Muza, a celebrated emporium or harbour, where the Arabian merchants reſorted with their frankincenſe, ſpices, and perfumes. Theſe two were ſituated in the province of Yaman. In that of Hejaz ſtood the ſtill more famous cities of Mecca and Medina; alſo Thaifa or Taifa, Gjudda or Jodda, Yanbo or Al Yanbo, and Madian, the Modiana of Ptolemy, and the Midion or Madian of Scripture.

4 When peopled.

At what time the abovementioned kingdoms were firſt peopled we have no certain accounts. The moſt conſiderable nations inhabiting Arabia Petræa, in the early ages, were the Iſhmaelites, the Nabatei or Nabatheans, the Cedræi or Kedareni, and the Agareni or Hagareni; and of theſe the Iſhmaelites were the moſt powerful, if they did not comprehend all the reſt; and if the Hagareni were not the ſame people with them, they muſt at leaſt have been nearly related. Kimſhi, an oriental hiſtorian, inſinuates, that they were originally the children of Hagar by an Arab, after ſhe had left Abraham. In after ages, the names of all the nations ſituated here were abſorbed in that of *Saracens*, by which the Iſhmaelites are diſtinguiſhed in the Jeruſalem Targum. A nation alſo is mentioned by Pliny, called *Arraceni*, and *Saraceni* by Ptolemy and Dioſcorides, which was probably no other than the Iſhmaelites above mentioned In Arabia Deſerta ſeveral tribes reſided, all of whom were very obſcure, except the Aiſitæ and Agræi. The former are ſuppoſed by Bochart to have been Job's countrymen, and the latter to have been the ſame with the Hagareni, Arraceni, or Saraceni, abovementioned. Arabia Felix was inhabited by many different tribes; the moſt remarkable of which were the Sabæi, Gerræi, Minæi or Minnæi, Atramitæ, Maranitæ, Catabani, Aſcitæ, Homeritæ, Sapphoritæ, Omanitæ, Saraceni, Nabathæi, Thamydeni, and Bnizomenæ; but neither their limits nor ſituation can now be determined with any manner of preciſion.

5 Diviſion of the Arabs.

According to the oriental hiſtorians, the Arabs are to be divided into two claſſes; *viz.* the *old loſt Arabians*, and the *preſent*. The moſt famous tribes among the former were thoſe of Ad, Thamud, Taſm, Jadês, Jorham, Amalek, Amtem, Haſbem, Abil, and Bâr. Concerning theſe, though now entirely loſt and ſwallowed up among other tribes, there are ſome remarkable traditions, of which the following may ſerve as a ſpecimen.

6 Tradition concernidg the tribe of Ad.

The tribe of Ad deduced their origin from Ad the ſon of Aws, or Uz, the ſon of Aram, the ſon of Shem, who, after the confuſion of tongues, ſettled in Al Abkaf, or the winding ſands in the province of Hadramant, on the confines of Yaman, where his poſterity greatly multiplied. Their firſt king was Sheddâd, the ſon of Ad, who built a ſtately palace and made a delightful garden in the deſarts of Aden, which he deſigned as an imitation of the celeſtial paradiſe. This garden he called *Irem:* and when it was finiſhed, he ſet out with a great retinue to take a view of it; but, having ſome thoughts of aſſuming divine honours, he was deſtroyed by a tempeſt from heaven, while yet a day's journey from his paradiſe. The garden and palace, however, were preſerved, though inviſible, as a monument of divine vengeance.

After the death of Sheddâd, the kingdom of Ad was governed by a long ſeries of princes, concerning whom many fables are related by the eaſtern writers. The concluſion of their hiſtory, however, is as follows. "The Adites, in proceſs of time falling from the worſhip of the true God, into idolatry, God ſent the prophet Hûd, ſuppoſed to be the ſame with Heber, to preach to and reclaim them. But they refuſing to acknowledge his miſſion or to obey him, God ſent an hot and ſuffocating wind, which blew ſeven nights and eight days, and, entering at their noſtrils, paſſed thro' their bodies, and deſtroyed them all, a very few only excepted, who had liſtened to Hûd, and retired with him to another place." Others relate, "that, before this terrible cataſtrophe, they had been previouſly chaſtiſed with a three years drought; and therefore ſent Kail Ebn Ithar, and Morthed Ebn Sdaa, with 70 other principal men to Mecca, then in the hands of the tribe of Amalek, whoſe prince was Moawiyah Ebn Becr, to obtain of God ſome rain. Kail having begged of God that he would ſend rain to the people of Ad, three clouds appeared, a white, a red, and a black one; and a voice from heaven ordered him to chooſe which he would. Kail failed not to make choice of the laſt, thinking it would be laden with moſt rain; but when this cloud came over them, it proved to be fraught with the Divine vengeance, and a tempeſt broke forth from it which deſtroyed them all."

7 Arabs from whom deſcended.

The *preſent Arabs*, according to their own hiſtorians, are ſprung from Kahtan, the ſame with Joktan, the ſon of Eber; and Adnan, deſcended in a direct line from Iſhmael the ſon of Abraham. The former of theſe they call the *genuine* or *pure* Arabs, and the latter the *naturalized* or *inſititious* Arabs.

Joktan the ſon of Eber had 13 ſons, who ſome time after the confuſion of languages ſettled in Arabia, extending themſelves from Meſha to Sephar, a mountainous place in the ſouth-eaſtern part of that peninſula. According to the Arabian hiſtorians, he had 31 ſons, all of whom left Arabia and went into India, except two, viz. Yarab and Jorham; the former of whom, they ſay gave the name both to their country and language. Iſhmael and his mother Hagar having been diſmiſſed by Abraham, entered into the wilderneſs of Paran, as related in the book of Geneſis. The ſacred hiſtorian informs us, that during his reſidence in the wilderneſs he married an Egyptian; and the Arabian writers ſay that he alſo took to wife the daughter of Modad king Hejaz, lineally deſcended from Jorham the founder of that kingdom. By the Egyptian he was probably the father of the Scenite or wild Arabs; and having allied himſelf to the Jorhamites, he is conſidered by the Arabians as the father of the greateſt part of their nation.

8 Joktan the firſt king.

9 Reſervoir of Saba.

Kahtan, or Joktan, is ſaid to have firſt reigned, and worn a diadem in Yaman; but the particulars of his reign we no where learn. He was ſucceeded by Yarab already mentioned, he by Yaſhab, and Yaſhab by Abd Shems. He was ſucceſsful in his expeditions againſt his enemies, carried off great ſpoils, and took many of them priſoners. He is ſaid to have built the city of Saba or Mareb, and above it a ſtupendous mound or building which formed a vaſt reſervoir, containing all the water that came down from the mountains. By means of this reſervoir, the kings of Yaman not only ſupplied the inhabitants of Saba and their lands with water, but likewiſe kept the territories they had ſubdued in greater awe, as by cutting off their communication with it they could at any time greatly diſtreſs them.

Abd Shems was ſucceeded by his ſon Hamyar, from whom the tribe of Hamyar is ſaid to take its name; and he by a ſeries of 17 Kings, concerning whom we have no remarkable particular, except that from one of them called *Africus* the continent of Africa took its name. The laſt of theſe was ſucceeded by a daughter named *Balkis* or *Belkis*, whom ſome will have to be the queen of Sheba who paid a viſit to Solomon. After Balkis came Malea, ſurnamed *Naſherolneam* on account of his magnificence and liberality. Having had bad ſucceſs in an expedition, where his army was overwhelmed by torrents of ſand, he cauſed a braſen ſtatue to be erected with the following inſcription in the old Hamyaritic character. "There is no paſſage behind me, no moving farther; the ſon of Sharhabil." He was ſucceeded by Shamar Yaraaſh, ſo called on account of his being affected with a conſtant tremor. To this prince the city of Sarmacand is ſaid to owe its exiſtence. After Shamar Yaraaſh we have a liſt of 15 kings, of whom nothing worth mentioning is recorded, except of one Abu Carb Aſaad, who adorned the Caaba or temple of Mecca with tapeſtry, and firſt introduced Judaiſm among the Hamyarites. He was put to death by his ſubjects, probably on account of religion. The laſt of the 15 kings above mentioned was called *Abrahah*, who was ſucceeded by his ſon Sabban. He had that famous ſword called *Samſannah*, which afterwards came into the hands of the khalif Al Raſhid. This prince was ſucceed by Dhu Shanater, who had ſix fingers on each hand. He was abandoned to unnatural luſt, and dethroned for abuſing ſome of the nobleſt youths in the kingdom. To him ſucceeded Yuſef, who lived about 70 years before Mahomet. He perſecuted all thoſe who would not turn Jews, putting them to death by various tortures, the moſt common of which was throwing them into a glowing pit of fire; whence he had the appellation of the *lord of the pit.* This perſecution is taken notice of in the Koran. The laſt of the Hamyaritic monarchs was Dhu Jadan, according to Abulfeda, but, according to others, the Yuſef juſt mentioned, who was ſurnamed *Dhu Nowas,* on account of his flowing curls, and was the laſt who reigned in an uninterrupted ſucceſſion. He was a bigotted Jew, as already mentioned; and treated his ſubjects with ſuch barbarity, that they were obliged to aſk the aſſiſtance of Eleſbaas or Eleſbaan, king of Ethiopia, againſt him. Dhu Nowas, not being able to make head againſt the Ethiopians, was at laſt driven to ſuch extremity, that he forced his horſe into the ſea, and loſt both his life and crown together.

10 Balkis ſuppoſed to be the queen of Sheba.

11 Sarmacand by whom built.

12 Yuſef, a bloody perſecutor.

13 His ſubjects call in the king of Ethiopia, who dethrones Yuſef.

14 Chriſtian religion eſtabliſhed in Arabia.

15 Ethiopians driven out.

The king of Ethiopia, having thus become maſter of Yaman, eſtabliſhed there the Chriſtian religion, and fixed upon the throne one Abryat an Ethiopian. He was ſucceeded by Abraha-Ebn-Al-Sabah, ſurnamed the *ſlit-noſed*, from a wound he had formerly received in it. He was likewiſe ſtyled *lord of the elephant*, from a ſtory too ridiculous to deſerve notice. He was ſucceeded by two other Ethiopian princes; but at laſt Seif Ebn Dhu Yazan, of the old royal family of Hamyar, having obtained aſſiſtance from the king of Perſia, which had been denied him by the emperor Heraclius, recovered his throne, and drove out the Ethiopians; but was himſelf ſlain by ſome of them who were left behind. The ſucceeding princes were appointed by the Perſians, till Yaman fell into the hands of Mahomet.

16 Terrible inundation by the breaking down of the reſervoir of Saba.

We have already taken notice of the vaſt mound or reſervoir made by Abd Shems, from which he ſupplied the city of Saba with water. This building ſtood like a mountain above the city, and was by the Sabæans eſteemed ſo ſtrong, that they were under no fear of its ever failing. The water roſe almoſt to the height of 20 fathoms; and was kept in on every ſide by a work ſo ſolid, that many of the inhabitants had their houſes upon it. About the time of Alexander the Great, however, a terrible inundation happened. According to the Arabian hiſtorians, God being diſpleaſed at the pride and inſolence of the inhabitants of this city, reſolved to humble them; and for this purpoſe ſent a mighty flood, which broke down the mound by night whilſt the inhabitants were aſleep, and carried away the whole city with the neighbouring towns and people. This inundation is ſtyled in the Koran the *inundation of Al-Haram;* and occaſioned ſo terrible a deſtruction that from thence it became a proverbial ſaying to expreſs a total diſperſion, "that they were gone and ſcattered like Saba".—By this accident no leſs than eight tribes were forced to remove their habitations; ſome of which gave riſe to the kingdoms of Hira and Ghaſſan.

17 Origin, &c. of the kingdom of Hira.

The kingdom of Hira was founded by Malec, a deſcendant of Cahlan the brother of Hamyar; but after three deſcents, the throne came by marriage to the Lakhmians, who were deſcendants of Lakhm the ſon of Amru, the ſon of Abd Ems. Theſe princes, whoſe general name was *Mondar*, preſerved their dominion, notwithſtanding ſome ſmall interruption from the Perſians, till the khalifat of Abubecr, when Al Mondar Maghrur, the laſt of them, loſt his life and crown by the arms of Khaled-Ebn-Al-Walid. This kingdom continued 622 years and eight months, according to Ahmed Ebn Yuſef. Its princes were under the protection of the kings of Perſia, and were their lieutenants over the Arabs of Irak, as the kings of Ghaſſan were for the Roman emperors over thoſe of Syria.

18 Of Ghaſſan.

The kingdom of Ghaſſan was founded by the tribe Azd, who, according to ſome, ſettling in Syria Damaſcena, near a water called *Ghaſſan*, from thence took their name; but others ſay they went under this appellation before they left Yaman. Having driven out the Dajaamian Arabs, who before poſſeſſed the country, they made themſelves maſters of a conſiderable territory. Here they maintained themſelves, according to ſome 400, according to others 600, and according to Abulfeda 613 years, when the laſt of their kings ſubmitted to the khalif Omar, and embraced the Mahometan religion; but receiving afterwards a diſguſt, ſoon returned to Chriſtianity, and took refuge in Conſtantinople.

19 Of Hejaz.

The kindom of Hejaz was founded by Jorham the ſon of Kahtan, where princes of his line reigned till the time of Iſhmael, who maried the daughter of Modad one of thoſe princes. Some author's relate that Kider, one of Iſhmael's ſons, had the crown reſigned to him by his uncles the Jorhamites: but, according to others, the deſcendants of Iſhmael expelled that tribe; who, retiring to Johainah, were after various adventures deſtroyed by an inundation. After the expulſion of the Jorhamites, the government of Hejaz ſeems not to have continued long in the hands of one prince, but to have been divided among the heads of tribes, almoſt in the ſame manner as the Arabs of the deſart are governed at this day.

20 Tribe of Khozaab aſſumes the government of Mecca.

The tribe of Khozaab, after the above-mentioned inundation of Saba, fled into the kingdom of Hejaz, and ſettled themſelves in a valley called *Marri* near Mecca. Here they founded an ariſtocracy, aſſuming to themſelves both the government of the city of Mecca, and the cuſtody of the Caaba or temple there. They continued maſters of this city and territory, as well as preſidents of the Caaba for many ages; till at length one Koſa, of the tribe of Koreiſh, circumvented Abu Gabſhan, a weak and ſilly man, of whom, while in drunken humour, he bought the keys of the temple for a bottle of wine; but when Abu Gabſhan grew cool, and reflected on his imprudence, he ſufficiently repented of what he had done; whence the Arabian proverbs, "More vexed with late repentance than Abu Gabſhan; more fooliſh than Abu Gabſhan," &c. The tribe of Khozaab endeavoured afterwards to give ſome diſturbance to the Koreiſh in the poſſeſſion of the keys of the Caaba, which furniſhed the latter with a pretence for depriving them of the civil government of Mecca. After the Koreiſh had poſſeſſed themſelves of this city, they kept up the ſame form of government which had prevailed there before. Beſides theſe kingdoms, there were many others of leſſer note, of which we find nothing remarkable.

21 Folly of Abu Gabſhan

Thus we have briefly mentioned the moſt memorable events recorded by the Arabian hiſtorians previous to the time of Mahomet; but, before entering upon an account of that famous impoſtor and the kingdom founded by him, it will be proper to take notice of ſeveral circumſtances in different parts of the world, which at that time concurred to facilitate his ſcheme, and without which, in all probability, he would never have been able to accompliſh it.

22 Cauſe of Mahomet's ſucceſs.

The firſt and great cauſe of Mahomet's ſucceſs in his impoſture, was the groſs corruption and ſuperſtition with which the Chriſtian religion was at that time obſcured in all parts of the world. Had the pure doctrines of Chriſtianity been then as publicly known as the ridiculous fopperies which deformed the Eaſtern and Weſtern churches, Mahometaniſm could never have got a hearing. But along with the true religion, mankind ſeemed alſo to have loſt the uſe of their rational faculties, ſo that they were capable of ſwallowing the groſſeſt abſurdities; ſuch as it now appears almoſt incredible that any of the human race could receive as truths. Another cauſe was, the manner of government and way of life among the Arabs. Divided into ſmall independent tribes, they never were capable of a firm union but by ſuperſtition; and had

Mahomet attempted their conqueſt in any other way, it was impoſſible he could have ſucceeded. As there were alſo among them Jews, Pagans, and Chriſtians of all ſorts, this impoſtor, by adopting ſomething out of every religion then extant, cunningly recommended himſelf to the profeſſors of every one of them. Add to all this, that, by allowing of polygamy, and ſetting forth his paradiſe as conſiſting in the enjoyment of women, he adapted himſelf to the corrupt diſpoſitions of mankind in general.

If the diſtracted ſtate of religion favoured the deſigns of Mahomet on the one hand, the weakneſs of the Grecian and Perſian Monarchies aſſiſted him no leſs powerfully on the other. Had thoſe once formidable empires been in their vigour, either of them would have been ſufficient to cruſh Mahometaniſm in its birth; but both of them were then ſtrangely reduced. The Roman empire had continued to decline after the time of Conſtantine: the weſtern parts of it were then entirely over-run by the Goths and other barbarous nations; and the eaſtern, or Greek empire, was ſo much reduced by the Huns on one hand, and the Perſians on the other, as to be incapable of making any great effort. The Perſian monarchy itſelf was in little better condition. It is true, they ravaged the dominions of the Greeks, and often overcame them in the field: but that was more owing to the weakneſs of the Grecian empire, than to the ſtrength of the Perſians; and ſo effectually did the inteſtine broils, which aroſe chiefly on account of religion, weaken the kingdom of Perſia, that the moſt conſiderable part of it was annexed by the khalif Omar to his dominions.

As the Greeks and Perſians were then in a languiſhing ſituation, ſo the Arabs were ſtrong and flouriſhing. Their country had been peopled at the expence of the Grecian empire; whence the violent proceedings of the different religious ſectaries forced many to take refuge in Arabia. The Arabs were not only a populous nation, but unacquainted with the luxuries and delicacies of the Greeks and Perſians. They were inured to hardſhips of all kinds, and conſequently much better fitted than their effeminate neighbours to endure the fatigues of war, as the event very fully verified.

23
Mahomet's birth, deſcent, &c.

Mahomet was born in the year of Chriſt 569. According to the Eaſtern hiſtorians, he was deſcended in a direct line from Iſhmael. Kedar, or, as the Arabians call him, *Kidâr*, after his father Iſhmael's death, communicated his name to the greateſt part of Arabia Petræa. He was ſucceeded in his authority and poſſeſſions by his ſon Hamal; Hamal by Nabet, and Nabet by Salaman. After Salaman came Al Homeiſa, then Al Yaſa, whoſe ſon Odad was ſucceeded by Odd the father of Adnan. Counting ten generations forward in the ſame line, we come at laſt to Fehr, who ſeems to have diſtinguiſhed himſelf by ſome glorious actions, as he was denominated *Koreiſh*, on account of his bravery. He is to be conſidered as the root of the politeſt and moſt celebrated tribe of the Arabs. He had three ſons, Gâleb, Mohâreb, and Al Aâreth. From Mohâreb the Banu Mohâreb, denominated likewiſe *Sheibân*, took their origin; from Al Hâreth, the Banu Al Kholoj; and from Gâleb, in a direct line, the impoſtor Mahomet. Gâleb was the father of Lowa; and he of Caab, whoſe ſon Morrah had for his immediate deſcendant Kelâb the father of Koſa. It was this Koſa who aggrandized the tribe of the Koreiſh, by purchaſing the keys of the Caaba from Abu Gabſhan, as we have already related. By this he not only aggrandized his tribe, but became the prince of it himſelf. He was ſucceeded by his ſecond ſon Abd Menâf, to whom the *prophetic light*, which is ſaid to have manifeſted itſelf in his face, gave the right of primogeniture. Abd Menâf was ſucceeded by his ſon Amni, ſurnamed *Hâſhem*, or "one that broke bread," on account of his ſingular generoſity during a famine at Mecca. Having amaſſed great ſums of money, he took a journey into Syria, where he purchaſed a vaſt quantity of meal, which he made into cakes and divided with his own hands amongſt the people of Mecca. He likewiſe killed a prodigious number of camels, with which he fed them, and relieved them in the time of their diſtreſs: and finding that the ſoil about Mecca was ſo barren as to produce no fruits but what are common in the deſarts, and conſequently no corn or grain, which the Meccans are obliged to bring from other places, he appointed two caravans to ſet out yearly for that purpoſe, the one in ſummer, and the other in winter; by means of which, the city was amply ſupplied with proviſions of all kinds. The proviſions brought by them were diſtributed twice a-year; and Hâſhem, by his prudent conduct, raiſed the glory of his people to the higheſt pitch; inſomuch, that all the neighbouring great men and heads of tribes made their court to him. Nay, ſo great veneration is the memory of Hâſhem held in by the Arabs, that from him the family of Mahomet among them are called *Hâſhemites*; and he who preſides over Mecca and Medina, who muſt always be of the race of Mahomet, has to this day the title of the "Chief or Prince of the Hâſhemites."

24
Fehr head of the Koreiſh.

25
Haſhem's generoſity.

Hâſhem died at Gaza in Syria, and was ſucceeded by his ſon Abdal Motalleb or Mateleb. He is ſaid to have been extremely affable and eaſy of acceſs, as well as juſt and generous to a great degree; ſo that, in the beginning of the month *Ramadan*, he entertained the poor upon the flat roof of his houſe, and afterwards ſupplied the fowls of the air and wild beaſts of the field with proviſions of various kinds, which he ordered his ſervants to leave upon the ſummits of the neighbouring mountains. The well which God ſhowed to Hagar in the wilderneſs is ſaid to have been miraculouſly diſcovered to Abdal Motalleb, about 500 years after it had been filled up by Amru prince of the Jorhamites. This well is by the Arabs called *Zemzem*; which ſome derive from her calling to Iſhmael, when ſhe ſpied it, in the Egyptian tongue, *Zem, Zem*, i. e. Stay, Stay; though others aſcribe it to a different origin. The water of this well which is on the eaſt ſide of the Caaba, and covered with a ſmall building and cupola, is highly reverenced; being not only drank with particular devotion by the pilgrims, but alſo ſent in bottles as a great rarity to moſt parts of the Mahometan dominions.

26
Well Zemzem diſcovered by Abdal Motalleb.

Abdalla, the father of the Mahomet, was a younger ſon of Abdal Motalleb, and remarkable for his beauty. In his 24th or 25th year, he married Amina, the daughter of Wâheb, the ſon of Abdal Menâf. She is repreſented as the moſt beautiful, prudent, and virtuous lady of her tribe; and conſequently the moſt worthy of ſuch an extraordinary perſon as Abdalla. He died young, and, in his father's life-time, left his widow an infant ſon in very mean circumſtances; his whole ſubſtance conſiſting only of five camels and one female Ethiopian ſlave. Abdal Motalleb was, therefore, obliged to take care of his grandſon Mahomet; which he not only did during his life, but at his death enjoined his eldeſt ſon Abu Taleb to provide for him for the future.

27 Mahomet at firſt a merchant.

Abu Taleb was extremely kind to his nephew, and inſtructed him in the buſineſs of merchandiſe; for which purpoſe he took him into Syria when he was but 13 years of age, recommending him to Khadijah, a noble and rich widow, for her factor; in whoſe ſervice he behaved ſo well, that ſhe married him, and thus raiſed him to an equality with the richeſt in Mecca.

28 Begins to broach his doctrine.

Though Mahomet had probably formed a deſign of introducing his new religion pretty early, he did not think proper to avow it till the 40th year of his age. The grand article of his faith was, the unity of the divine nature, which he pretended was violated by the Jews and Chriſtians no leſs than by the Pagans; for which reaſon, he reſolved to make an attempt to reſcue the world from the ignorance and ſuperſtition which prevailed at that time. This reformation he intended ſhould begin in his own family; and therefore, having retired with his houſehold to a cave in Mount Hara, near Mecca, he there opened the ſecret of his miſſion to Khadijah; acquainting her that the angel Gabriel had juſt appeared to him, and told him that he was appointed the Apoſtle of God. He alſo repeated to her a paſſage which he ſaid had been revealed to him by the miniſtry of the angel, with an account of many prodigies which happened at his birth (See MAHOMET). This pretended revelation was received by Khadijah with the greateſt joy; and in a kind of ecſtaſy ſhe immediately communicated the good news to her couſin Waraka Ebn Nawfal, who, being a Chriſtian, could write in the Hebrew character, and was pretty well verſed in the Scriptures both of the Old and New Teſtament.

29 Converts his wife and couſin, &c.

He very readily came into her opinion, ſwore by God that what ſhe ſaid was true, and that "Mahomet was the great prophet foretold in the law by Moſes the ſon of Amram."

Mahomet finding his firſt ſtep ſo ſucceſsful, as Waraka was a very conſiderable perſon, began to entertain great hopes of accompliſhing his deſign. He next converted his ſervant Zeid, to whom he gave his liberty on the occaſion, which afterwards became a rule to his followers; and then Ali the ſon of Abu Taleb, though at that time only nine or ten years of age. This laſt, however, making no account of the other two, he uſed to call *the firſt of believers*. The next perſon he applied to was Abu Becr, a man of very conſiderable authority among the Koreiſh. He was eaſily gained over, and by his influence ſeveral others; ſo that Mahomet now made his miſſion no longer a ſecret. To Abu Becr he gave the name of *Al Saddik*, or *the faithful witneſs*; becauſe he not only vouched for every thing he ſaid, but alſo greatly increaſed the number of his followers. Mahomet likewiſe complimented him with the title of *Atik*, or *preſerved*; intimating thereby that he was certainly ſaved from hell-fire.

Having given out that he was commanded from heaven to admoniſh his near relations, Mahomet directed Ali to prepare an entertainment, and invite to it the ſons and deſcendants of Abdal Motalleb. He intended to open his mind to them; but Abu Laheb, one of Mahomet's uncles, making the company break up before the prophet had an opportunity of ſpeaking to them, he was obliged to invite them again the next day. Having now propoſed the matter, he aſked which of them would become his wazir, prime miniſter, or vicegerent. This was accepted by Ali; upon which Mahomet ſaid to him, "This is my brother, my deputy, and my *(khalif)* ſucceſſor, or vicar; therefore ſhow yourſelves ſubmiſſive and obedient to him."

30 Rejected by the Koreiſh.

At this ſpeech all the company fell a-laughing, telling Abu Taleb that he muſt now pay obedience and ſubmiſſion to his own ſon. Notwithſtanding this repulſe, however, Mahomet was ſo far from being diſcouraged, that he began to preach to the people in public. They heard him with ſome patience till he began to upbraid them with the idolatry, obſtinacy, and perverſeneſs of themſelves and their fathers; which ſo highly provoked them, that they openly declared themſelves his enemies, except ſome few who were converted. The prophet was now protected by the authority of his uncle Abu Taleb; who, however, was earneſtly ſolicited to perſuade his nephew to deſiſt, and at laſt threatened with an open rupture in caſe he could not prevail on him ſo to do. This had ſuch an effect upon Abu Taleb, that he adviſed his nephew not to puſh the matter any farther; repreſenting the great danger he and his followers would otherwiſe run: but our prophet was not to be ſo intimidated; and told his uncle plainly, that "if they ſet againſt him the ſun on his right hand, and the moon on his left, he would not abandon his enterprize."

31 His reſolution.

Abu Taleb, therefore, finding him ſo firmly reſolved, uſed no further arguments, but promiſed to ſtand by him to the utmoſt of his power: ſo that notwithſtanding the people of his tribe came to a determination to expel both Mahomet and his followers, he found a powerful ſupport in his uncle againſt all their machinations.

Mahomet now entered upon his apoſtolic function with uncommon diligence and application; and ſoon gained over his uncle Hamza, and Omar Ebn Al Khattab, a perſon very much eſteemed, and who before had been his violent oppoſer.

32 His followers perſecuted.

Notwithſtanding this ſucceſs, however, the Koreiſh continued their oppoſition, and came to a reſolution to proſcribe all who had embraced Mahomet's doctrine. In conſequence of this reſolution, the *Moſlems*, as his followers were called, were now treated with ſuch ſeverity, that they found it no longer ſafe to continue in Mecca; nay, ſeveral of them in the fifth year of his miſſion found themſelves obliged to fly into Ethiopia, where they were kindly received by the Najaſhi or king of that country, who refuſed to deliver them up to thoſe whom the Koreiſh ſent to demand them. At this refuſal they were ſo exaſperated, that they came to a reſolution to ſuppreſs effectually the new religion which had now made a conſiderable progreſs.

33 The Koreiſh entering into a league againſt him

In order to this, they entered into a ſolemn league or covenant againſt the Haſhemites, and the family of Abdal Motalleb in particular, engaging themſelves to contract no marriages with them, nor to have any manner of communication with them otherwiſe; and, to give this the greater weight, they reduced it into writing, and laid it up in the Caaba. Upon this the tribe became divided into two factions; and all the family of Haſhem, both Moſlems and unbelievers, repaired to Abu Taleb as their head; except only Abdal Uzza, ſurnamed Abu Laheb, the ſon of Abdal Motalleb, who, out of hatred to his nephew and his doctrine, went over to the oppoſite party. After this the authority of Abu Taleb was ſcarce ſufficient to protect Mahomet from the fury of the Koreiſh; who, according to Al Jannabi, made frequent attempts upon him; ſometimes endeavouring to deſtroy him by force, at other times by ſecret wiles and machinations: nay, to compaſs their end, he tells us that they had recourſe to magic, inchantments, and diabolical illuſions. In ſhort, they gave him at laſt ſo much trouble, that he was obliged to change his habitation, and ſeek a new aſylum for himſelf and his companions. This he found in the houſe of one Orkam, which was advantageouſly ſituated on a hill called *Safa.* Here he converted Orkam's family, and the houſe was afterwards held in high eſtimation by the Moſlems.

34 Their writing deſtroyed by a worm.

The two factions into which the tribe of Koreiſh was divided ſubſiſted for five years, when they were put an end to by a very ſtrange accident. Mahomet told his uncle Abu Taleb, that God had manifeſtly ſhowed his diſapprobation of the covenant entered into againſt them, by ſending a worm to eat out every word of the inſtrument except the name of God. With this particular Abu Taleb immediately acquainted the Koreiſh; offering, in caſe it proved falſe, to deliver up his nephew to them; but if it ſhould prove true, he inſiſted that they ought to lay aſide their animoſity, and annul the league they had made againſt the Haſhemites. To this they acquieſced; and going to inſpect the writing, found it to be as Abu Taleb had told them; the words "In thy name, O God," being the only ones which remained. On ſo remarkable a proof of the divine diſpleaſure, the league was immediately annulled, and all acts of hoſtility between the two parties ceaſed.

35 Mahomet ſtill perſecuted by the Koreiſh.

36 Anſars, who.

After this memorable event Mahomet remained with his uncle Abu Taleb, who ſurvived the reconciliation only about eight months. The ſame year alſo died Khadijah, Mahomet's wife. Her death, as well as that of his uncle, proved a great detriment to his affairs; for the Koreiſh, notwithſtanding the former reconciliation, began now to proſecute him with more violence than ever. He was therefore obliged to fly for ſhelter to Al Tayef; which he choſe on account of its being the reſidence of his uncle Al Abbas, whoſe protection he imagined he would be able to ſecure. In this, however, he found himſelf miſtaken; and though he ſtaid a month in the city, during which time he gained over a few, yet at laſt the lower ſort of people roſe againſt him and obliged him to return to Mecca. This refuſal, though it greatly diſcouraged the new converts, did not in the leaſt abate the zeal of Mahomet: on the contrary, he continued to preach boldly to the public aſſemblies at the pilgrimage to Mecca, exclaiming againſt idolatry, and particularly againſt the worſhip of two idols Allat and Al Uzza, to which the tribes, eſpecially the women of that of Thakif, were very much addicted. By this the prophet was often expoſed to great danger: however, he gained ſome converts, and amongſt them ſix of the inhabitants of Yathreb, of the Jewiſh tribe of Khazraj; who, on their return home, failed not to ſpeak much in commendation of their new religion, and exhorted their fellow-citizens immediately to embrace it. Theſe converts of the tribe of Khazraj are by the Arab writers called *Al Anſar, Al Anſarii,* or *Anſars;* that is, aſſiſtants, favourers, ſupporters, &c. becauſe they aſſiſted and ſupported the prophet when he was purſued to the very brink of deſtruction. They firſt met mahomet on a little hill called *Al Akabah,* where a temple ſtood, and where they firſt took an oath to exert themſelves in ſupport of their new apoſtle and his religion. An uninterrupted friendſhip and harmony reigned for a long time amongſt the members of the Jewiſh tribes of Khazraj, Koreidha, and Nadir, whoſe great progenitor, ſay the Arabs, was Aaron the ſon of Amran. Mahomet therefore inſinuating himſelf into the good graces of the Anſars, they readily embraced his religion, and proved of very conſiderable ſervice.

37 Mahomet's journey to heaven.

38 Almoſt proves the ruin of his cauſe.

The next remarkable thing recorded of Mahomet is the invention of his night-journey to heaven. This he probably intended to ſupply the place of miracles. The abſurdities contained in that relation, however, are ſo great, that when he related it to his uncle Al Abbas, and Omm Hana the daughter of Abu Taleb, they endeavoured to diſſuade him from making it public. This advice he was ſo far from following, that he related the whole to Abu Jahl, one of his moſt inveterate enemies, who ridiculed him for it, and placed the ſtory in ſuch a ridiculous light to the Koreiſh, that they were on the point of inſulting him; ſeveral of his followers alſo left him; and the whole deſign had probably been ruined, had not Abu Becr vouched for his veracity, and declared, that, if Mahomet affirmed it to be true, he firmly belived the whole. This declaration not only retrieved the prophet's credit, but increaſed it to ſuch a degree, that he was ſure of making his diſciples ſwallow whatever he pleaſed; and on this occaſion it is ſaid by ſome that he gave Abu Becr the name of the *faithful witneſs,* as we have already related.

39 Congregation of Moſlems formed at Medina.

In the twelfth year of Mahomet's miſſion, twelve men of Yathreb, or Medina, of whom ten were of the tribe of Kharai, and two of that of Aws, came to Mecca, and took an oath of fidelity to the prophet at the hill Al Akaba. When they had ſolemnly engaged to do all required of them, Mahomet ſent one of his diſciples, named *Maſab Ebn Omair,* home with them, to inſtruct them more fully in the grounds of their new religion. Maſab being arrived at Medina, with the aſſiſtance of the new proſelytes, gained ſeveral others; and acquainting Mahomet with the ſucceſs of his miſſion, deſired leave to form a congregation of Moſlems at Medina. This the prophet readily granted; in conſequence of which, the new Moſlems regularly aſſembled, to the number of forty perſons, in the houſe of Saad Ebn Khaithama. The next year Maſab returned to Mecca, accompained by ſeventy-three men and two women of Medina, who had profeſſed Mahometaniſm, beſides ſeveral others who were yet unbelievers. On their arrival they ſent immediately to Mahomet, and offered him their aſſiſtance, of which he now ſtood in the greateſt need; for his adverſaries were by this time grown ſo powerful in Mecca, that he could not ſtay there much longer without imminent danger. He therefore accepted their propoſal, and met them one night by appointment at the hill Al Akaba. At this interview he was attended by his uncle

Al Abbas; who, though then an unbeliever, wiſhed his nephew well, and made a ſpeech to the people of Medina; wherein he told them, that as Mahomet was obliged to quit his native city and ſeek an aſylum elſewhere, and as they had offered him their protection, they would do well not to deceive him; and if they were not firmly reſolved to defend, and not to betray him, they had better declare their minds, and let him ſeek for protection ſomewhere elſe. Upon their proteſting their ſincerity, Mahomet ſwore to be faithful to them, a part of the Koran being read to all preſent, on condition they ſhould protect him againſt all inſults, as heartily as they would do their own wives and families. They then aſked him what recompence they were to expect if they ſhould happen to be killed in his quarrel: he anſwered, Paradiſe; upon which they pledged their faith to him, after Mahomet had choſen twelve out of their number, who were to have the ſame authority under him that the twelve apoſtles had under Chriſt.

Finding now a confederacy formed in his favour, our prophet began to pull off the maſk as to his true ſentiments concerning the means of reformation. Hitherto he had propagated his religion by fair means only; and in ſeveral paſſages of the Koran, which he pretended were revealed before this time, he declared, that his buſineſs was only to preach and admoniſh; that he had no authority to compel any perſon; and that whether they believed or not, was none of his concern, but belonged ſolely to God. But no ſooner did he find himſelf enabled, by the alliance abovementioned, to reſiſt his enemies, than he gave out that God had allowed him and his followers to defend themſelves; and at length, as his forces increaſed, he pretended not only to have leave to act on the defenſive, but to attack the infidels, deſtroy idolatry, and ſet up the true religion by the power of the ſword. To this he was excited by an apprehenſion that pacific meaſures would greatly retard, if not entirely overthrow, his deſigns; and therefore he determined to uſe the moſt violent methods to convert the Pagan Arabs, or rather to extend his own authority.

40 The Koreiſh reſolve to put Mahomet to death.

The Koreiſh, in the mean time, finding that Mahomet had conſiderably extended his influence, and hearing of the league concluded with the Anſars, began to think it abſolutely neceſſary that he ſhould be prevented from eſcaping to Medina; and, in order to do this the more effectually, they reſolved in a council, wherein it is ſaid the devil aſſiſted in perſon, to put an end to his life. To accompliſh this with the greater ſafety, they agreed that a man ſhould be choſen out of every tribe, and that each ſhould have a blow at him; that ſo the guilt of his death might fall equally on all the tribes, and thus the Haſhemites would be prevented from attempting to revenge the death of their kinſman, as they were much inferior in power to the reſt of the tribes put together. Mahomet now directed his companions to repair to Medina, where, in conſequence of the late treaty, they might be aſſured of protection. This they accordingly did: but he himſelf, with Abu Becr and Ali, remained behind; not having received, as he pretended, the divine permiſſion to retire. Here he narrowly watched the motions of the Koreiſh, and was ſoon appriſed of their machinations: for the abovementioned conſpiracy was ſcarce formed, when by ſome means or other it came to Mahomet's knowledge; and he gave out that it was revealed to him by the angel Gabriel, who alſo commanded him to retire from Mecca. The conſpirators were already aſſembled at the prophet's door; but he, to amuſe them, ordered Ali to lie down in his place, and wrap himſelf in his green cloak: this Ali complied with, and Mahomet miraculouſly, according to the Arabs, eſcaped to the houſe of Abu Becr.

41 He outwits them and eſcapes.

The conſpirators, in the mean time, perceiving through a crevice Ali wrapped up in the green cloak, took him for Mahomet himſelf, and watched there till morning, when Ali aroſe, and they found themſelves deceived.

42 In great danger at mount Thur.

The prophet next retired in company with Abu Becr to a cave in mount Thur, an hill a little ſouth of Mecca. Here he had ſtill a more narrow eſcape; concerning which we have the following account from an Arabic tradition. "The Koreiſh having detached a party from Mecca to reconnoitre the mouth of the cave, when they came there, found it covered by a ſpider's web, and a neſt built at the entrance by two pigeons which they ſaw, and which had laid two eggs therein. On ſight of this they reaſoned with themſelves in the following manner: "If any perſon had lately entered this cavern, "the eggs now before us would infallibly have been "broke, and the ſpider's webb demoliſhed; there can "therefore be no body in it;" after which, they immediately retired. As the prophet, therefore, and his friend, were now ſaved ſo miraculouſly by means of the pigeon's eggs and the interpoſition of the ſpider's web, he afterwards enjoined his followers, in memory of ſo remarkable an event, to look upon pigeons as a kind of ſacred animals, and never to kill a ſpider."

43 He is purſued and overtaken, but ſtill eſcapes.

The prophet and Abu Becr having ſtaid in this cave three days in order to recover a little from their conſternation, ſet out for Medina; but the Koreiſh, being informed of the route they had taken, ſent a party after them, under the command of Soraka Ebn Malec. Theſe overtook them; and, as the Arab hiſtorians tell us, Soraka's horſe fell down when he attempted to ſeize Mahomet. Upon this he recommended himſelf to the prophet's prayers, and remounted his horſe without hurt: but, as he ſtill continued the purſuit, his horſe fell down with him a ſecond time; upon which he returned to Mecca, without offering any farther violence: and Mahomet, thus happily delivered from the greateſt dangers, arrived without farther moleſtation at Medina, where he was received with the greateſt demonſtrations of joy.—This flight of the prophet from Mecca to Medina was reckoned ſo remarkable by the Moſlems, that they made it the æra from whence all their remarkable tranſactions were dated, called it the *Æra of the Hegira*, or *flight*. The beginning of the Hegira correſponded with the 16th of July, A. D. 622.

44 Æra of the Hegira.

On Mahomet's arrival at Medina, his firſt care was to build a moſque for his religious worſhip, and an houſe for himſelf. The city of Medina at that time was inhabited partly by Jews and partly by heretical Chriſtians, that formed two factions which perſecuted one another with great violence. This gave the impoſtor ſuch an opportunity of propagating his new religion, that in a ſhort time the city was entirely at his devotion. Here he ſtrengthened himſelf by marrying Ayeſha the daughter of Abu Becr, though then only ſeven years of age, and gave his own daughter Fatima in marriage to Ali, 45 Union of the Anſars and Mohajerin.

the ſon of Abu Taleb. The next point he had in view was the union of the Mohajerin, or thoſe who fled from Mecca on account of their religion, with the Anſars above mentioned. To facilitate this, after the moſque and houſe were finiſhed, he eſtabliſhed among the Moſlems, a fraternity, the principal ſtatute of which was, that they ſhould not only treat one another like brethren, but likewiſe moſt cordially love, and mutually cheriſh, one another to the utmoſt of their power. But, leſt even this ſhould prove inſufficient, he coupled the individuals of the two bodies of Anſars and Mohajerin; and this was the laſt tranſaction of the firſt year of the Hegira.

The next year was uſhered in, according to Abulfeda, with a change of the *Kebla*, or place whither the Mahometans were to turn their faces in prayer. At firſt it had been declared to be perfectly indifferent where they turned their faces. Afterwards he directed them to pray with their faces towards the temple of Jeruſalem, probably with a view to ingratiate himſelf with the Jews; and, now in order to gain the Pagan Arabs, he ordered his followers to pray with their faces towards the eaſt. This inconſtancy gave great offence, and occaſioned the apoſtacy of many of his diſciples. About this time Mahomet receiving advice that a rich caravan of the Koreiſh was on the road from Syria to Mecca, he detached his uncle Hamza, at the head of 30 horſe, to ſeize upon it; who accordingly lay in wait for it in one of the woods of Yamama, thro' which it was to paſs: here, however, he was informed that the caravan was guarded by 300 men, ſo that he returned without making any attempt; but the prophet made the proper diſpoſitions for acting hereafter againſt the Koreiſh with ſucceſs. This year alſo Mahomet ſent out a party of 60 or 80 horſe, all Mohajerin, except one who was an Anſar, to make repriſals on the the Koreiſh. They were met by a party of their enemies, and both ſides immediately prepared for an engagement: however, they parted without bloodſhed, except one of the Koreiſh, who was killed by an arrow ſhot by one of the Moſlems.

46 Mahomet takes a caravan, and gains the battle of Bedr.

Mahomet, having now put himſelf into an offenſive poſture, began in earneſt to make repriſals on the Koreiſh. His firſt exploit was the taking of a caravan attended by a ſmall guard; and this being accompliſhed by a party conſiſting only of nine men, contributed greatly to encourage the Moſlems. But what moſt eſtabliſhed the impoſtor's affairs, and was indeed the true foundation of all his future greatneſs, was his gaining the battle of *Bedr;* of which we have the following account.——The prophet being informed that Abu Sofian Ebn Harb eſcorted a caravan of the Koreiſh with only 30 or 40 men, reſolved to advance at the head of a ſmall detachment of his troops to intercept it. To this he was excited by the riches of the caravan, which conſiſted of a large quantity of merchandize, conſiſting of the riches of Syria, carried on the backs of a thouſand camels. He therefore ſent out a party to reconnoitre it, with orders to wait in ſome convenient place, where they might remain undiſcovered. But Abu Sofian having notice of Mahomet's motions, diſpatched a courier to Mecca, requeſting ſuccours from his countrymen, that he might be able to defend the caravan. Upon this Mahomet drew together all his forces, which amounted to no more than 313, while his enemies conſiſted of very near 1000, Abu Sofian having been reinforced by the Meccans with 950 men. The two armies did not long remain in a ſtate of inaction: but before the battle three champions from each party engaged each other in ſingle combat. In this the Moſlem champions were victorious, and the event greatly diſcouraged the Koreiſh. Mahomet, in the mean time, taking advantage of this lucky event, offered up his prayers to God with great fervency and vehemence; after which, feigning himſelf in a trance, he pretended that God had aſſured him of victory. Then throwing an handful of duſt or gravel towards the enemy, he cried out, "May the faces of them be confounded;" and attacked the Koreiſh with ſuch bravery, that they were ſoon put to flight, leaving 70 dead on the ſpot, and having as many taken priſoners. The loſs on Mahomet's ſide was only 14 men, and among the priſoners was Al Abbas the prophet's uncle.

Though this action may ſeem of little conſequence in itſelf, it was of very great advantage to Mahomet's affairs at that time. He was immediately treated with the higheſt reſpect by the Najaſhi, or King of Ethiopia, who received a particular account of the victory ſoon after it was gained; while the ſuperſtitious Moſlems did not fail to look upon it as an evident declaration of heaven in their favour. Nay, notwithſtanding the ſmall number of enemies to be overcome, and who were only mortal men, theſe ignorant bigots did not heſitate to own the aſſiſtance of no leſs than 4000 angels, who, according to them, rode on black and white horſes, having on their heads white and yellow ſaſhes, that hung down between their ſhoulders!

Notwithſtanding their diſaſter, however, Abu Sofian made a pretty good retreat, and conducted the greateſt part of the caravan to Mecca. This chagrined the Moſlems, though they found great ſpoil on the field of battle; the diviſion of which had likely to have proved fatal to their cauſe, by the quarrels that it occaſioned among them. So hot, indeed, were the diſputes on this occaſion, that the impoſtor was obliged to pretend an immediate revelation from heaven, empowering him to retain a fifth part for religious purpoſes, and to diſtribute the reſt equally. This became a law for his ſucceſſors; but, with regard to himſelf, the prophet often took the liberty of infringing it; for which, no doubt, a new revelation was always a ready and convenient ſalvo. As for thoſe who were ſlain on Mahomet's part in this battle, they were all looked upon by the Moſlems as martyrs; and the prophet perceiving among the priſoners two of his inveterate enemies, immediately cauſed their heads to be ſtruck off.

47 His law concerning the diviſion of ſpoils.

The Koreiſh, in order to be revenged on Mahomet for their late defeat at Bedr, ſent Amru Ebn Al As, who afterwards conquered Egypt, with ſome other of their principal people, on an embaſſy to the king of Ethiopia, in order to intereſt him in their quarrel. To do this the more effectually, they accuſed Mahomet and his followers of ſpeaking diſreſpectfully of JESUS and of his mother MARY; which accuſation they hoped would likewiſe induce him to deliver up the Moſlem refugees that were then at his court. But the bad ſucceſs that had attended the arms of the Koreiſh hitherto, joined to the excuſes made by the refugees, not only hindered the Najaſhi from delivering them up, but alſo prompted him to diſmiſs the ambaſſadors, and return the preſents they had brought him. In the mean time, Abu Sofian, who had ſworn never to uſe perfumes or enjoy women till he had another battle with Mahomet, ſet out from Mecca with a body of 200 horſe. He advanced to a poſt within three miles of Medina; from whence he ſent a detachment, who burnt a barn, together with a man in it that was winnowing wheat. Mahomet, being informed of this outrage, moved immediately towards him with a detachment of cavalry;

48 Abu Sofian's cowardice.

but Abu Sofian was ſo intimidated by his approach, that he fled with precipitation, leaving behind him all the ſacks of flour or meal that had been brought for the ſubſiſtence of his troops. Inſtead therefore of coming to an engagement with the impoſtor, as he had ſworn, he contented himſelf with alarming the country, and pillaging ſuch as he ſuſpected of favouring Mahometaniſm. This year alſo Mahomet conquered the tribes called *Banu Solaim, Ghatfan,* and the *Banu Kainoka*; plundering likewiſe a rich caravan belonging to the Koreiſh, and acquiring from thence 25,000 dirhems for his own ſhare of the plunder.

In the year of Chriſt 625, being the third of the Hegira, the Koreiſh aſſembled an army of 3000 men, among whom were 200 horſe and 700 armed with coats of mail. The command of this army was given to Abu Sofian, who was attended by his wife Henda Bint Otba, and ſat down at a village about ſix miles diſtant from Medina. Mahomet, being much inferior to the enemy, reſolved at firſt to keep himſelf within the town, and receive them there; but afterwards, by the advice of his companions marched out againſt them at the head of 1000 according to ſome, 1050 according to others, or, as ſome ſay, only 900 men. Of theſe 200 were cuiraſſiers; but he had only one horſe beſides his own in the whole army. He diſtributed three ſtandards among his troops; of which one was given to the tribe of Aws, another to that of Khazraj, and the third to Mohajerin. The grand ſtandard was carried before the prophet by Moſaab Ebn Omair.

49 Battle of Ohod.

With theſe forces Mahomet formed a camp in a village near Ohod, a mountain about four miles north of Medina, which he contrived to have on his back; and the better to ſecure his men from being ſurrounded, he placed 50 archers, the flower of his troops, in the rear, with ſtrict orders not to quit their poſt. On the other hand, the army of the Koreiſh was drawn up in the form of a creſcent, and made a very good appearance. The right wing was commanded by Khaled Ebn Al Walid, afterwards ſo terrible to the Greeks, the left by Acrema Ebn Abu Jahl; and the centre by Abu Sofian. The corps de reſerve was headed by Abu Sofian's wife, accompanied by 15 other matrons, who performed the office of drummers, lamenting the fate of their countrymen ſlain at Bedr, in order to animate the troops who attended them. The attack was begun by the Moſlems, who fell upon the enemy with ſuch fury, that their centre immediately began to give away. Ali, or, according to Abulfeda, Hamza, ſlew Arta the enemy's great ſtandard-bearer; which ſtruck them with ſuch terror, that they ſoon betook themſelves to flight, falling foul upon their own corps de reſerve. Victory had now been no longer doubtful, notwithſtanding the vaſt inferiority of Mahomets troops, had not the 50 archers, contrary to the prophet's expreſs command, quitted their poſt to pillage the enemy. Upon this Khaled, perceiving the Moſlem army to be greatly expoſed, attacked them in the rear with ſuch bravery, that he turned the fortune of the day. Not content with putting the troops there in diſorder, he cried out with all his might, "Mahomet is ſlain; and this had ſuch an effect upon the Moſlems, that they immediately took to their heels, nor could the utmoſt endeavours of the prophet himſelf afterwards rally them.

50 Mahomet defeated.

He therefore found himſelf obliged to quit the field of battle; in doing which he was very near loſing his life, being ſtruck down by a ſhower of ſtones, and wounded in the face by two arrows, which occaſioned the loſs of two of his fore-teeth. He likewiſe received a contuſion on his upper lip; and had even been killed on the ſpot, had not one of his companions, named *Telha*, Abu Becr's nephew, received a blow that was levelled at him. On this occaſion Telha received a wound in his hand, which deprived him ever after of the uſe of ſome of his fingers. Of the Moſlems 70 were ſlain; among whom were Hamza the prophet's uncle, and Moſaab the ſtandard-bearer. Amongſt the wounded were Abu Becr, Omar, and Othman; but as ſoon as they underſtood that the prophet was ſafe, they returned to the charge with a conſiderable body, and, after an obſtinate diſpute, carried him off. The good retreat made by theſe champions ſo diſcouraged the troops of Abu Sofian, that they did not purſue the flying enemy, but contented themſelves with remaining maſters of the field of battle; nor did that general, tho' he exulted not a little in his victory, make any farther uſe of it than to give Mahomet a challenge to meet him the next year at Bedr, which was accepted; and after his return to Mecca, he deſired a truce with the Moſlems, which was readily granted.

51 He apologizes for his defeat.

This defeat had like to have proved the total ruin of the impoſtor's affairs, and muſt inevitably have done ſo had the conquerors made the leaſt uſe of their victory. Some of his followers now aſſerted, that had he been really a prophet ſent from God, he could not have been thus defeated; and others were exaſperated on account of the loſs of their friends and relations who had been ſlain in the late engagement. To ſtill the murmurs of the former, he laid the blame on the ſins of thoſe who had accompanied him; and, to pacify the latter, he pretended a revelation from heaven, wherein the period of all mens lives was ſaid to be unalterably fixed without regard to their own actions, or to any external objects; ſo that thoſe who were killed in battle behoved to have died, though they had remained at home in their own houſes. By the aſſiſtance of this laſt doctrine he encouraged his followers to fight, without fear, for the propagation of their faith, as all their caution would not be ſufficient to avert their deſtiny, or prolong their lives even for a ſingle moment.

The next year, (A. D. 626), Mahomet, beſides ſeveral other leſs conſiderable ſucceſſes, reduced a fortreſs belonging to the Jewiſh tribe of Al Nadir, who had revolted on account of the defeat at Ohod: on this occaſion, by an expreſs revelation, as he pretended, he kept the whole booty to himſelf; and, about the ſame time, forbad his followers the uſe of wine, or to play at games of chance, on account of the diſturbances and quarrels which were likely to be excited by that means among them. This year alſo he marched with a body of infantry to Bedr, to meet Abu Sofian, as he had promiſed the year before: but that general's heart failing him, he returned home without facing the prophet; and this piece of cowardice the Moſlems did not fail to impute to a terror ſent immediately from God.

52
Siege of Medina.

The year following, however, the Koreiſh, in conjunction with the tribe of Ghatfan, and the Jews of Al Nadir and Koreidha, aſſembled an army of 12,000 men, with which they formed the ſiege of Medina, thus threatening the impoſtor and all his followers with utter deſtruction at once. On the enemy's approach, Mahomet, by the advice of a Perſian named *Salman*, ordered a deep ditch to be dug round the city, and went out to defend it with 3000 men. The Arabs having inveſted the town, both ſides remained in a ſtate of inactivity for ſome time; which was ſo well employed by the impoſtor, that he found means to corrupt ſome of the leading men in the enemy's camp. The good effects of this ſoon appeared; for a champion having advanced to the Moſlem entrenchments, and challenged the beſt man in their army to fight him in ſingle combat, the challenge was immediately accepted by Ali, who ſlew him and another that came to his aſſiſtance; after which, thoſe who had been corrupted by Mahomet's agents ſo ſoured a conſiderable part of the forces, that they deſerted their camp; upon which all the reſt were obliged to raiſe the ſiege and return home.

53
The ſiege raiſed.

The prophet, being now happily delivered from the moſt powerful combination that had ever been formed againſt him, was viſited by the angel Gabriel; who aſked him, whether he had ſuffered his men to lay down their arms, when the angels had not laid down theirs? ordering him at the ſame time to go immediately againſt the tribe of Koreidha, and aſſuring him that he himſelf would lead the way. Upon this Mahomet immediately ſet out for the fortreſs of the Koreidhites, and puſhed on the ſiege with ſo much vigour, that, tho' it was deemed impregnable, he obliged the garriſon to capitulate in twenty-five days. The Koreidhites, not daring to truſt themſelves to the impoſtor's mercy, ſurrendered at diſcretion to Saad Ebn Moadh, prince of the tribe of Aws, hoping that he, being one of their old friends and confederates, would have ſome regard for them. Here, however, they found themſelves diſappointed; for Saad, being highly provoked at them for aſſiſting the Koreiſh while in league with Mahomet, ordered the men to put to the ſword, the women and children made ſlaves, and their goods divided among the Moſlems. This ſentence was no ſooner heard by Mahomet, than he cried out that Saad had pronounced the ſentence of God; and, in conſequence of this deciſion, ordered the men, to the number of 600 or 700, to be immediately maſſacred. The women and children were alſo carried into captivity. Their immoveable poſſeſſions were given to the Mohajerin, and the goods divided equally.

54
Khoreidhites maſſacred.

Mahomet now continued to be ſucceſsful, gradually reducing the Arab tribes one after another. In 628, he ſent an agent to Conſtantinople, deſiring leave of the Greek emperor to trade with his ſubjects; which was immediately granted. The ſame year alſo he concluded a peace for ten years with the inhabitants of Mecca, and obtained liberty the next year to perform his devotions at the Caaba. What tended conſiderably to bring about this pacification was an account brought to the Koreiſh by one whom they had ſent with an actual defiance to Mahomet, of the prodigious veneration which his followers had for him.

55
Prodigious veneration for Mahomet.

This meſſenger acquainted them that he had been at the courts both of the Roman emperors and of the kings of Perſia, but never ſaw any prince ſo highly reſpected as Mahomet was by his companions. Whenever he made the ablution in order to ſay his prayers, they ran and caught the water which he had uſed; whenever he ſpit, they licked it up, and gathered up every hair that fell from him, with great veneration. This intimated how deſperately they would fight in his defence, and probably inclined his enemies to avoid hoſtilities.

56
He invites foreign princes to embrace his religion.

In 629, the impoſtor began to think of propagating his religion beyond the bounds of Arabia, and ſent meſſengers to ſeveral neighbouring princes to invite them to embrace Mahometaniſm; but, before ſending the letters, he cauſed a ſilver ſeal to be made, on which were engraved in three lines the following words, "MAHOMET THE APOSTLE OF GOD." This ſeal, he believed, would procure the letters to which it was affixed a more favourable reception at the courts of thoſe princes whither they were directed. The firſt to whom he applied was Khoſru Parviz the king of Perſia; but he, finding that Mahomet had put his own name before his, tore the letter in pieces, and ſent away the meſſenger very abruptly. He alſo ſent a letter to the ſame purpoſe to Conſtantinople; but though the emperor Heraclius diſmiſſed his meſſengers honourably, he refuſed to abandon the Chriſtian faith. Beſides theſe, he wrote five other letters, which he diſtributed among thoſe who he thought would be moſt likely to acknowledge him for an apoſtle. However, we do not hear that by means of letters he ever introduced his religion into a foreign country.—

57
Is poiſoned, but recovers.

But while our impoſtor was thus going on in the full career of ſucceſs, and induſtriouſly propagating his infamous falſehoods by all the means he could think of, he was poiſoned by a maid, who wanted, as ſhe ſaid, to make an experiment whether he was a prophet or not. This was done by communicating ſome poiſon to a ſhoulder of mutton, of which one of his companions named *Baſhar Ebn Al Bara*, eating heartily, died upon the ſpot; and Mahomet himſelf, though he recovered a little, and lived three years after, yet never enjoyed perfect health. Notwithſtanding this misfortune, however, he ſtill continued his enterprizes. The year 630, proved remarkably fortunate. It was uſhered in by the converſion of Khalid Ebn Al Walid, Amru Ebn Al As, and Othman Ebn Telha, three of the moſt conſiderable perſons among the Koreiſh; and this ſoon enabled him to become maſter of the whole peninſula of Arabia.

58
Meccans violate the treaty with Mahomet.

This year alſo the inhabitants of Mecca took it into their heads to violate the treaty concluded with Mahomet: for the tribe Becr, who were the confederates of the Koreiſh, attacking thoſe of Khozaab, who were in alliance with Mahomet, maſſacred 20 of them, and afterwards retired; being ſupported in this action by a party of the Koreiſh themſelves.—The conſequence of this violation was ſoon apprehended; and Abu Sofian himſelf made a journey to Medina, in order to heal the breach and renew the truce: but in vain; for Mahomet, glad of this opportunity, refuſed to ſee him. Upon this he applied to Abu Becr, Ali, Omar, and Fatima, to intercede for their countrymen with the prophet; but ſome of theſe giving him rough anſwers, and others none at all, he was obliged to return to Mecca as he came. Mahomet immediately gave orders for the neceſſary preparations, that he might ſurpriſe the Meccans, who were by no means in a condition to receive him; but Hateb Ebn Abu Baltaa, hitherto a faithful Moſlem, attempted to give them notice of their danger by a letter, though without effect. His letter was intercepted: and he alleged in his excuſe, that the only reaſon he had for his conduct was to induce the Koreiſh to treat his family with kindneſs. This excuſe the prophet accepted, as he had greatly diſtinguiſhed himſelf at the battle of Bedr, but ſtrictly forbade any ſuch practices for the future; which having done, he immediately made the neceſſary diſpoſitions for ſetting forward.

Mahomet's army, on this occaſion, was compoſed of Mohajerin, Anſars, and other Arabs, who had lately become proſelytes. As they drew near to Mecca, he ſet up his ſtandards, and advanced in order of battle to Mar Al Dharan, a place about four paraſangs from Mecca, where the whole army encamped. Here he ordered 10,000 fires to be lighted, and committed the defence of the camp to Omar, who cut off all communication with the town, ſo that the Meccans could receive no certain advice of their approach. Among others that came from Mecca to reconnoitre the Moſlem camp, Abu Sofian Ebn Harb, Hakim Ebn Hezam, and Bodail Ebn Warka, fell into Omar's hands; and being conducted to Mahomet, were obliged to embrace Mahometaniſm in order to ſave their lives.

The firſt rumour of this expedition had not a little terrified the Koreiſh, though they were not apprized that the prophet had reſolved upon a war: but perceiving now, upon the report of Abu Sofian, who had been ſent back to them, that the enemy was at their gates, they were thrown into the utmoſt conſternation. Of this Mahomet being informed, he reſolved to take advantage of the confuſion that then reigned among them. He therefore firſt diſpatched Hakem and Bodail to the Meccans, inviting them to take an oath of allegiance to to him, and become converts to his new religion; after which, he made the following diſpoſition of his forces. Al Zobier was ordered to advance with a detachment towards the town on the ſide of mount Cada. Saad Ebn Obad, prince of the tribe Khazraj, marched by his order with another detachment towards the height of Coda, which commands the plain of Mecca. Ali commanded the left wing of the army, conſiſting of Anſars and Mohajerin. The prophet put into his hands the great ſtandard of Mahometaniſm, with orders to poſt himſelf upon mount Al Hajun, and to plant the ſtandard there; ſtrictly enjoining him, however, not to ſtir from thence till he himſelf arrived, and till a proper ſignal ſhould be given him from Saad for that purpoſe. Khaled led the right wing, conſiſting of the Arabs lately converted, with which he was to poſſeſs himſelf of the plain of Mecca. Abu Obeidah commanded in the centre, which conſiſted entirely of infantry: the prophet himſelf remained in the rear, from whence he could moſt eaſily diſpatch his orders to all the generals as occaſion ſhould require. He expreſsly prohibited Khaled and all his other officers to act offenſively unleſs they were firſt attacked. Things being in this ſituation, the army upon a ſignal given put itſelf immediately in motion. The prophet mounted his camel with great alacrity, and was that day cloathed in red. Al Zobeir purſued the rout aſſigned him without oppoſition; nor did Saad diſcover the fainteſt traces of an enemy: Ali took poſſeſſion of his poſt without the loſs of a man; and in like manner Abu Obeidah ſeized on the ſuburbs. Khaled, however, in his march to the plain, was met by a large body of the Koreiſh and their confederates, whom he immediately attacked and defeated, putting 28 of them to the ſword. Not content with this, he purſued them into the town, and maſſacred a great number of the inhabitants; which ſo terrified the reſt, that ſome ſhut themſelves up in their houſes, while others fled different ways in order to avoid the fury of the mercileſs and impious tyrant, who was now become maſter of the city. Thus was Mecca reduced, with the loſs only of two men on the ſide of the impoſtor.

59
Mecca taken.

Mahomet being now maſter of the city, made his public entry into it exactly at ſun-riſing. When the firſt tumult was over, he went in proceſſion round the Caaba ſeven times, touching the corner of the black ſtone with the ſtaff in his hand, as often as he paſſed it, with great devotion. Then he entered the Caaba; where obſerving ſeveral idols in the form of angels, and the ſtatutes of Abraham and Iſhmael with the arrows of divination in their hands, he cauſed them all to be deſtroyed. He alſo broke in pieces with his own hands a wooden pigeon, that had long been eſteemed a deity by the idolatrous Koreiſh. Afterwards entering into the interior part of the Caaba, he repeated with a loud voice the form uſed at this day by the Mahometans, "Allah Akbar, God is great," &c. turning towards every part of the temple. Then he prayed between the two pillars there, with two inclinations, as well as without the Caaba; ſaying to thoſe that attended him, "This is your Kebla, or the place towards which you are to turn your faces in prayer."

Having thus effectually ſubdued the Koreiſh, put an end to all commotions, and purged the Caaba of 360 idols, the prophet's next care was to ingratiate himſelf with the people. Sending therefore for ſome of the principal of them, he aſked them what kind of treatment they expected from him, now he had conquered them? To this they replied, "None but what is favourable, O generous brother:" upon which he diſmiſſed them, telling them they were from that moment a free people. After this, pretending a new revelation, he reſtored the keys of the Caaba to Othman Ebn Telha, who was in poſſeſſion of them before; and who was now ſo much affected by this piece of juſtice, that he immediately became a proſelyte. Next day the prophet declared Mecca an aſylum, and publickly gave out that he would maintain to the utmoſt of his power the inviolable ſecurity of the place. He then was ſolemnly inaugurated; after which he proſcribed, according to ſome, ſix men and four women, according to others, eleven men and one woman: but of theſe only three men and one woman were put to death; the reſt being pardoned on their embracing Mahometaniſm, and one woman making her eſcape. The remainder of this year was ſpent in various expeditions againſt different tribes of the Arabs, which were in general attended with ſucceſs.

The ninth year of the Hegira, being that of Chriſt 631, is called by the Mahometans the year of *Embaſſies;* for the Arabs, who had hitherto been expecting the iſſue of the war between Mahomet and the Koreiſh, no ſooner ſaw that which was the moſt conſiderable of the whole ſubmit to him, than they began to come in to him in great numbers, and to ſend embaſſies to make their ſubmiſſions to him, both while at Mecca and after his return to Medina, whither he had returned ſoon after the taking of Mecca: and this good fortune continued without interruption to the year 632, when this famous impoſtor breathed his laſt, having juſt reduced under his ſubjection the whole peninſula of Arabia, and being ready to break into the neighbouring kingdoms in order to ſatisfy his ambition.

60
Mahomet dies.

61
Great confuſion on his death.

The death of Mahomet occaſioned ſuch a conſternation in Mecca, that the governor hid himſelf, fearing to be called to an account for his former conduct; and the inhabitants, upon the firſt arrival of this melancholy news, conſidered themſelves as deſtitute of all manner of protection. After the firſt impreſſions of their fear, however, were over, they began to meditate a revolt; but were prevented by one Sohail Ebn Amru, a principal man of the Koreiſh. The tumults at Medina, however, were not ſo eaſily appeaſed. The news of this ſad event was no ſooner publiſhed there, than a number of people aſſembled before his door, crying out, “How can our apoſtle be dead? Our interceſſor, our mediator, has not entirely left us! He is taken up into heaven, as was Iſa (Jeſus); therefore he ſhall not be buried.” This was confirmed by Omar; who drew his ſword and ſwore, that if any perſon affirmed Mahomet to be dead, he would cut off his hands and his feet. “The apoſtle of God (ſays he) is not dead: he is only gone for a ſeaſon, as Moſes the ſon of Amran was gone from the people of Iſrael for forty days, and then returned to them again.” The populace therefore kept the body above ground, even after the belly began to ſwell; nor could the prophet's uncle Al Abbas, notwithſtanding this, convince them to the contrary. Upon hearing of theſe tranſactions, Abu Becr immediately poſted from Al Sonah, another quarter of the city, and expoſtulated with them in the following manner: “Do you worſhip Mahomet, or the god of Mahomet? If the latter, he is immortal, and liveth for ever; but if the former, you are in a manifeſt error, for he is certainly dead.” The truth of this aſſertion he immediately evinced from ſeveral paſſages of the Koran, in ſo clear and concluſive a manner, that he not only ſatisfied Omar, but calmed the minds of all the people.

The prophet having left no directions concerning a ſucceſſor, very warm diſputes aroſe between the Mohajerin and the Anſars about the right of electing a khalif. The former inſiſted on having that right, becauſe they had attended Mahomet in his flight to Medina; and the others, becauſe they had ſupported him when expelled from his native city, &c. In ſhort, the diſputes became ſo hot, that an open rupture muſt have commenced, had not they been terminated by a propoſal that each party ſhould chooſe a khalif. This amuſed them a little for the preſent; but not proving perfectly agreeable to the Mohajerin, Abu Becr propoſed two perſons, Omar and Abu Obeidah, offering to ſwear allegiance to him on whom the ſuffrages of both parties ſhould fall. But this producing no deciſion, Omar ſwore fealty to Abu Becr, and his example was followed by all the Moſlems on the ſpot; upon which he was acknowledged both by the Mohajerin and Anſars to be the rightful ſucceſſor of Mahomet.

62
Abu Becr ſucceeds him.

63
Ali diſſatisfied.

Theſe tranſactions, however, were not at all agreeable to Ali, who, as ſon-in-law to the prophet, had undoubtedly the beſt title to the ſucceſſion. He expoſtulated with Abu Becr about the manner of his election, which had been effected without his knowledge; and received for anſwer, that the exigence of affairs would not admit of deliberation; and that, had not the election been ſo ſudden, the oppoſite party would have wreſted the power entirely out of their hands. Ali was in Fatima's apartment when Abu Becr had the good luck to be elected khalif; and, upon the arrival of the news, expreſſed great diſſatisfaction. He found himſelf, however, ſoon obliged to change his note, when the new khalif ſent Omar with orders to burn the houſe where he and his friends were aſſembled, in caſe he did not concur in ſupporting the election. But notwithſtanding his forced compliance on this occaſion, it is not to be doubted that he reckoned himſelf injured; and his pretenſions were thought to be juſt by a great number of Moſlems: which notion is entertained by a very conſiderable party of Mahometans even at this day; and theſe are called *Shiites* or *ſectaries.*

64
Rebellions extinguiſhed by Khaled.

Soon after Abu Becr's acceſſion, many of the Arabs refuſed to pay the tribute impoſed upon them by Mahomet, and even attempted to ſhake off his yoke altogether. This ſo alarmed the khalif and his ſubjects at Medina, that, fearing a general revolt, they ſent all not able to bear arms into the cavities of the rocks and mountains, and put themſelves in as good a poſture of defence as the ſhort time would permit. In the mean time Khaled was diſpatched with an army of 4500 men to reduce the rebels; and he ſoon coming up with them, gave them a total defeat, brought off a vaſt quantity of plunder, and made many of their children ſlaves. Nor was he content with this; for being ſent by Abu Becr to Malek Ebn Noweirah, an eminent perſon among the Arabs, and famous for his ſkill in poetry as well as his horſemanſhip and bravery, to bring him over by fair means, he immediately ordered his head to be cut off. By this means, indeed, he extinguiſhed all the remains of rebellion; but rendered himſelf exceedingly obnoxious to Abu Becr, who would have put him to death, had not Omar ſtrongly interceded for him: for Khaled had greatly exceeded his commiſſion, as Malek had returned to Mahometaniſm, and had offered to pay the money. This was not, however, the only piece of ſervice Khaled performed at this time; he alſo defeated and killed Moſeilama, who had ſet up for a prophet in the time of Mahomet, and even wanted to take the grand impoſtor himſelf into company with him. The ſame general likewiſe defeated and diſperſed the troops of another prophet, called *Toleiah Ebn Khowailed,* obliging himſelf to remain concealed till after the death of Abu Becr. About the ſame time another body of rebels committed great diſorders in the province of Bahrein. Againſt theſe Abu Becr diſpatched Al Ola at the head of a conſiderable army, who ſoon obliged them to return to Mahometaniſm; having put great numbers of them to the ſword, and plundered their country in a dreadful manner.

65
War with the Greeks.

Abu Becr having now no enemy to contend with in

Arabia, and being free from all apprehenſions of a competitor, reſolved next to turn his arms againſt the Greek emperor. Some ſkirmiſhes had happened, in the time of Mahomet, between the Moſlems and Greeks; in one of which Zeid, a Moſlem commander, had been killed. To revenge his death, his ſon Oſama was on the point of making an irruption into Syria at the time of Mahomet's deceaſe. This enterpriſe the khalif ordered him to go on with; and it was executed by Oſama with great ſucceſs. He entered Syria, and laid waſte the country; doing the Greeks a good deal of damage; after which he returned to Arabia without any conſiderable loſs.

66 Kingdom of Hira deſtroyed.

Soon after the khalif ſent Khaled at the head of a powerful army to invade Irak, and put an end to the kingdom of Hira. In this undertaking he was attended with his uſual ſucceſs. The king Al Mondar Al Maghrur loſt his life in defence of his dominions; and the kingdom was totally deſtroyed, after it had continued 622 years and eight months, as we have already hinted. The inhabitants became tributaries; and, according to Eutychius, the tribute collected on this occaſion amounted to 70,000 pieces of money. This, according to Al Makin, was the firſt tribute-money ever brought to Medina.

The exigence of the khalif's affairs in Syria, however, did not ſuffer Khaled long to remain in Irak. Before the departure of the army under his command, Abu Becr had come to a reſolution to invade Syria; and finding his deſign approved by the principal officers of his court, he ſent circular letters to the petty princes of Yaman, the chief men of Mecca, &c. informing them of his intention to take Syria out of the hands of the infidels; acquainting them, at the ſame time, that a war for the propagation of the true religion was an act of obedience to God. To theſe letters they paid a proper regard; and in a very ſhort time appeared at Medina at the head of their reſpective troops, and pitched their tents round the city. Here they ſtaid till the Moſlem army deſtined to act againſt the emperor was completely formed, and in a capacity to begin its march. The khalif having viewed the troops from the top of an hill, and prayed to God for ſucceſs, attended the generals a little way on foot. As the generals were on horſeback, they could not forbear expreſſing their uneaſineſs at the khalif's thus demeaning himſelf; but he told them, that it ſignified little whether they walked on foot or rode, as they had all the ſame views, viz. the ſervice of God, and the propagation of religion.

67 Abu Becr's directions to his general.

At parting, he addreſſed Yezid Ebn Abu Sofian, whom he had inveſted with the ſupreme command, in the following manner; "Take care, Yezid Ebn Abu Sofian, to treat your men with tenderneſs and lenity. Conſult with your officers on all preſſing occaſions, and encourage them to face the enemy with bravery and reſolution. If you ſhall happen to be victorious, deſtroy neither old people, women, nor children. Cut down no palm-trees, nor burn any fields of corn. Spare all fruit-trees, and ſlay no cattle, but ſuch as you ſhall take for your own uſe. Adhere always inviolably to your engagements, and put none of the religious perſons you ſhall meet with in monaſteries to the ſword. Offer no violence to the places they ſerve God in. As for thoſe members of the ſynagogues of Satan *who ſhave their crowns*, cleave their ſkulls, and give them no quarter, except they embrace Iſlamiſm (Mahometaniſm), or pay tribute."

The Greek emperor was greatly alarmed at the approach of the Moſlem army; however, he made all neceſſary preparations for his defence, and ſent out a detachment to reconnoitre the enemy. Theſe having fallen in with the Arabs, a battle enſued, in which the Greeks were defeated with the loſs of 1200, while the Arabs loſt only 120 men. This was ſucceeded by a great many ſkirmiſhes, in which the Moſlems were generally victorious. The rich ſpoil taken on theſe occaſions was ſent as a preſent to the khalif; who having acquainted the inhabitants of Mecca with his good ſucceſs, they were thereby ſo elated, that they furniſhed him with a ſtrong reinforcement, which was immediately ordered into Syria. The Greek emperor, in the mean time, having ordered another body of his troops to advance towards the frontiers, they found an opportunity of engaging the Moſlem army under Abu Obeidah, a perſon of great piety, but little experience in war.

68 The Moſlems defeated.

Him they totally defeated; and Abu Becr was ſo much provoked at his defeat, that he deprived him of the command, which was given to Khaled, who was for this purpoſe recalled from Irak. That general's firſt exploit was the reduction of Boſtra, a very rich and populous city of Syria Damaſcena; which, however, he accompliſhed by treachery rather than by force of arms. Having left a garriſon of 400 men in Boſtra, and being joined by Abu Obeidah's forces, he laid ſiege to Damaſcus with an army of 45,000 men.

69 Damaſcus beſieged.

This ſo alarmed the emperor, that he diſpatched an army of 100,000 men, commanded by one Werdan, to the relief of that city. Khaled, on hearing of the approach of this formidable army, was for marching immediately with all his forces, and giving them battle; but this was oppoſed by Abu Obeidah, as it would enable the inhabitants of Damaſcus to procure freſh ſupplies both of arms and proviſions, and conſequently render the reduction of the place more difficult. It was, therefore, at laſt agreed, that a body of troops ſhould be detached under Derar Ebn Al Wazar, an excellent officer, and an implacable enemy to the Chriſtians (as indeed were all the Moſlem generals except Abu Obeidah), to fight the enemy, whilſt the ſiege was carried on by the two generals.

70 The Greeks defeated with great ſlaughter.

Khaled, fearing leſt Derar's furious zeal and hatred to the Chriſtians ſhould prove fatal to his troops, told him before his departure, that though they were commanded to fight for the propagation of their religion, yet they were not allowed to throw away the lives of their men; and therefore ordered him to retire to the main body of the army, in caſe he found himſelf preſſed by a ſuperior force. But Derar, deaf to this ſalutary admonition, with his ſmall body of troops ruſhed upon the whole Chriſtian army, notwithſtanding the vaſt diſproportion of numbers. He charged them, however, with ſuch bravery, that he penetrated to the ſpot where the general gave his orders, killed the ſtandard-bearer, and carried off the ſtandard itſelf, in which was a croſs richly adorned with precious ſtones. Nay, he would in all probability have put Werdan's army to flight, had not the general's ſon, the commandant of Hems, arrived in the heat of the engagement with a body of 10,000 men; with which he attacked the Moſlems ſo briſkly in the rear, that he forced them to retire, and took Derar himſelf priſoner. This ſo diſcouraged them that they would have taken to their heels, had not Rafi Ebn Omeirah animated them with the following words. "What! do not you know, that whoever turns his back upon his enemies offends God and his prophet; and that the prophet declared the gates of paradiſe ſhould be open to none but ſuch as fought for religion? Come on! I will go before you. If your captain be dead, or taken priſoner, yet your God is alive, and ſees what you do." This exhortation had ſuch an effect upon his troops, that, returning to the charge, they maintained their ground with unparalleled bravery, till Khaled arrived with a conderable body of infantry and 1000 horſe. The arrival of this general ſoon turned the fortune of the day. A party of the imperial army went over to the Moſlems, and the reſt took to their heels. Derar alſo was retaken, and carried off in triumph. However, Werdan, having collected the ſhattered remains of his forces, and received a reinforcement from the emperor, found his army ſtill to amount to 70,000 men, with which he reſolved to make another attempt for the relief of Damaſcus. They were attended with ſtill worſe ſucceſs in this ſecond attempt than they had been before; being utterly defeated with the loſs of 50,000 men, ſo that they were no more in a condition to attempt any thing; and, in conſequence of this, the city was ſoon taken, notwithſtanding the utmoſt efforts of the beſieged.

71 The city taken.

72 Abu Becr dies, and is ſucceeded by Omar.

This diſaſtrous event happened in the year 634; and the very day that Damaſcus was taken, Abu Becr died of a conſumption in the 63d year of his age. He was ſucceeded by Omar, who was proclaimed khalif that very day; and the firſt title aſſigned him was, *The khalif of the khalif of the apoſtle of God.* But the Arabs conſidering, that by the additions to be continually made at the acceſſion of every new khalif, the title would become too long, they with one voice ſaluted him, *Emperor of the believers;* which illuſtrious title deſcended afterwards to his ſucceſſors by a kind of inconteſtable right.

The new khalif was no ſooner ſettled than he replaced Abu Obeidah in the command of the army in Syria, being greatly diſpleaſed with the cruel and bloodthirſty diſpoſition of Khaled. He alſo commanded Abu Obeidah to have an eye upon Paleſtine, and to invade it as ſoon as an opportunity offered. Khaled bore his diſgrace with great magnanimity; and ſwore, that though he had always had the greateſt regard for Abu Becr, and the utmoſt averſion to Omar, he would ſubmit to God's will, and obey the new khalif as the lawful ſucceſſor of Mahomet. The Moſlem forces in the mean time having made all proper diſpoſitions for improving the advantages they had gained, Abu Obeidah ſent a detachment of 500 horſe to a place called *Dair Abil Kodos*, about 30 miles from Damaſcus, to plunder the Chriſtians there. In this place their lived a prieſt ſo eminent for his ſanctity, that the neighbouring people of all ranks reſorted to him for his bleſſing and inſtruction. When any perſon of diſtinction married, he took with him his new ſpouſe, in order to receive this holy man's benediction. The fame of this prieſt's ſanctity drew ſuch numbers of people to that place every Eaſter, that a great fair was kept annually at his houſe, to which were brought vaſt quantities of the richeſt ſilks, plate, jewels, &c. When the Arabs drew near to this place, to which they were conducted by a Chriſtian, they were informed that the governor of Tripoli had married his daughter to a perſon of diſtinction, who had carried his lady to the above-mentioned prieſt. She was attended by a guard of 5000 men; beſides which, the Jews, Greeks, Copts, and Armenians, at that time aſſembled about the monaſtery, amounted to 10,000. Notwithſtanding this the Moſlem commander determined to cary off the lady; and having told his men, that they ſhould either enjoy the riches of the Chriſtians, or the pleaſures of paradiſe, he commanded them to fall on the enemy. The impetuoſity of theſe enthuſiaſts at firſt bore all down before them; but the Chriſtians perceiving they were but an handful of men, ſurrounded them on all ſides, and reſolved to make them pay dear for their temerity. But Abu Obeidah, being informed of their dangerous ſituation, immediately diſpatched Khaled with a ſtrong detachment to the relief of his diſtreſſed countrymen. The conſequence of this was, that the Chriſtians were entirely defeated, and the unhappy lady carried off, with 40 maids that waited upon her, as well as all the wealth brought to the above-mentioned fair; among which were many rich garments curiouſly wrought, and in particular one adorned with the effigies of our Saviour. All theſe were ſold for ten times their weight of gold to ſome of the opulent Arabs of Yaman. The young lady was given to Abdallah, who kept her to the reign of Yezid. Of this advantage Abu Obeidah ſent notice to the khalif by a letter, in which he alſo acquainted him that ſome of his men had drunk wine. Theſe delinquents, by the advice of Ali, had each of them 80 ſtripes beſtowed upon the ſoles of their feet; after which many others, who had never been ſuſpected of drinking this prohibited liquor, made a voluntary confeſſion, and received the ſame chaſtiſement.

73 Governor of Tripoli's daughter carried off.

74 Puniſhment of ſome ſoldiers who had drunk wine.

The Moſlem general next ſet about reducing the principal fortreſſes in Syria, and ſoon became maſter of Kinniſrin, Baalbec, Adeſtan, Shaizar, and Hems; on the news of which, the Greek emperor Heraclius, reſolving if poſſible to put a ſtop to the cruel and unprovoked ravages of theſe barbarians, ſent againſt them an army of 240,000 men, commanded by one Manuel, whom the Arabs call *Mahan*. But this vaſt multitude was utterly defeated by Khaled; upon whom Abu Obeidah conferred the ſupreme command, on account of his ſuperior ſkill in military affairs. This battle was fought near a village called *Yermouk*; and according to the Arabian hiſtorians, the Chriſtians had 150,000 men killed, and 40,000 taken priſoners, while the Moſlems loſt no more than 4030 men.

75 The Greeks utterly defeated at Yermouk.

76 Omar viſits Jeruſalem.

The defeat of Yermouk was immediately followed by the loſs of the whole province of Paleſtine. The reduction of Jeruſalem was one of its firſt conſequences; and Omar being appriſed of the ſucceſs of his arms, immediately ſet out to viſit that holy place, at the requeſt, it is ſaid, of the inhabitants. The khalif was attended in his journey by a numerous retinue, moſt of whom afterwards returned home. He rode upon a red camel, and carried with him two ſacks, one of which contained a ſort of proviſion conſiſting of barley, rice, or wheat, ſodden and unhuſked, and the other fruits. Before him he had a leather bottle, very neceſſary in theſe deſart countries to put water in; and behind him a wooden platter. Before he left the place where he had reſted the preceding night, he conſtantly ſaid the morning prayer; after which he addreſſed himſelf to his attendants in a devout ſtrain, always uttering before them ſome pious ejaculations. Then he communicated his proviſion to them; every one of his fellow-travellers eating with him out of the ſame platter, without the leaſt diſtinction. His clothes were made of camels hair, and were in a very tattered condition; nor could any thing be more mean or ſordid than the figure he made. On the road he diſtributed juſtice among his ſubjects: concerning which we have ſeveral anecdotes; but that moſt to his honour is the following.

77 Anecdote of him.

Having obſerved ſome poor tributaries expoſed to the heat of the ſun, a very cruel puniſhment in thoſe hot countries, for not being able to pay the ſum demanded of them, he ordered them to be releaſed; telling his attendants, that he once heard the apoſtle of God ſay, "Do not afflict men in this world; for thoſe who do ſo, God ſhall puniſh in hell-fire at the day of judgement." His orders were immediately executed, to the great grief of the oppreſſors; and the khalif continued his route. On the confines of Syria he was met by Abu Obeidah attended by an eſcorte, who conducted him to the Moſlem camp, where he was received with the utmoſt demonſtrations of joy; and from thence to Jeruſalem. The morning after his arrival, he ſaid prayers and preached to the troops. In his ſermon he repeated the following paſſage out of the koran, "Whomſoever God ſhall direct, he ſhall be rightly directed; and whomſoever he ſhall cauſe to err, thou ſhalt not find any to defend or to direct." Upon this a Chriſtian roſe up, and ſaid aloud twice, "God cauſes no one to err." Omar made no anſwer to him, but commanded the Moſlems near him to ſtrike off the infidel's head if he repeated thoſe words again; but the prieſt took care to give him no further interruption. After the concluſion of his ſermon, he pitched his tent, made of hair, within ſight of the city: then he ſigned the articles of capitulation; by which the inhabitants were intitled to the free exerciſe of their religion, the poſſeſſion of their properties, and his protection.

The articles of capitulation being ſigned, Omar, in purſuance of his engagements, gave the inhabitants a ſchedule, by which they were ſecured in the full poſſeſſion of all that had been agreed upon; after which the gates were opened to him, and he entered the town. He was waited upon by the patriarch Sophronius, with whom he converſed familiarly, and aſked him many queſtions concerning the antiquities of the city. One of the firſt places they viſited was the temple of the reſurrection, in the midſt of which Omar ſat down; and when the hour of prayer was come, told the patriarch he had a mind to pray, and deſired him to ſhow him a place for that purpoſe. Sophronius told him he might do ſo where he was; but this he abſolutely refuſed. Then the patriarch led him to St Conſtantine's church; but he likewiſe declined praying there. At laſt he ſaid his prayers upon one of the ſteps of the eaſt gate of the church; telling the patriarch afterwards, that had he prayed in any of the churches, the Moſlems would infallibly have taken it from them, which he ſaid they might attempt as it was, and therefore gave him a paper, wherein the Moſlems were commanded not to pray on the ſteps of St Conſtantine's church in any numbers, but only one by one. After this he deſired the patriarch to ſhow him a place where he might erect a moſque; and was conducted to the place where Jacob's ſtone lay, on which he ſlept when he ſaw the viſion of the ladder. This ſtone had been hitherto ſlighted, and no building ſuffered to be erected upon it, in order to fulfil our Saviour's prophecy, that the habitation of the Jews ſhould be left unto them deſolate, and that not one ſtone ſhould be left upon another. In conſequence of this neglect it was entirely covered with dirt, which the khalif immediately began to carry away in his veſt; and the Moſlems ſoon haſtening to aſſiſt him, the ſtone was cleared in a very ſhort time. We are told by Theophanes, that when Omar entered the temple of the reſurrection, he was clad in ſuch mean and dirty apparel, that the patriarch took great offence at his appearance, and with much difficulty at laſt prevailed upon him to put on ſome clean linen and clothes till his own could be waſhed. The ſame author relates, that when the patriarch firſt ſaw Omar in that place, he could not forbear crying out, "This is of a truth the abomination of deſolation, ſpoken of by Daniel the prophet, ſtanding in the holy place!" Theſe words, as Mr Ockley imagines, being overheard by the Moſlems, they trumped up a ſtory of the patriarch's having owned that the conqueſt of Jeruſalem by Omar was foretold by the prophet Daniel; and that an ancient prophecy was kept in Jeruſalem concerning Omar, wherein his perſon was deſcribed, his name and religion ſpecified, and he declared to be the only man that could reduce that city.

Before the khalif left Syria, he divided that country into two parts; one of which, that lay between Haûran or Aûran and Aleppo, which was not perfectly conquered, he committed to the care of Abu Obeidah, giving him the ſtricteſt orders to reduce it as ſoon as poſſible. Yezid Ebn Abu Sofian was commanded to take upon him the care of the other, which comprehended Paleſtine, and the ſea-coaſt, and to make himſelf abſolute maſter of it, having a body of troops aſſigned him for that purpoſe. He alſo directed Amru Ebn Al As to invade Egypt, then in a very languiſhing condition, with a body of Moſlem forces.

78 He returns to Medina.

After having made theſe diſpoſitions for extending his conqueſts, Omar ſet out for Medina, where he arrived in perfect health, to the great joy of the inhabitants, who apprehended, from his long ſtay at Jeruſalem, that he had intended to fix his reſidence there.

Soon after Omar's departure, Yezid advanced to Cæſarea; but found the place ſo ſtrong, that he was obliged to continue ſome time in a ſtate of inaction. Abu Obeidah, in the mean time, advanced towards Aleppo, the citadel of which was at that time the ſtrongeſt in Syria. The citizens were ſtruck with the utmoſt conſternation at his approach. They had at that time two governors, who were brothers, and reſided in the caſtle, which was ſituated at a little diſtance from the city. The names of theſe two governors, who were of very different diſpoſitions, were Youkinna and John. Their father, by the emperor Heraclius's appointment, preſided over all that tract which lay betwixt Aleppo and the Euphrates; and, after his death, the chief management of affairs devolved upon Youkinna, his brother John ſpending his time moſtly in devotion and acts of charity. He would therefore gladly have prevailed on Youkinna to purchaſe a peace from the Arabs with money, rather than make his country a ſcene of blood and ravages; but this not ſuiting the martial genius of Youkinna, he armed a conſiderable number of the citizens, among whom were ſeveral Chriſtian Arabs, and diſtributed money among them. He then told his men that he intended to act offenſively againſt the Arabs, and even to engage them if poſſible before they drew too near. To inſpire them with the greater reſolution, he obſerved, that the Moſlem army was divided into ſeveral bodies; one of which had orders to beſiege Cæſarea, another to march to Damaſcus, and the third to invade Egypt. Having thus animated his troops, he put himſelf at the head of 12,000 of them, and marched forwards to get intelligence of the enemy's motions.

79 A Moſlem detachment defeated by Youkinna.

Abu Obeidah, in the mean time, had ſent before him Caab Ebn Damarah, with 1000 men; giving him expreſs orders not to fight till he had received information of the enemy. Youkinna's ſpies diſcovered Caab and his men reſting themſelves and watering their horſes without the leaſt apprehenſion of danger; of which the general being appriſed, he poſted one part of his troops in ambuſcade, and with the other attacked the Moſlems. The Arabs behaved with their uſual valour; and at firſt repulſed the Chriſtians, notwithſtanding their ſuperiority in numbers: but being attacked by the troops that lay in ambuſh, they were at laſt forced to retire; having 170 killed, and almoſt all the reſt wounded.

80 Aleppo ſubmits to Abu Obeidah.

After Youkinna's departure, the inhabitants of Aleppo, conſidering the calamities that awaited them if their city ſhould be taken by ſtorm, ſubmitted without delay to Abu Obeidah, and were taken under the protection of the khalif. This diſagreeable news being communicated to Youkinna, he poſted home with all poſſible expedition, leſt an attempt ſhould be made on the caſtle in his abſence. On his arrival at Aleppo, he was ſo highly incenſed againſt the inhabitants, that he threatened them with death if they did not diſannul the treaty with the Arabs, and deliver up the authors of it into his hands.

81 Cruelty of Youkinna.

This demand not being immediately complied with, he fell upon the citizens with great fury, and killed 300 of them; among whom was his brother John, whoſe head he cauſed to be ſtruck off, charging him with being the author and abettor of the late pernicious ſcheme. He would have made a much greater ſlaughter, had not the Moſlem army at that inſtant arrived before the town; upon which Youkinna retired into the caſtle with a conſiderable body of troops: but before this could be effected, he was obliged to ſuſtain an attack from the Arabs, in which he loſt 3000 men. The action was no ſooner ended than the inhabitants of Aleppo brought out forty of Youkinna's men, and as a proof of their fidelity delivered them into Abu Obeidah's hands. Of theſe, ſeven embraced Mahometaniſm, and the reſt were beheaded.

82 He is beſieged in the citadel.

Immediately after Youkinna had ſhut himſelf up in the caſtle, a council of war was held in the Moſlem camp, wherein it was deliberated what meaſures were to be purſued on the preſent occaſion. Khaled gave it as his opinion, that the caſtle ought immediately to be attacked with all the Arab forces, before the emperor had time to ſend them any aſſiſtance. This advice was followed by Abu Obeidah, who cauſed the citadel to be immediately inveſted; and ſoon after he had ſurrounded it with all his forces, made a moſt vigorous aſſault. The beſieged defended themſelves with great bravery, and after a very warm diſpute drove the enemy into their camp; and as they threw a great many ſtones out of their military engines, many of the Moſlems were killed, and a much greater number wounded. This encouraged Youkinna to make a ſally with a ſtrong party of the garriſon the following night. The fires being then out in the Moſlem camp, and the beſiegers not expecting ſuch an unſeaſonable viſit, 60 of them were killed on the ſpot, and 50 taken priſoners. Youkinna, however, being briſkly attacked by Khaled, who ſoon drew together a body of troops to oppoſe him, loſt about 100 men in his retreat. The next day, he cauſed the priſoners to be beheaded in the ſight of the Moſlem camp; and receiving advice that a ſtrong party of Arabian cavalry was ſent out to forage, he ordered a body of his horſe to drive them to their camp; which they accordingly did, killed 130 of them, ſeized all their camels, horſes, &c. and then retired to the mountains. Here they propoſed to remain concealed till the following night, and then return to the caſtle; but Abu Obeidah, being informed of what had happened, detached Khaled and Derar with a body of troops to purſue the Greeks, and revenge the late affront. Khaled, being informed of the route the Chriſtians had taken, poſſeſſed himſelf of the only paſs by which they could return to the caſtle; and having poſted there a body of his men whoſe courage he could depend upon, took 300 of the Greeks priſoners as they attempted to return, and put all the reſt to the ſword. The next morning, to retaliate Youkinna's cruelty, the priſoners were all brought out and beheaded in the ſight of the garriſon.

83 His vigorous defence.

Notwithſtanding this diſaſter, Youkinna made ſeveral ſallies with good ſucceſs, wherein he killed a great number of the enemy, and harraſſed them to ſuch a degree, that Abu Obeidah found himſelf obliged, for his greater ſecurity, to remove his camp to about a mile's diſtance from the caſtle; by which manœuvre he likewiſe hoped that Youkinna would be leſs upon his guard. Herein, however, he found himſelf miſtaken: for the Greek commander, by the prudent meaſures he took, eluded all ſurpriſe; and tho' Abu Obeidah continued the ſiege for four months after the laſt-mentioned blow given to the garriſon by Khaled, yet he had ſcarce any hopes of making himſelf maſter of it at laſt. Having nothing material to write to the khalif, he remained a long time ſilent; at which Omar being very much concerned, wrote to him, deſiring an account of the affairs in Syria. Abu Obeidah acquainted him that the city of Aleppo had ſubmitted to him; and that the citadel was the only place which held out in all that country, before which he had loſt a great number of men, which he ſaid, had induced him to think of raiſing the ſiege, and moving with his army in that track which lay between Antioch and Aleppo. This news was by no means agreeable to the khalif, who commanded his general to continue the ſiege at all events, and ſent him a reinforcement of Arab troops, together with 70 camels, to aſſiſt the infantry in their march.

84 The citadel taken by ſtratagem.

Among the troops ſent by Omar on this occaſion, there was an Arab of a gigantic ſize, called *Dames*, who was a man of great courage and reſolution. He obſerving the little progreſs made by the Moſlems, bethought himſelf of a ſtratagem by which that fortreſs might be reduced, which ſeemed ſo difficult to be accompliſhed by force. He therefore deſired that Abu Obeidah would aſſign him the command of a party conſiſting only of thirty men; which at Khaled's requeſt was readily granted. Then he begged the general to raiſe the ſiege, and retire to about three miles diſtance from the caſtle, which was likewiſe immediately complied with. The following night Dames, who had poſted himſelf with his party very near the citadel, found means to ſeize a Greek, from whom he learned that Youkinna, after the ſiege was raiſed, had exacted large ſums of money from the citizens, on account of the treaty they had concluded with the Arabs; and that he was one of thoſe who had endeavoured to make their eſcape from the oppreſſion of ſuch a tyrant, by leaping down from the wall. This man Dames took under his protection; but beheaded five or ſix others who fell into his hands, and could give no good account of themſelves. He then covered his head and ſhoulders with a goat's ſkin, and took a dry cruſt in his hand, creeping on the ground till he got cloſe to the foot of the wall. If he heard any noiſe or ſuſpected any perſon to be near, he made ſuch a noiſe with his cruſt as a dog does when he is gnawing a bone, his companions ſometimes walking, and ſometimes creeping after him in the ſame manner. He had before diſpatched two of his men to Abu Obeidah, to deſire that a detachment of horſe might be ſent him by break of day to ſupport his ſmall party, and facilitate the execution of the plan he had formed. At laſt Dames found an opportunity of raiſing ſeven men upon his ſhoulders, who ſtood one upon another's ſhoulders in ſuch a manner that the higheſt reached the top of the wall. Here he ſoon placed himſelf, ſeized a watchman whom he found aſleep, and threw him over the wall. Two others, whom he found in the ſame condition, he ſtabbed with his dagger, and threw them over likewiſe. Then he laid down his turban, and drew up the ſecond of his brethren, as they two did the third, and by their help Dames himſelf and all the reſt were enabled to mount the wall. He then privately ſtabbed the centry at each of the gates, and put his men in poſſeſſion of every one of them. The ſoldiers of the garriſon, however, were at laſt alarmed, and ſurrounded the Arabs, who were on the point of periſhing, when Khaled appeared at the head of a detachment of cavalry. On ſight of that general, who was now grown terrible to the Chriſtians, the beſieged threw down their arms and ſurrendered at diſcretion. Youkinna and ſome of the principal officers turned Mahometans, in order to ſave their poſſeſſions; and the caſtle, being taken by ſtorm, was pillaged by the Moſlems. Dames acquired great glory by this exploit; and, out of complaiſance to him, the army did not decamp from Aleppo till he and his men were perfectly cured of their wounds.

85
Youkinna's apoſtacy.

After the reduction of the citadel of Aleppo, Abu Obeidah intended to march to Antioch; but was diverted by Youkinna, who was now become a violent enemy to the Chriſtians. He told the Moſlem general, that his conqueſt of that part of the country would not be complete without the reduction of Azaz, a place of great importance, where Theodorus, Youkinna's couſin-german, was commandant. This fortreſs he propoſed to become maſter of, by putting himſelf at the head of 100 Arab horſe dreſſed in the Greek habit, who were to attend him to Azaz. Upon his arrival there, he was to aſſure Theodorus that he was ſtill in reality a Chriſtian, and had taken that opportunity to eſcape from the Moſlem camp. But, to make his ſtory more probable, Abu Obeidah was to ſend after him a detachment of 1000 horſe, who were to purſue him as far Morah, a village in the neighbourhood of Azaz, with orders to poſt themſelves there; from whence, if ſuch a meaſure ſhould be found neceſſary, they might eaſily advance to Azaz, to facilitate the conqueſt of that place. To this ſcheme Abu Obeidah agreed; but Youkinna with all his men were immediately taken priſoners by Theodorus, who had been informed of the whole affair by a ſpy in the Moſlem camp, who had ſent him a letter by a pigeon. The fortreſs, however, was ſoon reduced, and Youkinna regained his liberty; but was ſoon after taken priſoner a ſecond time, and brought before his old maſter Heraclius, who then reſided at Antioch. He told the emperor, that he had only pretended to embrace Mahometaniſm, in order to be able to do his Imperial Majeſty the more eſſential ſervice; and ſo far gained upon him, that he was ſoon after appointed governor of that city; the conſequence of which was, that the Arabs were put in poſſeſſion of it by his treachery.

86
He is taken priſoner & brought before Heraclius.

87
Attempt to aſſaſſinate Omar miſcarries.

The emperor being quite diſheartened at his continual bad ſucceſs, it was ſuggeſted to him by the king of Ghaſſan, who had fled to him for refuge, as we have already obſerved, that, however deſperate his affairs might be, they would be perfectly reſtored by the aſſaſſination of the khalif. This piece of ſervice he undertook to perform for the emperor; and diſpatched one Wathek Ebn Moſafer, an Arab of his tribe, and a reſolute young man, to Medina for that purpoſe. Wathek, ſome time after his arrival there, having obſerved the khalif to fall aſleep under a tree, on which he had placed himſelf ſo as not to be obſerved by any one, drew his dagger, and was upon the point of ſtabbing him; but, as the Arab writers tell us, he was deterred by a lion, who walked round the khalif, and licked his feet till he awoke, after which he inſtantly went away. This ſtruck Wathek with a profound reverence for Omar; he came down from his tree where he had been confined by the lion, confeſſed his deſign, and embraced the Mahometan religion.

88
The Greeks defeated.

Soon after the reduction of Antioch, Abu Obeidah ſent an account of his ſucceſs to Omar; and receiving an order to invade the mountainous parts of Syria, he aſked his general officers which of them would command the body of troops deſtined for that purpoſe. One Meiſarah Ebn Meſrouk having offered his ſervice, the general gave him a black ſtandard, with the following inſcription upon it in white letters: "There is but one God; Mahomet is the Apoſtle of God." The body aſſigned him for this purpoſe conſiſted of 300 Arabs, and 1000 black ſlaves commanded by Dames. Meiſarah, at the head of his troops, with ſome difficulty aſcended the mountains, and, with much more, advanced to that part where the emperor's forces were poſted. The cold was ſo intenſe on the ſummits of thoſe mountains, that the Arabs, who had been accuſtomed to a warm climate, could hardly bear it. For ſome time they could not meet with a ſingle perſon to give them intelligence of the enemy's motions; but at laſt they took a Greek priſoner, who informed them, that the imperial army, which conſiſted of 30,000 men, lay encamped on a ſpot not three leagues diſtant. The priſoner refuſing to profeſs Mahometaniſm, they cut off his head, and then marched towards the imperial camp. The Greeks, hearing of their approach, advanced to meet them; and the Moſlems being ſurrounded on all ſides, were on the point of being all cut off, when Khaled appeared at the head of 3000 horſe, and after him Ayab Ebn Ganem with 2000 more. At the approach of the horſe under the command of the terrible Khaled, the Greeks retired, leaving all their tents, together with their rich furniture and effects, to the Arabs. In this engagement, one of Omar's chief favourites, named *Abdallah Ebn Hodaſa*, was taken priſoner, and ſent directly to Conſtantinople. The khalif was ſo much concerned at this, that he ſent a letter to Heraclius, deſiring his releaſe; which the emperor not only complied with, but made him many valuable preſents, ſending at the ſame time a jewel of immenſe value as a preſent to the khalif.

89 Omar's diſintereſtedneſs.

This Omar offered to the jewellers of Medina, but they were ignorant of its value: the Moſlems therefore begged him to keep it for his own uſe; but this he ſaid he could not be anſwerable for to the public. It was therefore ſold, and the money depoſited in the public treaſury.

About this time alſo, Khaled advanced with a body of troops as far as the Euphrates, and took Manbij, Beraa, Bales or Balis, exacting of the inhabitants 100,000 dinars for their preſent ſecurity, and impoſing on them an annual tribute for the future. He alſo made himſelf maſter of Raaban, Dulouc, Korus, the Cyrus or Cyrrhus of the ancients, and ſeveral other fortified towns, nothing being now able to ſtand before him. Amru Ebn Al As now likewiſe prepared for the reducing ſome places in Paleſtine that ſtill held out. While he remained in this province, he had a conference with Conſtantine the emperor's ſon, who endeavoured to perſuade him to make peace with the Chriſtians; but this he not agreeing to, unleſs they would conſent to pay tribute, all hopes of an accommodation vaniſhed and the generals on both ſides prepared to enter upon action. In the mean time an officer came from the Chriſtian camp, dreſſed in very rich apparel, who challenged the ſtouteſt man among the Moſlems to fight him in ſingle combat. The challenge was accepted by a young Arab officer of Yaman; who being animated by a notion, derived from the prophet himſelf, that "the ſpirits of the martyrs reſt in the crops of green birds, that eat of the fruits and drink of the rivers of paradiſe," diſcovered an uncommon eagerneſs to encounter his enemy. But the Chriſtian officer not only killed this youth, but two or three more of the Moſlems who came to his aſſiſtance.

90 Account of Toleiha the falſe prophet.

He was then attacked by Serjabil Ebn Hoſanah, one of the generals, but a man ſo weakened by faſting, that he could ſcarce ſtand before him, and would therefore have been undoubtedly killed, had not a Greek horſeman very opportunely interpoſed, and with one blow of his ſcymitar cut off the Chriſtian's head. Serjabil, greatly ſurpriſed at this deliverance, aſked the horſeman who he was, and from whence he came; to which he replied in the following terms: "I am the unfortunate Toleiha Ebn Khowaid, who ſet up for a prophet, and, lying againſt God, pretended to inſpiration." In conſequence of having ſaved his life, Serjabil introduced him to Amru; and writing a letter to Omar, wherein he acquainted him with the ſignal proof Toleiha had given of his repentance, he obtained his pardon from the khalif.

Though the two armies did not come to a general engagement, yet they had frequent ſkirmiſhes, in which the Arabs always got the better, and in ſome the Greeks ſuffered very conſiderably. This, together with the ſeverity of the ſeaſon, which was then uncommonly cold, ſo dejected the ſoldiery, that they began to deſert in great numbers. Conſtantine therefore, finding his troops to diminiſh daily, and the Arabs to grow ſtronger and ſtronger, took the advantage of a tempeſtuous night to eſcape to Cæſarea, which Yazid had not been able to take; leaving his camp to be plundered by the enemy.

91 Youkinna takes Tripoli.

This city was ſoon after inveſted by Amru; and at the ſame time Youkinna, having made himſelf maſter of Tripoli by treachery, ſeized 50 ſhips from Cyprus and Crete, which carried a ſupply of arms and proviſions for the emperor's troops, and had entered the port without knowing that the Arabs were maſters of the town. With theſe ſhips he undertook an expedition againſt Tyre; and telling the inhabitants that he brought a ſupply of arms and proviſions for Conſtantine's army, he was admitted into the town, and received with great kindneſs. Here, however, he had not been long before he was diſcovered by one of his own ſoldiers, and put under arreſt, with 900 of his men. He was however ſet at liberty by thoſe to whoſe care he was committed; and then opened the gates of the town to Yezid, by whom it had been inveſted.

92 Tyre and Cæſarea reduced.

Conſtantine having got intelligence at Cæſarea of the loſs of Tripoli and Tyre, was ſo diſheartened, that he ſet ſail from that city with all his family and the greateſt part of his wealth; and the citizens then thought proper to make the beſt terms they could with Amru. The ſurrender of this city was followed by that of all the other cities and fortreſſes in the province; and thus the Arabs drove the Greeks out of the whole country of Syria extending from the Mediterranean to the Euphrates. This conqueſt was completed in the 18th year of the Hegira, ſix years after it had been undertaken.

93 Violent ſtorms, plague, &c.

This year there happened ſuch violent ſtorms of hail in the peninſula of the Arabs, that a conſiderable extent of territory was laid waſte by them, and a great number of animals of various kinds deſtroyed. An epidemical diſtemper likewiſe raged at Medina, which ſpread itſelf all over the neighbouring territory, and ſwept away great numbers of people. Syria alſo was viſited by a dreadful plague; ſo that the Moſlems loſt there 25,000 men, among whom were Abu Obeidah himſelf, Yezid Ebn Abu Sofian, Serjabil, and many other perſons of diſtinction. In ſhort, ſo great was the mortality, occaſioned by the plague, both in Arabia and Syria, that the Arabs ſtyle the 18th year of the Hegira the *year of deſtruction*.

94 Egypt reduced.

Amru Ebn Al As having now executed the khalif's orders in Syria, ſet out on his expedition againſt Egypt. His firſt attempt was on Tarma, a town ſituated on the iſthmus of Suez. This he reduced after a month's ſiege; and having narrowly viewed its ſituation, he formed a deſign of cutting through the iſthmus, and thus joining the Mediterranean and the Red ſea: but this project was not well reliſhed by the khalif, who apprehended that it would facilitate the entrance of the Chriſtians into the peninſula of Arabia. From Tarma he marched to Meſr, the Memphis of the ancient geograpers; which, after a ſiege of ſeven months, was delivered up to him by the treachery of Al Mokawkas the Governor. From Meſr, he continued his march towards Alexandria, and, having defeated the emperor's army, cloſely inveſted that city. While his army lay before this capital, Amru himſelf had the misfortune to be taken priſoner and carried into the town. Being brought before the governor, he aſked him why he committed ſuch ravages and depredations in the Chriſtian territories? To this Amru reſolutely anſwered, "We have come hither to oblige you either to profeſs Mahometaniſm, or pay an annual tribute to the khalif; to one of which conditions you muſt ſubmit, or be all of you put to the ſword." A Greek who ſtood by, hearing this, told the governor that Amru was certainly the Moſlem general, and therefore deſired him to cut off his head. Upon this Werdan, one of Amru's ſlaves, perceiving the extreme danger his maſter was in, gave him a box on the ear, exclaiming againſt his impudence for talking in ſuch a manner. The governor being impoſed upon by this ſhallow artifice, not only ſaved his life, but, to ſhow his generoſity, diſmiſſed him without ranſom. This was ſoon followed by the loſs of Alexandria, and that by the conqueſt of the whole kingdom: after which, Amru diſpatched Okba Ebn Nafe with a body of troops to penetrate farther into Africa; and that general made himſelf maſter of all the country lying between Barka and Zoweilah, reducing under his dominion alſo that part of the continent which now forms the piratical kingdom of Tripoli in Barbary.

95
Together with Barca and Tripoli.

Soon after the Moſlems had made themſelves maſters of Alexandria, a grievous famine raged in Arabia, particularly at Medina, then the reſidence of the khalif. This obliged Omar to write to Amru to ſend him a ſupply of corn, with which Egypt at that time abounded. In compliance with this order, Amru ſent a train of camels laden with corn, in a continued line from Egypt to Medina; the firſt of which were entering Medina when the laſt were leaving Alexandria. But this method of conveying corn proving too tedious and expenſive, he ordered him to clear the Amnis Trajanus of Ptolemy, now the Khalis, which runs from one end of Cairo to the other, of the ſand and gravel with which it was choaked. This he accordingly did, and by that means rendered the communication between Egypt and Arabia much more eaſy than it had formerly been.

96
The Perſians defeated.

While the Arabs thus extended their conqueſts in the weſt, they were no leſs ſucceſsful in the eaſt. We have already taken notice of Khaled's having been ſent into Irak to reduce the kingdom of Hira, and of his being recalled to aſſiſt in the conqueſt of Syria. As the kings of Hira were under the protection of the Perſian monarchs, the deſtruction of that kingdom neceſſarily brought on a war with the Perſians. After the departure of Khaled, the command of the forces was left with Ebn Obeid Ebn Maſud, together with Al Mothanna Ebn Haretha, Amru Ebn Haſem, and Salit Ebn Kis. Abu Obeid having paſſed a river contrary to the advice of the other generals, was killed, and his troops in great danger; however, Al Mothanna made an excellent retreat, and repaſſed the river without any conſiderable loſs. After this he fortified himſelf in his camp till he received a conſiderable reinforcement from the khalif; when the Moſlem army marched to Dir Hind, and thence continued to make frequent excurſions, ravaging that part of Irak that lay next to the Euphrates, a body of 12,000 choſen horſe was now diſpatched againſt thoſe invaders, under the command of one Mahran. At firſt the Perſians had the advantage, and obliged the Arabs to retire; but they were ſoon brought back by Al Mothanna, and the battle laſted from noon till ſun-ſet. At laſt Al Mothanna, engaging Mahran in ſingle combat, laid him dead at his feet; upon which the Perſians fled to Al Madayen, a town ſituated on the Tigris, about a day's journey from Bagdad. After this a powerful army was diſpatched by the Perſians under the command of one Ruſtam; but he alſo was killed, and his troops were entirely diſperſed. At the ſame time Abu Muſa, another Moſlem general, defeated a formidable body of troops under the command of Al Harzaman, a noble Perſian, at Ahwaz.

Not content with thoſe victories, ſoon after the reduction of Damaſcus, the khalif diſpatched Saad Ebn Abu Wakkas, to diſlodge the Perſians from ſome diſtricts they poſſeſſed in the neighbourhood of the Euphrates. Saad having drawn together a body of 12,000 men, advanced to Kadeſia, a city bordering upon the deſarts of Irak; where having utterly defeated an army of 120,000 Perſians, he made himſelf maſter of the opulent city of Al Madayen, and poſſeſſed himſelf of Yezdejerd's treaſure; which was ſo rich, if we may believe the Arabian writers, that Saad took out of it three thouſand millions of dinars, amounting to two thouſand and twenty-five millions of pounds ſterling; an enormous and almoſt incredible ſum. From thence Saad went to that part of the palace where the king's plate was depoſited, which he carried off, as well as an immenſe quantity of camphire with which another part of the palace was entirely filled. This laſt the Arabs ſeem to have carried off merely for the ſake of plundering, as they were ſo much unacquainted with the nature of it, that they mixed it with their bread, which gave it a bitter and diſagreeable taſte. Afterwards the Arab general carried off the crown and royal garments, adorned with gold and jewels of ineſtimable value. He alſo plundered his armoury, which was well ſtored with all ſorts of weapons; after which he cauſed the roof of his porch to be opened, where he found another treaſure equal in value to ten millions of crowns. He alſo found among the furniture of the palace a piece of ſilk tapeſtry, 60 cubits ſquare, which was adorned with a great variety of beautiful flowers, herbs, and plants, formed of gold, ſilver, and jewels, the moſt valuable that could be procured. This being brought to Omar, he cut in pieces, and diſtributed it among the Moſlems; and that part of it which fell to Ali's ſhare, and which was yet none of the beſt, he ſold for 20,000 crowns.

97
Incredible treaſure taken from them.

98
Meſopotamia reduced.

In the twentieth or twenty-firſt year of the Hegira, the Arabs, ſtill unſated with conqueſt, invaded Meſopotamia under Aiyad Ebn Ganem, where the city of Edeſſa ſubmitted on the firſt ſummons. From Edeſſa he marched to Conſtantia, or Conſtantina, ſuppoſed to be the Nicephorium of the ancients. This he took by ſtorm, as likewiſe Daras, where he maſſacred all the people he found in the place; and theſe repeated ſucceſſes ſo terrified the reſt of the fortified towns, that they all ſubmitted without reſiſtance. At the ſame time Al Mogheirah Ebn Shaabah, one of the khalif's commanders, made himſelf maſter of Shiz, a place famous for the birth of Zerduſht the Perſian philoſopher, and over-ran the whole province of Aderbijan. He alſo poſſeſſed himſelf of all the country of Armenia bordering on mount Taurus; nay, he in a manner obliged the whole region to own the authority of the khalif, and penetrated into Cappadocia. The ſame year alſo Saad made himſelf maſter of Ahwas, the capital of Khuzeſtan (the ancient Suſiana); in conſequence of which he became maſter of the greateſt part, if not of the whole, of that province; at the ſame time that Al Nooman conquered the greateſt part of Khoraſan.

99 Omar murdered.

But while Omar's troops were thus irreſiſtibly over-running the fineſt countries in the known world, a period was put to his conqueſts and his life, by a Perſian named *Abu Lulua*, who ſtabbed him thrice in the belly while he was performing his devotions at Medina. The reaſon of this was becauſe the khalif refuſed to remit him ſome part of the tribute, which according to the Mahometan cuſtom he was obliged to pay for the free exerciſe of his religion. The Arabs, perceiving that he had killed their ſovereign, immediately ruſhed upon him; but the aſſaſſin defended himſelf ſo deſperately, that he killed ſeven of them and wounded 13: but at laſt one the khalif's attendants threw his veſt over him, and ſeized him; upon which he ſtabbed himſelf, and ſoon after expired.

100 Succeeded by Othman.

Omar having languiſhed three days after the wounds given him by the Perſian, expired in the 10th, 11th, or 12th year of his reign, and after his death Othman Ebn Affan was choſen; though Ali had a better title, and ſeems indiſputably to have been the moſt virtuous, if not the only virtuous perſon, as well as the braveſt warrior among them. He was inaugurated in the 24th year of the Hegira, nearly coincident with the year of our Lord 645.

Othman was no ſooner ſettled on the throne, than he commanded Al Mogheirah to complete the conqueſt of the territory of Hamadan; which he eaſily accompliſhed, and at the ſame time reduced Bira, a ſtrong caſtle in Meſopotamia, which either had never ſubmitted, or had revolted on the departure of the Moſlem troops out of that province. Another army, under Abdallah Ebn Amar, was alſo diſpatched into Perſia, to deprive Yezdejerd of the poor remains of his dominions; and this was done ſo effectually, that the unhappy monarch was obliged to fly to Sijeſtan and abandon Perſia altogether.

101 Coloſſus of Rhodes deſtroyed.

In the 27th year of the Hegira, the iſland of Cyprus was reduced by Moawiyah; who ſoon after conquered the iſland of Aradus, and took Ancyra; after which he reduced the iſland of Rhodes, broke in pieces the famous Coloſſus, and ſold the metal of it to a Jew of Edeſſa. In the mean time another of the Arab commanders entered Iſauria, where he committed dreadful depredations, plundering many towns and villages, putting a great number of people to the ſword, and carrying off 5000 priſoners. In the 31ſt year of the Hegira, one Habib having made an irruption into that part of Armenia which was ſtill unconquered, defeated a body of the Emperor's troops, purſuing them as far as mount Caucaſus, and laying waſte all the neighbouring territory. About the ſame time alſo, Abul Abar, who had been conſtituted admiral by Moawiyah, gave the emperor Conſtance a ſignal defeat by ſea, on the coaſt of Lycia, in which ſuch a number of Chriſtians were killed, that the neighbouring ſea was dyed with their blood.

102 Inſurrections againſt the khalif.

But while Othman was thus carrying every thing irreſiſtibly before him abroad, he neglected to ſecure the affections of his ſubjects at home, which ſoon proved his ruin. Sedition was induſtriouſly propagated through all the provinces of the empire, and articles of accuſation brought againſt the khalif. The chief of theſe were, That he had recalled one who had been baniſhed by the prophet: that he had removed Saad, an officer of diſtinguiſhed bravery, and ſupplied his place by one who drank wine, and was otherwiſe of a ſcandalous life; that he had ſquandered away vaſt ſums among his favourites; that he had removed Amru from the government of Egypt, to which he had preferred his own foſter-brother; and, laſtly, that he had preſumed to ſit on the top of Mahomet's pulpit, whereas Abu Becr had always ſat on the higheſt ſtep and Omar on the loweſt. To this formidable accuſation the poor khalif pleaded guilty, and promiſed to make all the reparation in his power; but his condeſcenſion only ſerved to increaſe the inſolence of the rebels. They were however appeaſed by Ali; and public tranquillity had undoubtedly been reſtored, had it not been for Ayeſha, one of Mahomet's widows, who procured the deſtruction of the khalif by a ſcheme truly worthy of the wife of ſuch an huſband. That traitreſs, being deſirous of raiſing one of her favourites named Telha to the dignity of khalif, prevailed on Merwan the ſecretary of ſtate to write a letter to the prefect of Egypt, enjoining him to put to death Mahomet Ebn Abu Becr, with whom it was ſent, and who was to be his ſucceſſor. This letter Merwan took care ſhould be diſcovered: and Mahomet taking it for a genuine order of the khalif, publiſhed the ſuppoſed injury all over the neighbouring countries. He then marched with a body of rebels to Medina, where the innocent khalif was beſieged in his palace; and, notwithſtanding all his proteſtations, nothing leſs than his death could ſatisfy the enraged multitude. In this deplorable ſituation Othman ſent to Ali for aſſiſtance; who commanded his two ſons Haſan and Hoſein to defend the palace gates. This they did for ſome time with fidelity enough, till finding the khalif reduced to great ſtraits for want of water, they abandoned their poſts; upon which the rebels eaſily made themſelves maſters of the palace, and cruelly murdered the khalif in the 82d year of his age, after he had reigned 12 years. His body remained three days unburied; and was at laſt thrown into a hole made for it, and without the uſual ablution, or the leaſt funeral ſolemnity.

103 He is murdered.

The arms of the Moſlems had hitherto been ſo ſucceſsful, and their conqueſts ſo rapid, that they may ſeem not only to have vied with Alexander, but to have bid fairer for univerſal monarchy than any nation either before or ſince.—The ruin of mighty empires always originates from the impoſſibility of keeping them united. Diviſions ariſe; civil wars break out; and the kingdom being weakened by theſe inteſtine feuds, the common enemies take advantage of them to ruin the whole fabric.—If we conſider Mahomet, as in truth he was, not as an enthuſiaſt, but as a politician, and the founder of an empire; we ſhall find him in that capacity ſuperior perhaps to any that ever exiſted. The empire of Alexander the Great, which aroſe with ſtill more rapidity than that of the Arabs, had no ſupport but from his own ambition and perſonal qualifications. While he lived, he was without a rival, becauſe all were afraid of him; but when he died, the bands of union whereby his empire had been held together, were immediately diſſolved. His captains were not inſpired with the ſame veneration for his ſon, who was unborn at the time of his death, that they had for his father; and therefore they ſought not to conquer for him, but for themſelves; and the conſequence was, that the kingdom fell to pieces the moment that he died. The ſame thing happened to the empires of Jenghiz Khan, Tamerlane, and others, who made vaſt conqueſts in a ſhort time. They erected mighty empires indeed; but their duration, we may ſay, was but momentary. The empire of the Romans was founded on a kind of enthuſiaſtic deſire of aggrandizing the city of Rome: patriotiſm became faſhionable; and as the city never ceaſed to exiſt, thoſe who conquered always had the ſame end in view, namely to exalt the republic more and more. This empire, therefore, was not only very extenſive, but very durable; though, as it was impoſſible that mankind could always continue to venerate a city, the ſame diviſions that ruined other empires at laſt brought this to an end.—The foundation of Mahomet's empire ſeemed to be ſtill more firm. He was not only the king, but, we may ſay, the god of his people. Whatever enthuſiaſm people may ſhow in defending their country, nay even their neareſt relations, experience has taught us, that it is greatly inferior to what is ſhown by thoſe who fight in defence of religion. This enthuſiaſm Mahomet had taken care not only to bring over to his ſide, but to exalt to its higheſt pitch, by inculcating upon his followers, that their rewards in the next world ſhould be proportionable to the fury with which they fought in this. To live at peace, except with thoſe who ſubmitted to his will, did not at all enter into his plan; and he who made no conqueſts, or at leaſt did not ſtrive to make them, was no true believer. By this means, let his empire be ever ſo much extended, the temptation to making freſh conqueſts was ſtill equally ſtrong; and not only the commanders of armies, but every private perſon, had the moſt powerful motives to urge him towards the conqueſt of the whole world, had that been poſſible.

104 Cauſes of the decline of the Moſlem empire

—The only thing Mahomet ſeems to have failed in was, the appointment of the ſucceſſion to the apoſtleſhip; and why he was deficient in this is inconceivable. From this one ſource proceeded the diviſions which ruined his empire when it was ſcarce erected, and of which we are now to give the hiſtory.

Tho' the prophet had been ſo deficient in providing for the ſafety of his kingdom as not to name a ſucceſſor at his death; yet his ſon-in-law Ali was always of opinion that the ſucceſſion belonged of right to him; and that it ought to be, like that of other kingdoms, hereditary. This diſpoſition to render the apoſtleſhip hereditary in his family, was, in all probability, what diſguſted the Moſlems with Ali; againſt whom they could otherwiſe have no objection:

105 Character of Ali.

for he was endowed with every amiable quality; a firm believer in Mahomet; and of ſuch unparalleled ſtrength and courage, that he never declined a combat to which he was challenged, nor ever failed to come off victorious; for which reaſon he was ſtyled by his countrymen, "the Lion of God."

106 He is choſen khalif.

On the death of Othman, however, notwithſtanding the prejudices againſt Ali, as none could pretend ſo good a right to the khalifat as he, the Arabs immediately took the oath of allegiance to him, tho' with an intention to break it as ſoon as poſſible, as was fully evinced by the event. The diſturbances which happened immediately on Ali's acceſſion were owing partly to the machinations of Ayeſha, who, having got Othman murdered on purpoſe to raiſe Telha to the dignity of khalif, and now finding Ali unanimouſly choſen, reſolved to deſtroy him alſo. She therefore pretended great concern for the death of the late khalif, and accuſed Ali of being his murderer: but being reproved by one of the Moſlems for endeavouring to blacken an innocent perſon, when ſhe could not but know herſelf guilty; ſhe replied, that Othman's infidelity had indeed made her his enemy, but that ſhe had forgiven him upon his repentance. At the time of Ali's inauguration ſhe was at Mecca, where ſhe enjoyed a very conſiderable ſhare of influence and authority.

107 Diſturbances raiſed by Ayeſha

At her inſtigation, Telha Ebn Obeidallah, and Zobeir Ebn Al Awam, began to repreſent to Ali, that the murderers of Othman ought to be brought to condign puniſhment; offering themſelves at the ſame time for that purpoſe. This they did purely to ſow diſſenſion, for they themſelves had been deeply concerned in the murder; and Ali, ſufficiently aware of their intention, told them it was impoſſible till the empire ſhould be more ſettled. Finding themſelves diſappointed in this attempt, they next begged the government of Cufa and Baſra, that they might with the greater facility extinguiſh any rebellion that ſhould happen. Here again Ali was aware of their intention; and refuſed their requeſt, under pretence that he ſtood in need of perſons of their great capacity, as counſellors, about his perſon. Then they deſired leave to perform a pilgrimage to Mecca, which the khalif could not refuſe; and they were no ſooner got there, than they ſet about raiſing an army againſt him without any provocation at all.

108 And Moawiyah.

This, however, was not the only ſource of diſcord at preſent. Ali had been diſpleaſed with the governors of provinces appointed by Othman; and therefore diſmiſſed them immediately upon his acceſſion. This was very impolitic; but he was prompted to it by that raſhneſs and want of prudence which is inſeparable from, or rather is the very eſſence of, great courage. The conſequence of this was, that Moawiyah, governor of Syria, was, immediately upon his diſmiſſion by Ali, proclaimed khalif by the troops under his command.—Thus the Moſlems were divided into two factions; the one under Moawiyah and Ayeſha, who adhered to the houſe of Ommiyah, to which Othman and Moawiyah belonged; and the other to Ali. The adherents of the houſe of Ommiyah were called *Motazalites*, or *ſeparatiſts*.

109 Ali raiſes an army.

Ali finding how matters were ſituated, and that a very ſtrong party was formed againſt him, endeavoured to ingratiate himſelf as much as poſſible with the Koreiſh; and to raiſe an army againſt Ayeſha, who had now taken the field, and even reduced the city of Baſra. He made a formal ſpeech to the people on hearing this bad news, and deſired their aſſiſtance. But though he was very much beloved on account of his perſonal merit, and the beſt orator of the age, he could not with all his eloquence for ſome time prevail on them to give a deciſive anſwer in his favor. At laſt Ziyad Ebn Hantelah ſtept to Ali of his own accord, and ſaid, "Whoſoever retreats, we will advance." Upon this two Anſars, doctors of the law, ſtood up, and pronounced Ali innocent of the death of Othman; which deciſion ſoon induced the Anſars and the body of the people to eſpouſe his quarrel. He then left Medina, with a body of 900 men, and advanced to Arrabah, where he was joined by ſeveral other parties. From this place he wrote to the people of Cufa and Medina, preſſing them to ſend him farther aſſiſtance, and to diſpoſe the Motazalites to an accommodation. From Medina he very ſoon obtained a large ſupply of horſes, arms, and other neceſſaries; and from Cufa he obtained with difficulty a reinforcement of 8000 men.

110 He defeats and takes Ayeſha priſoner.

Being greatly animated by this ſeaſonable ſupply, Ali advanced towards Baſra, where the troops of Ayeſha were ready to receive him. Both parties ſeemed averſe to an engagement; and Ayeſha began to be very much intimidated at the ſight of Ali's army, which, however, was inferior to her own: but, by ſome means or other, a battle was at laſt brought about, in which, Ayeſha was defeated and taken priſoner. The only remarkable effort that was made by the troops of Ayeſha in this engagement, was in defence of her perſon. It is ſaid, that no fewer than 70 men who held her camel by the bridle, had their hands cut off ſucceſſively; and that the pavilion in which ſhe ſat was ſo full of darts and arrows, that it reſembled a porcupine. Ayeſha was treated very kindly by Ali, who at firſt ſet her at liberty, but afterwards confined her to her houſe at Medina, and commanded her to interfere no more with ſtate-affairs, though he ſtill allowed her to perform the pilgrimage to Mecca.

After this victory, Ali had no enemies to contend with either in Arabia, Irak, Egypt, Perſia, or Khoraſan. A ſtrong party, however, ſtill remained in Syria, headed by Moawiyah, who founded his claims to the khalifat on a pretended declaration of Othman that he ſhould be his ſucceſſor. In this defection he was joined by Amru Ebn Al As, who had obtained a promiſe of the government of Egypt, provided Moawiyah could be advanced to the dignity of khalif.

Ali, with his uſual good-nature, endeavoured to bring the rebels to a ſenſe of their duty, and often ſent propoſals of accommodation to Moawiyah; but he ſtill remained inflexible. Perceiving, therefore, that it would be neceſſary to invade Syria, he entered that country with an army of 70,000 men, while Moawiyah advanced to meet him with 80,000; and by repeated reinforcements Ali's army at laſt amounted to 90,000, and Moawiyah's to 120,000. The two armies came in ſight of each other towards the cloſe of the 36th year of the Hegira, when they ſeemed ready to enter upon action; but only ſome ſkirmiſhes happened between them, wherein neither party ſuſtained any conſiderable loſs. The firſt month of the 37th year was ſpent in fruitleſs negociations; but in the ſecond month they began to fight in different parties, without ever hazarding a general engagement. Theſe battles continued, according to ſome, for 40 days, and according to others, 110. Maowiyah's loſs amounted to 45,000 men, and Ali's to 25,000, among whom, were 26 who had been intimately acquainted with Mahomet himſelf, and were dignified with the title of *The Companions*. The moſt famous of theſe was Ammar Ebn Yaſer, Ali's general of horſe, who was upwards of 90 years of age, and was highly eſteemed by both parties. The loſs of this general ſo exaſperated Ali, that he charged the Syrians with a body of 12,000 men, broke them, and challenged Moawiyah to fight him in ſingle combat. This challenge Moawiyah declined, inſiſting that it was not a fair one, as Ali could not but be ſenſible of his ſuperiority in ſtrength. As the challenge was given in the hearing of both armies, Amru inſiſted that Moawiyah could not in honour refuſe it; but the coward made no other reply than that Amru aſpired to the khalifat himſelf, and wanted to enjoy it after his death. The battle being now renewed with great fury, Moawiyah's forces were puſhed to their camp; which had certainly been taken, had not Amru bethought himſelf of the following ſtratagem to retrieve Moawiyah's affairs, when he ſeemed on the very brink of deſtruction. He ordered ſome of his men to fix copies of the Koran to the points of their lances, and carry them to the front of the battle, crying out at the ſame time, "This is the book that ought to decide all differences between us; this is the book of God between us and you, that abſolutely prohibits the effuſion of the Moſlem blood."—This produced the deſired effect. The khalif's troops threw down their arms, and even threatened him with death if he did not ſound a retreat; which he therefore found himſelf obliged to do, and thus had a deciſive victory wreſted out of his hands.

111 Moawiyah challenged to a ſingle combat by Ali.

112 Amru's ſtratagem

According to this new mode of deciſion, the two parties were each to chooſe their arbitrator; but even this was not allowed to Ali, though Moawiyah had liberty to chooſe Amru Ebn Al As. The troops of Irak, not content with offering ſo groſs an affront to the khalif, inſiſted on naming for his arbitrator Abu Muſa Al Aſhavi; a very weak man, and one who had already betrayed him. The conſequence of this appointment was, that Ali was depoſed by both the arbitrators; and he accordingly dropt his title to the khalifat, but without laying down his arms, or putting himſelf in Moawiyah's power.

113 Ali depoſed

After this deciſion, Ali retired to Cufa, where he was no ſooner arrived, than 12,000 of theſe troops who had themſelves forced him to accept of the arbitration, pretending to be offended with the ſtep he had taken, revolted from him. Theſe were called *Kharejites*, that is, rebels or revolters: and *Mohakkemites*, or judiciarians, becauſe they affirmed that Ali had referred to the judgment of men what ought to have been only referred to the judgment of God; and, therefore, that inſtead of keeping the peace he had made with Moawiyah, he ought to purſue his enemies, who were likewiſe the enemies of God, without mercy. To this Ali replied, That as he had given his word, he ought to keep it: and, in ſo doing, he only followed what was preſcribed by the law of God. The Kharejites.

rejites replied, That God was the only judge between him and Moawiyah, and that conſequently he had committed an enormous ſin, of which he ought ſincerely to repent. This irritating Ali, he with ſome warmth replied, That if any ſin had been committed on this occaſion, it was by themſelves, who had forced him to take the ſteps of which they now complained.

114
He defeats the Kharejites.

This anſwer not proving agreeable, they choſe for their general Abdallah Ebn Waheb, who appointed for their rendezvous Naharwan, a town ſeated between Waſet and Bagdat, about four miles to the eaſtward of the Tigris. Here they aſſembled an army of 25,000 men; and Ali, having tried gentle methods ineffectually, at laſt marched againſt them in perſon. Before he attacked them, however, he planted a ſtandard without the camp, and made proclamation by ſound of trumpet, that whoever would repair to it ſhould have quarter, and whoever would retire to Cufa ſhould find a ſanctuary there. This had ſuch an effect, that Abdallah's army was ſoon reduced to 4000 men, with whom he ruſhed upon the khalif's forces; but all of them were cut in pieces, except nine who eſcaped.

Had Ali marched againſt Moawiyah immediately after the defeat of the Kharejites, and while his troops were fluſhed with victory, he had probably reduced him entirely: but by allowing his troops to refreſh themſelves, they all deſerted him, and Moawiyah's party had an opportunity of gathering ſtill more ſtrength; and though Moawiyah's troops often made incurſions into the territories of Ali, the latter ſeems afterwards to have acted only on the defenſive.

115
They attempt to murder Ali, Amru, and Moawiyah.

At laſt the Kharejites, imagining that it would be for the good of the Moſlem affairs that Moawiyah, Ali, and Amru, were dead, diſpatched aſſaſſins to murder all the three. Moawiyah was wounded, but recovered; Amru's ſecretary was killed by miſtake; but Ali was wounded with a poiſoned ſword, which occaſioned his death.

116
Ali aſſaſſinated.

The aſſaſſin was taken, and Ali would have pardoned him had he recovered, but ordered him to be put to death if he died, that he might, as he ſaid, "have an immediate opportunity of accuſing him before God." Even in this order he ſhowed his uſual clemency, as he ordered the aſſaſſin to be diſpatched at one blow, and without torture of any kind.

Thus fell Ali, the moſt virtuous of all the Mahometan khalifs, after he had reigned near five years, and lived 63. He was preſſed by thoſe about him to nominate a ſucceſſor before he died; but this he declined, ſaying, he would follow the example of the Apoſtle of God, who had not named any: and, as his ſon Haſan inherited his father's piety, though not his courage, he was declared khalif without any ſcruple.

117
Succeeded by Haſan:

Moawiyah, however, behaved in ſuch a manner towards him, as ſhowed his hoſtile intentions; and thoſe about Haſan preſſed him to declare war immediately. This Haſan, who was of an exceeding mild and peaceable diſpoſition, could hardly be perſuaded to do; and though he at laſt took the field, yet he immediately perceived his incapacity to diſpute the empire with Moawiyah; and therefore reſigned it, in ſpite of all the remonſtrances of his friends, to a traitor, who cauſed him after ſome years to be poiſoned by his wife.

118
Who reſigns the khalifat to Moawiyah.

Moawiyah being thus left ſole maſter of the Moſlem empire, found himſelf under a neceſſity of reducing the Kharejites, who were his enemies as well as Ali's, and had now gathered together a conſiderable army. Againſt theſe rebels the khalif would have diſpatched Haſan, but that prince refuſed; upon which he ſent the Syrian troops againſt them, who were defeated: however the Cufans, being at laſt perſuaded to take up arms, ſoon extinguiſhed the rebellion, and ſettled Moawiyah more firmly than ever on the Moſlem throne.

119
Conſtantinople beſieged without ſucceſs.

In the 48th year of the Hegira, the khalif ſent his ſon Yezid with a powerful army to beſiege Conſtantinople. In this expedition he was attended by three or four of the *Companions*, who, notwithſtanding their age, were prompted by zeal to undergo incredible fatigues. The Moſlem forces too, though they ſuffered extremely, were animated to ſurmount all difficulties by a tradition, according to which the prophet in his lifetime declared, "That the ſins of the firſt army that took the city of Cæſarea ſhould be forgiven." Concerning the particulars of this expedition we are in the dark: only, in general, that it proved unſucceſsful; and in it Abu Ayub, who had been with Mahomet at the battles of Bedr and Ohod, loſt his life. His tomb is held in ſuch veneration by the Moſlems, that the Sultans of the Ottoman family gird their ſwords on at it on their acceſſion to the throne.

120
Turks defeated.

In the 54th year of the Hegira, the Arabs made an irruption into Bukharia, and defeated a Turkiſh army that oppoſed them. The Turks loſt a great number of men; and the queen, who commanded in perſon, with great difficulty made her eſcape. She had only time to put on one of her buſkins; the other fell into the hands of the Arabs, who valued it at no leſs than 2000 dinars. About this time alſo, according to the Greek hiſtorians, a treaty was concluded between the emperor and the Moſlems, whereby the latter were allowed to keep the territories they had ſeized; in conſideration of which they were to pay 3000 pounds weight of gold, 50 ſlaves, and as many choice horſes. To theſe diſhonourable conditions they were obliged to ſubmit, in conſequence of their late unſucceſsful expedition to Conſtantinople, and ſome other defeats they had received. This peace was to continue for 30 years. The next year, Moawiyah, having conferred the government of Khoraſan upon Saad, Othman's grandſon, that general, ſoon after his promotion, paſſed the Jihun, or Amu, the Oxus of the ancients, and advanced with a body of troops to Samarkand, which opened its gates to him on his approach; ſoon after which he defeated an army of Uſbeck Tartars, and marced directly to Tarmud, or Tarmid, which alſo ſurrendered without oppoſition. The 57th year of the Hegira was remarkable for nothing but vaſt ſwarms of locuſts, which did incredible damage in Syria and Meſopotamia; and great diſcontents on account of the khalif's having nominated for his ſucceſſor his ſon Yezid, a perſon of ſcandalous life, and no way worthy of the throne. The 58th year of the Hegira was rendered remarkable by the death of Ayeſha, Mahomet's widow; and the 60th by that of Moawiyah, after having reigned, from Haſan's reſignation, nineteen years three months and five days; but concerning his age authors are not agreed. He was interred at Damaſcus, which was made the reſidence of the khalifs as long as the houſe of Ommiyah continued on the throne.

121
Moawiyah dies.

122
Succeeded by Yezid.

Yezid was proclaimed, in conſequence of his nomination, the ſame day his father died. His inaugura-

123
Hoſein and Abdallah refuſe to acknowledge him.

tion was performed on the new moon of the month Rajeb, correſponding to April 7th, 680. Immediately after his election, he wrote to Al Walid, governor of Medina, to ſeize Hoſein, the remaining ſon of Ali, and Abdallah Ebn Zobeir, in caſe they refuſed to acknowledge his right. He accordingly tendered the oath of allegiance to Hoſein, who returned an evaſive anſwer, and found means to eſcape to his own houſe. As for Abdallah, he delayed waiting upon the governor, under various pretences, for 24 hours; after which he made his eſcape to Mecca: hither Hoſein followed him; but received an invitation from the people of Cufa, who promiſed to aſſiſt him in vindicating the rights of his father Ali and himſelf. In the mean time, Yezid, being informed of Al Walid's negligence in ſuffering Abdallah and Hoſein to eſcape, removed him from his employment, appointing in his room Amru Ebn Saad, at that time commandant of Mecca. The new governor immediately diſpatched againſt Abdallah Amer Ebn Zobeir, Abdallah's, own brother, who mortally hated him: but Abdallah, having engaged Amer in the field, defeated and took him priſoner; which greatly raiſed his reputation at Medina, although Hoſein's ſuperior intereſt among them ſtill rendered him incapable of aſpiring to the khalifat by himſelf.

While Abdallah was thus ſtrengthening himſelf at Mecca and Medina, Hoſein was doing the ſame at Cufa. On the firſt notice of their inclinations, he had ſent to them Moſlem Ebn Okail, to whom, as repreſentative of the ſon of Ali, they had taken an oath of allegiance, and were now very preſſing on Hoſein to honour their city with his preſence. Beſides this, Hoſein was ſupported by the forces of Irak, who retained a great veneration for the memory of his father, and had all along conſidered the government of Moawiyah as a downright uſurpation.

Notwithſtanding all theſe ſteps taken at Cufa in favour of Hoſein, the deliberations of the conſpirators were carried on with ſuch ſecrecy, that Al Nooman the governor continued a ſtranger to them, even after the Cufans had determined immediately to enter upon action with an army of 18,000 men. At laſt, however, he began to be rouſed from his lethargy; but Yezid being diſpleaſed with his conduct, removed him from his government, appointing for his ſucceſſor Obeidallah Ebn Ziyad. This governor entered the city in the evening, and was received with all poſſible demonſtrations of joy by the Cufans, who miſtook him for Hoſein, owing to a black turban which he had on his head, reſembling that which Hoſein uſually wore. His firſt care was to extinguiſh the ſedition that had been excited by Moſlem. In order to this, he commanded a truſty ſervant to diſguiſe himſelf, and perſonate a ſtranger come out of Syria to ſee the inauguration of Hoſein; that he might get admiſſion into Moſlem's houſe, and penetrate all his councils. This commiſſion was faithfully executed; and Obeidallah underſtanding that Moſlem lodged in the houſe of one Sharik, who was then ſick, ſent a meſſenger to Sharik, letting him know that he intended to viſit him on a certain day. Sharik immediately came to a reſolution to receive him, and appointed Moſlem a place in the corner of the room whence he might ruſh out upon Obeidallah and kill him. The viſit was accordingly made; but Moſlem's heart failing him, the governor eſcaped: Hani, however, in whoſe houſe Moſlem had firſt lodged, was impriſoned by Obeidallah. Upon the news of this, Moſlem aſſembled about 4000 men, and beſieged Obeidallah in the caſtle. The governor, however, not in the leaſt diſpirited, made a ſpeech to Moſlem's followers; which had ſuch an effect upon them, that they all deſerted him except about 30. By the favour of the night, Moſlem eſcaped to a poor woman's cottage in the neighbourhood; but being betrayed by her ſon, Obeidallah ſent a datachment of 80 horſe to ſeize him. Moſlem made a gallant reſiſtance, and thrice cleared the houſe of them; but being at laſt overpowered with numbers, and grievouſly wounded, he was taken and brought to Cufa. While on the road, he endeavoured to ſend an account of his bad ſucceſs to Hoſein, then, as he ſuppoſed, on the road to Cufa; but without ſucceſs. When arrived at the caſtle he begged a draught of water: but thoſe who ſtood by told him he ſhould have none till he drank the hamim, or boiling liquor, which the Mahometans pretend is drunk by the damned in hell; and ſoon after this, being brought before the governor, he was beheaded along with Hani, and both their heads ſent as a preſent to Yezid.

124
Hoſein's obſtinacy.

Hoſein, in the mean time, was preparing to ſet out for Cufa, having received the moſt favourable advices from Moſlem, of whoſe fate he was ignorant, and who had ſent him a liſt of 140,000 men that were ready to obey his orders. This the wiſeſt of his friends repreſented as a deſperate enterprize, and intreated him to drop it, or at leaſt to defer his journey till he ſhould be better aſſured of ſucceſs: but Hoſein was deaf to all ſalutary counſel; nay, he could not, by the moſt earneſt intreaties, be prevailed upon to forbear taking his wives and children along with him. The conſequences of this obſtinacy may eaſily be imagined: Obeidallah diſpatched firſt 1000, and then 5000 men againſt him; with orders, however, not to offer any violence to him, provided he ſubmitted himſelf. To theſe terms the infatuated Hoſein would not agree: he offered indeed to return home, if Obeidallah would permit; but that not being granted, he deſperately engaged the troops of Obeidallah, and was after long reſiſtance cut in pieces with all his men. His head was brought to Obeidallah, who ſtruck it over the mouth with a ſtick, and treated it with great contempt. He was alſo inclined to have put his family to death; but probably feared an inſurrection, as the people of Cufa expreſſed great reſentment on account of Hoſein's death; nor was it at all agreeable to the khalif Yezid, who treated the family of the unfortunate Hoſein with the greateſt kindneſs.

125
He is defeated and killed.

This year, the 61ſt of the Hegira, Yezid appointed Salem Ebn Ziyad governor of Khoraſan; who, ſoon after entering upon the government, made an irruption into the Turkiſh territories. He took his wife along with him in this expedition, who was delivered of a child in the neighbourhood of Samarcand; on which occaſion ſhe is ſaid to have borrowed ſome jewels from the prince of Sogd's lady, which ſhe afterwards carried off with her. In the mean time Salem detached Mohalleb with a conſiderable body of troops to Khowarazm, the principal city of the Turks or Tartars in thoſe parts, from which he extorted the immenſe ſum of 50,000,000 pieces of money; from whence advancing to Samarcand, he forced the inhabitants of that city alſo to pay him an immenſe ſum; and then retired, with little loſs, into the province he governed.

126
Abdallah proclaimed khalif.

127
Yezid formally depoſed.

In the mean time Abdallah Ebn Zobier, finding himſelf, by the death of Hoſein, at the head of the partizans of the houſe of Haſhem, who were greatly oppreſſed by Yezid, began in earneſt to aſpire to the khalifat. As he had therefore never owned the authority of Yezid, he now openly declared againſt him, and was proclaimed khalif at Medina ſoon after the arrival of Hoſein's family in that place. Soon after his inauguration, to render himſelf the more popular, he expatiated on the circumſtances of Hoſein's death, which indeed were very tragical, and repreſented the Cufans as the moſt abandoned and perfidious villains upon earth. This went ſo well down with the citizens of Mecca and Medina, that they flocked to him in great numbers, ſo that he ſoon found himſelf at the head of a conſiderable force. The khalif Yezid being informed of his progreſs, ſwore he would have him in chains; and accordingly ſent a ſilver collar for him to Merwan, then governor of Medina: but the intereſt of Abdallah was now ſo ſtrong, that he laughed at the menaces both of the khalif and Merwan. Nay, the governor of Mecca, though he ſecretly hated him, thought it good policy, as matters then ſtood, to keep up a good underſtanding with Abdallah: but this coming to the ears of Yezid, he depoſed the governor; appointing in his place Walid Ebn Otbah, a man of known fidelity, and a bitter enemy of Abdallah. The new governor, therefore, immediately on his acceſſion, uſed all his art and ſkill to circumvent Abdallah; but to no purpoſe, as the latter was always on his guard. This conduct, however, giving him great diſguſt, as well as terrible apprehenſions, he wrote to the khalif, informing him that all the diſturbances were owing to the untractable diſpoſition of Walid; and that, if he would ſend a perſon of a different character, peace would ſoon be reſtored. This letter the khalif very injudiciouſly gave ear to, and diſmiſſed his faithful governor, appointing in his room one who was totally unqualified for that poſt. The people of Medina, now having freſh intelligence of Yezid's diſſolute manner of life, renounced their allegiance to him, and formally depoſed him in a very ſingular manner. After they had aſſembled in the moſque, about the pulpit there, one of them ſaid, “I lay aſide Yezid as I do this turbant,” and immediately threw his turbant on the ground. Another ſaid, “I put away Yezid as I do this ſhoe,” caſting away his ſhoe at the ſame time. Theſe examples being followed by others, there was a large heap of ſhoes and turbants almoſt inſtantly formed upon the ſpot. They then diſmiſſed Yezid's governor, and baniſhed from the city all the friends and dependents of the houſe of Ommiyah. Theſe, to the number of about 1000, took refuge in the houſe of Merwan Ebn Al Hakem, where they were ſo cloſely beſieged by Abdallah's party, that they found themſelves obliged to ſend to Yezid for immediate aſſiſtance; acquainting him, that if they were not ſuccoured, they muſt all inevitably periſh. The khalif, though he wondered that ſuch a number of men ſhould ſuffer themſelves to be ſo cooped up without making the leaſt reſiſtance, diſpatched Moſlem Ebn Okba to Medina, with a conſiderable body of troops, to quell the diſturbances. He ordered him to ſpare Ali the ſon of Hoſein and his family, as they had no hand at all in the diſturbances: then he was to ſummon the town of Medina to ſurrender for three days ſucceſſively; which if they refuſed, he was to take it by ſtorm, and give it up to be plundered by the ſoldiers for three whole days.

128
Medina taken and plundered by the khalif's forces.

The inhabitants of Medina being now ſenſible of their danger, ſuffered the friends of the houſe of Ommiyah to withdraw quietly out of the city; though, before they departed, a promiſe was extorted from them not to appear in arms againſt the reigning faction. Moſlem, in the mean time, advanced towards the city at the head of 5000 foot and 12,000 horſe; and having ſummoned it according to his inſtructions, upon its refuſal made the neceſſary preparations for an attack. The garriſon, however, for a conſiderable time, made a vigorous defence; but at laſt, moſt of the Anſars and principal officers being killed, the Arabs propoſed a capitulation. Moſlem, however, would hearken to no terms, and inſiſted on their ſurrendering at diſcretion; which being refuſed, he entered the city after a faint reſiſtance. Ali was treated with great reſpect; but all the men that had carried arms were put to the ſword, and Moſlem ſuffered his troops to raviſh 1000 women, and to pillage the city for three days ſucceſſively. Thoſe that eſcaped the ſlaughter he forced to acknowledge themſelves the ſlaves and vaſſals of Yezid. For this extreme ſeverity he was ſurnamed by the Arabs *Al Muſrif*, or *The Extravagant*, and ever after conſidered as an impious perſon, eſpecially as the prophet had declared that the wrath of God ſhould moſt certainly remain upon thoſe who ſacked or plundered the city of Medina.

129
Yezid dies.

After the reduction of Medina, Moſlem directed his courſe to Mecca, where Abdallah then reſided; but he died by the way, and the command of the troops devolved upon Hoſein Ebn Thamir Al Selwi. This general advanced to Mecca, which he beſieged for 40 days, battering the town with ſuch fury, that he beat down a great part of the famous temple there, and burnt the reſt; nor would the city itſelf have eſcaped the ſame fate, had not an end been put to the war by the arrival of certain accounts of the death of Yezid, who departed this life in the 64th year of the Hegira, anſwering to the year 684 of the Chriſtian æra, having lived 39, and reigned three years and ſix or eight months. On the news of his death, Hoſein offered to take the oath of allegiance to Abdallah; but the latter at that time durſt not truſt him, of which he had afterwards ſufficient reaſon to repent.

130
Moawiyah II. proclaimed khalif and reſigns.

Yezid was ſucceeded by his ſon Moawiyah II. who was proclaimed khalif at Damaſcus the ſame day that his father died; but being of a weakly conſtitution, and unable to bear the fatigues of government; reſigned the crown ſix weeks after his inauguration, and died ſoon after without naming a ſucceſſor.

This abdication having left the Moſlem empire abſolutely without a maſter, great commotions enſued. On the death of Yezid, Obeidallah Ebn Ziyad, governor of Baſrah, repreſented to the citizens that they ought to chooſe a protector till a new khalif ſhould be choſen; and if the perſon ſo choſen ſhould be diſagreeable

able to them, they might then remain in a ſtate of independency under the protector whom they had choſen. The inhabitants, perceiving the drift of this ſpeech, complimented him with that honour; which he accepted with ſeeming difficulty; but ſending a deputy to Cufa, the inhabitants of that city not only refuſed to acknowledge his authority, but threw duſt and gravel at his meſſenger. This coming to the ears of the people of Baſrah, they not only deprived Obeidallah of the dignity they had newly conferred upon him, but even expelled him the city. Nor could he prevail upon the Najari, a tribe of Anſars, to eſpouſe his quarrel, nor even upon his own relations, though he diſtributed among them great part of the ſixteen millions of pieces of money which he had found in the treaſury of Baſrah, and kept the remainder to himſelf. Nay, ſo odious had he rendered himſelf to all ranks, an account of his cruelties, particularly the death of Hoſein the ſon of Ali, that his brother Abdallah was unable to protect him from the fury of the populace, though he kept him concealed in womens clothes, and diſtributed among the mob 200,000 pieces of money. He was therefore at laſt conſtrained to leave the city, attended by a guard of 100 men. Immediately after his departure, the mob plundered his houſe, and purſued him, ſo that he was obliged to exchange his camel for an aſs, and thus with the utmoſt difficulty eſcaped into Syria.

131
Obeidallah forced to fly into Syria.

In the mean time, Hoſein Ebn Thamir, being returned into Syria with the forces under his command, gave a faithful account of the ſituation of affairs in Arabia to Merwan Ebn Al Hakem. He alſo acquainted him of the offer he had made to Abdallah of the oath of allegiance, which the latter had refuſed, or at leaſt would not come to Damaſcus in order to be inveſted with the ſupreme authority there. On this account he adviſed Merwan to take care of himſelf and the reſt of the houſe of Ommiyah, who had fled to Damaſcus after their expulſion from Medina. On this diſcourſe Merwan was inclined to ſubmit to Abdallah; but was diverted from it by Obeidallah, who inſiſted that no ſuperior ought to be acknowledged by Merwan, who was at the head of the Koreiſh. The people of Damaſcus had conſtituted Dahak Ebn Kais their protector, who inclined to Abdallah The Baſrans were at this juncture entirely in tumult and confuſion, not being able to agree about a protector after the expulſion of Obeidallah; ſo that at laſt they wrote to Abdallah, offering him the government of their territory. This he accepted, but could not be prevailed upon to ſtir from Mecca: nor could Merwan be perſuaded to ſuffer any of the Syrians to perform the pilgimage to Mecca, leſt they ſhould join Abdallah, and thereby contribute to his excluſion from the throne.

132
Merwan proclaimed khalif at Damaſcus.

In the midſt of this confuſion Abdallah might have eaſily ſecured the khalifat to himſelf, had he not with the utmoſt imprudence as well as inhumanity given orders for the extermination of the houſe of Ommiyah. This ruined his affairs; for they being now obliged to provide for their own ſafety, Merwan was proclaimed khalif at Damaſcus; and thus the whole Moſlem empire was rent into two potent factions, the one under Merwan, and the other under Abdallah.

We have already obſerved, that Dahak Ebn Kais inclined to favour Abdallah. This he continued to do after Merwan was proclaimed khalif, inſomuch that a battle ſoon enſued between his followers and thoſe of Merwan, in which Dahak was defeated and killed; and thus Merwan became maſter of all the province of Syria. Soon after this victory, Merwan advanced with a conſiderable body of troops towards Egypt; but ſent before him Amru Ebn Saad with a detachment, in order to facilitate his paſſage. That general having defeated Abdalrahman, Abdallah's lieutenant, in ſeveral briſk actions, he at laſt ſurrendered the whole country to Merwan for a ſum of money, and retired with the Arabs under his command to Hejaz. The Syrian troops, therefore, immediately took poſſeſſion of that country, and obliged the inhabitants to take an oath of allegiance to Merwan; who having appointed his ſon Abdalazziz to preſide over Egypt, returned with the greateſt part of his forces to Damaſcus. Here he was informed that Abdallah had diſpatched againſt him his brother Muſab with a conſiderable army. Againſt him Merwan diſpatched Amru Ebn Saad; who having ſoon come up with him, gave him a total defeat, and diſperſed his troops in ſuch a manner that Muſab found it impoſſible to rally them again.

133
Abdallah's forces defeated by Merwan.

134
The Cufans revolt.

In the 65th year of the Hegira, the inhabitants of Cufa, pretending to be ſeized with remorſe of conſcience for their treachery to Hoſein the ſon of Ali, raiſed an inſurrection againſt both the khalifs, and therefore aſſembled a body of 16,000 men, under the command of one Soliman, who was to revenge the death of Hoſein upon Obeidallah Ebn Ziyad and his adherents. But while Soliman and his troops remained yet inactive, Al Mockhtar, who had ſerved under Abdallah, and was diſguſted at not having been promoted as he expected, arrived at Cufa, and repreſenting the incapacity of Soliman, who indeed appears to have been totally unfit for ſuch an enterprize, offered to take the command upon himſelf. This, however, was refuſed; and as Al Mockhtar had no opinion of Soliman's military capacity, he found means to draw off 2000 of his troops; while 10,000 more choſe rather to violate the oaths they had taken, that run the riſk of being cut to pieces by a ſuperior enemy. Soliman, however, put a good face upon the matter; and, telling his troops that they were to fight for another world and not this, ſet forward to invade Syria with the 4000 who remained with him: but being advanced as far as Ekſas upon the Euphrates, he found that he had loſt 1000 men by deſertion; nor was he joined by the Separatiſts of Baſrah and Al Madayen, though they had promiſed him a reinforcement. Firmly perſuaded, however, that his cauſe was the cauſe of heaven, Soliman continued his march all night, and next day arrived at the tomb of Hoſein, where his men performed their devotions with ſuch enthuſiaſm of penitence, that one preſent ſwore he never ſaw ſuch crowding about the black ſtone in the temple of Mecca itſelf.—Continuing ſtill to advance, he received a friendly letter from Abdallah Ebn Yezid, the governor of Cufa, adviſing him to return, and repreſenting to him the folly of engaging ſo powerful an army as would be ſent againſt him, with an handful of men: but Soliman, imagining that he was only recalled in order to ſupport Abdallah Ebn Zobeir in his pretenſions to the khalfat, perſiſted in

135
Joined by Al Mockhtar.

136
Soliman's folly and enthuſiaſm.

137
He is cut in pieces with all his men

in his reſolution of penetrating into Syria. He told his troops, that they would never be nearer the two Hoſeins (Hoſein, and his brother Haſan, to whom alſo the Shiites give that name) than they were at preſent; and that ſhould they at this time meet with death, they would be in a ſtate of repentance, and conſequently could never die in a more proper time; and after this ſpeech, continuing ſtill to advance, he was at laſt met by Obeidallah at the head of 20,000 horſe, who, after an obſtinate engagement, cut to pieces Soliman and all his troops.

138
Merwin dies.

Soon after this deciſive action died the khalif Merwan, after he had reigned eleven months. He is ſaid by ſome authors to have been poiſoned by his wife Zeinab, Moawiyah's widow. Her he had married, with a promiſe that her ſon Khaled ſhould ſucceed him; but afterwards altering the ſucceſſion in favour of his own ſon Abdalmalec, young Khaled reproached him with his breach of promiſe: upon this Merwan calling him *baſtard*, the child complained to his mother, who, to be revenged for this affront, is ſaid to have poiſoned him, or ſmothered him in a pillow.

139
Narrow eſcape of the family of Ali.

In the beginning of the khalifat of Abdalmalec, Al Mokhtar, who had been impriſoned by the governor of Cufa, was releaſed at the interceſſion of Abdallah Ebn Omar, who had married his ſiſter. The year following, having put himſelf at the head of the Shiite ſectaries, he ſent propoſals of alliance to Abdallah Ebn Zobeir; but he, juſtly ſuſpecting his ſincerity, by a ſtratagem cut off near 3000 of his men. Upon this diſaſter, Al Mokhtar, fearing the houſe of Ali might be intimidated, ſent a letter to Mahomet Ebn Hanifyah, one of that family, in which he offered his aſſiſtance with a powerful army. This offer Mahomet declined, declaring himſelf only for pacific meaſures; but though he and all the reſt of Ali's family behaved in the moſt peaceable manner, Abdallah did not think himſelf ſafe till they owned his authority. He therefore impriſoned them, together with 17 of the principal citizens of Cufa, whom he threatened to put to death, and afterwards burn their bodies, if they did not within a limited time take an oath of allegiance to him. Al Mokhtar being informed of the diſtreſſed ſituation they were in, ſent a body of 750 horſe to Mecca, under Abu Abdallah, to releaſe them. That general not only executed his orders with great bravery, but took Abdallah himſelf priſoner, whom he would have cut to pieces on the ſpot, had he not been releaſed at the interceſſion of Mahomet, who for the preſent adjuſted the differences to the mutual ſatisfaction of all parties. After this reconciliation, Abu Abdallah, or rather Mahomet himſelf, diſtributed among 4000 of Ali's friends a ſum of money brought for that purpoſe, in order to indemnify them for the loſſes they had ſuſtained. Thus the friends of Ali were happily delivered, when only two days of time granted them by Abdallah remained, and a ſufficient quantity of wood and other combuſtibles was collected, in order to conſume their bodies. Notwithſtanding the reconciliation, however, that had lately taken place, Mahomet Ebn Hanifyah thought proper to poſt himſelf on a mountain near Mecca with a body of 4000 men.

140
Impiety of Al Mokhtar.

The Cufans having received advice before Merwan's death, that he had ſent Obeidallah with a powerful army towards their city, and even given him permiſſion to plunder it in caſe it ſhould be taken, appointed Yezid Ebn Ares, a man of undaunted courage, to oppoſe him; but Merwan dying before Obeidallah could execute his commiſſion, an end was put for the preſent to this expedition. The memory of it, however, ſtill remained; and Al Mokhtar, to whom Obeidallah was perſonally obnoxious, aſſembled a body of troops to act offenſively againſt him, and even againſt the Syrian khalif himſelf, in caſe he would ſupport Obeidallah. Among other preparations for their enterprize, Al Mokhtar cauſed a kind of portable throne to be made, telling his troops, that "it would be of the ſame uſe to them that the ark was to the children of Iſrael." It was therefore carried on a mule before the troops that were to march againſt Obeidallah, and the following prayer ſaid before it: "O God! grant that we may live long in thy obedience; help us; and do not forget us, but protect us." This expedient was ſo well adapted to the hot-headed enthuſiaſts who compoſed Al Mokhtar's army, that they attacked Obeidallah's camp, defeated him, and gained a complete victory. Obeidallah himſelf was killed in the action, his head ſent to Al Mockhtar, and his body reduced to aſhes.—By this victory the ſectaries were rendered ſo formidable, that Niſibin or Niſibis, and ſeveral other cities, ſurrendered to them without oppoſition. They now began to entertain thoughts of depoſing both the khalifs, and placing on the Moſlem throne one of the family of Ali; but all their towering hopes were ſoon fruſtrated by the defeat and death of Al Mokhtar by Muſab brother to Abdallah Ebn Zobeir. Al Mokhtar, after being defeated in a general engagement by Muſab, fled to the caſtle of Cufa, where he defended himſelf with great bravery for ſome time; but being at laſt killed, his men, to the number of 7000, ſurrendered at diſcretion, and were all of them put to the ſword on account of the outrages they had committed.

141
Obeidallah defeated and killed.

142
Al Mokhtar defeated and killed by Muſab.

143
Horrid cruelties committed by the Azarakites.

The next year, the 68th of the Hegira, the Azarakites, ſo denominated from Nafe Ebn Al Azarak, the author of their ſect, having aſſembled a conſiderable force, made an irruption into Irak. They advanced almoſt to the gates of Cufa, and penetrated to Al Madayen. Being ſworn enemies of the houſe of Ommiyah, and acknowledging no government ſpiritual or temporal, they committed terrible ravages in every part of the Moſlem territories through which they paſſed. They carried their exceſſes to ſuch a height as to murder all the people they met with, to rip open women with child, and commit every ſpecies of cruelty that could be invented upon the inhabitants without diſtinction. The governor of Mawſel and Meſopotamia, being informed of theſe unparalleled outrages, marched againſt them with a body of troops, and carried on a briſk war with them for eight months. During this period their leader Nafe Ebn Al Azarak died; and was ſucceeded by Katri Ebn Al Fojat, under whoſe conduct they continued their depredations. Muſab not being pleaſed with his lieutenant's management of the war, recalled him, and ſent in his place one Omar Ebn Abdallah Temimi, who gave the Azarakites a great overthrow at Naiſabur in Khoraſan, put many of them to the ſword, and purſued the reſt as far as Iſpahan and the province of Kerman. Here having received a reinforcement, they returned into the province of Ahwaz, and did incredible damage to the country through-

144
They are defeated and diſperſed.

through which they paſſed. But Omar advancing againſt them a ſecond time, they retired at his approach to Al Madayen, ravaging the diſtrict belonging to the city in a dreadful manner. However, Omar purſuing them thither alſo, they fled into the province of Kerman, and thence gradually diſperſed themſelves. This year there was a grievous famine in Syria, which ſuſpended all military operations.

145
Barbarity of Abdalmalec.

The next year, being the 69th of the Hegira, Abdalmalec left Damaſcus to march againſt Muſab. In his abſence he left Amru Eben Saad governor of the city; but he immediately ſeized upon it for himſelf, which obliged the khalif to return. After ſeveral ſkirmiſhes had happened between ſome detachments of the khalif's troops with thoſe of Amru, a pacification was concluded at the interceſſion of the women: but Abdalmalec barbarouſly put Amru to death with his own hand, notwithſtanding his promiſe; and was immediately ſeized with ſuch a tremor, that he loſt the uſe of almoſt all his faculties, and was obliged to be laid in bed. In the mean time the palace was attacked by Yahyah, Amru's brother, at the head of 1000 ſlaves. After a warm diſpute, they forced open the gates, killed ſeveral of the guards, and were upon the point of entering the palace, when the people within threw Amru's head among them. This ſo cooled their ardour, that they deſiſted from the attempt; and ſome money having been afterwards diſtributed among them, they retired. So great, however, was Abdalmalec's avarice, that after the tumult was appeaſed, he recalled all the money which had been diſtributed, and commanded it to be depoſited in the public treaſury.

146
Diſgraceful treaty with the Greeks.

In the 70th year of the Hegira, the Greeks made an irruption into Syria; and Abdalmalec having occaſion for all his forces to act againſt Abdallah Ebn Zobeir, was obliged to pay a tribute of 1000 dinars per day, according to Theophanes, and ſend every year 365 ſlaves and as many horſes to Conſtantinople. In this treaty it was alſo ſtipulated, that the revenues of Cyprus, Armenia, and Heria, ſhould be equally divided between the khalif and the Greek emperor.

147
Muſab defeated and killed by Abdalmalec.

Abdalmalec being now at leiſure to purſue his intended expedition againſt Muſab, marched againſt him in perſon; and having arrived at Maſken, a ſmall town on the frontiers of Meſopotamia, where he was waited for by Muſab, the latter was defeated through the treachery of the troops, and himſelf killed. After the battle, Abdalmalec repaired to Cufa, where he was received with the utmoſt ſubmiſſion; and people of all ranks came in crowds to take the oath of allegiance to him. He then ordered vaſt ſums of money to be diſtributed among them, and gave a ſplendid entertainment to his new ſubjects, to which even the meaneſt of them were not refuſed admittance. During this entertainment, the unfortunate Muſab's head was preſented to the khalif; upon which one of the company took occaſion to ſay to him, "I ſaw Hoſein's head in this ſame caſtle preſented to Obeidallah; Obeidallah's to Al Mokhtar; Al Mokhtar's to Muſab; and now at laſt Muſab's to yourſelf." This obſervation ſo affected the khalif, that, either to avert the ill omen, or from ſome other motive, he ordered the caſtle to be immediately demoliſhed. Abdallah Ebn Zobeir, in the mean time, having received the melancholy news of the defeat and death of his brother, aſſembled the people of Mecca, and from the pulpit made a ſpeech ſuitable to the occaſion. He alſo did his utmoſt to put Mecca in a proper poſture of defence, expecting a ſpeedy viſit from his formidable competitor, who now gave law to Irak, Syria, and Egypt, without controul.

148
Azarakites defeated.

Soon after Abdalmalec's return to Damaſcus, he appointed his brother Baſhar governor of Cufa; and Khaled Ebn Abdallah governor of Baſra. The latter had no ſooner entered upon his office, than he indiſcreetly removed from the command of the army Al Mohalleb, one of the greateſt generals of the age; appointing in his room Abdalaziz, who was greatly his inferior in military ſkill. Of this diſmiſſion the Azarakites being informed, they immediately attacked Abdalaziz, entirely defeated him, and took his wife priſoner. A diſpute ariſing among the victors about the price of that lady, one of them, to end it immediately cut off her head. Upon this diſaſter, Khaled was commanded to replace Al Mohalleb, which he did; and having in conjunction with him attacked the Azarakites, forced their camp, and entirely defeated them.

149
Mecca beſieged by Al Hejaj.

In the 72d year of the Hegira, Abdalmalec having no enemy to contend with but Abdallah Ebn Zobeir, made great preparations for an invaſion of Hejaz, giving the command of the army to be employed on this occaſion to Al Hejaj, one of his moſt warlike and eloquent captains. Before that general had put his army in march for Mecca, he offered his protection to all the Arabs there that would accept of it. Abdallah being informed of the enemy's approach, ſent out ſeveral parties of horſe to reconnoitre, and give him intelligence of their motions. Between theſe and ſome of Al Hejaj's advanced guards ſeveral ſkirmiſhes happened, in which Abdallah's men had generally the worſt. This encouraged Al Hejaj to ſend to the khalif for a reinforcement, his troops amounting to no more than 2000 men, who were inſufficient for reducing Mecca. He aſſured him at the ſame time, that Abdallah's fierceneſs was very much abated, and that his men deſerted to him daily. The khalif, upon this, ordered a reinforcement of 5000 men under the command of Tharik Ebn Amer; but notwithſtanding this additional ſtrength, he made but little progreſs in the ſiege for ſome time. While he battered the temple of Mecca with his machines, it thundered and lightened ſo dreadfully, that the Syrians were ſtruck with terror, and refuſed to play any longer upon that edifice. Upon this Al Hejaj ſtuck the corner of his veſt into his girdle, and putting into it one of the ſtones that was to be diſcharged out of the catapults, ſlang it into the town, and this occaſioned the recommencement of the operations. The next morning the Syrians were annoyed by freſh ſtorms, which killed 12 men, and quite diſpirited them. Al Hejaj, however, animated them, by obſerving that he was a ſon of Tehama; that this was the ſtorm of Tehama, and that their adverſaries ſuffered as much as they. The day following ſome of Abdallah's men were killed by a very violent ſtorm, which gave Al Hejaj a farther opportunity of animating his troops. At laſt, Abdallah having been deſerted by moſt of his friends, 10,000 of the inhabitants of Mecca, and even by his own ſons Hamza and Khobeib, deſired to know his mother's ſentiments as to what courſe he was to take. He repreſented to her, that he was almoſt entirely abandoned by his ſubjects and relations; that the few who perſiſted in their fidelity to him could ſcarce enable him to defend the city any longer; and that the Syrian khalif would grant him any terms he ſhould think fit to demand. His mother, however, being of an inflexible reſolution, and not able to bear the thoughts of ſeeing her ſon reduced to the rank of a private perſon, being herſelf the daughter of Abu Becr the firſt khalif, adviſed him by no means to ſurvive the ſovereignty, of which he was on the point of being deprived. This advice being agreeable to his own ſentiments, he reſolved to die in defence of the place. In purſuance of this reſolution, he defended the city, to the amazement of the beſiegers, for ten days, though deſtitute of arms, troops, and fortifications. At laſt, having taken a final leave of his mother, and being animated by deſpair, he made a ſally upon the enemy, deſtroyed a great number of them with his own hand, and was at length killed fighting valiantly upon the ſpot.

150 Abdallah killed.

At the laſt interview he had with his mother, ſhe is ſaid to have deſired him to put off a coat of mail he had on for his defence; and, in order to inſpire him with the greater fortitude, ſhe gave him a draught in which a whole pound of muſk had been infuſed. Al Hejaj ordered his head to be cut off, and his body to be affixed to a croſs; and by reaſon of the muſk he had drank, the body emitted a grateful odour for ſeveral days.

By the reduction of Mecca, and the death of Abdalla Ebn Zobeir, Abdalmalec remained ſole maſter of the Moſlem empire; but he ſuſtained a great loſs next year, in having an army of 100,000 men totally cut off by the Khazarians in Armenia. The governor, however, having marched in perſon againſt them at the head of only 40,000 men, but all choſen troops; penetrated into the heart of Armenia, defeated and diſperſed a large body of the Khazarians, drove them into their temples, and reduced them to aſhes.

151 Khazarians reduced.

One of his generals alſo defeated an army of 80,000 Khazarians at the Iron or Caſpian gates, and deſtroyed a great number of them, obliging the reſt to embrace the Mahometan religion.

152 Cruelty of Al Hejaj.

Al Hejaj, in conſequence of his ſervices, was made governor, firſt of Medina, and then of Irak, Khoraſan, and Sijiſtan; in all which places he behaved with the greateſt cruelty. Having entered the city of Cufa muffled up in his turbant, he was ſurrounded by crowds of people who preſſed forward to ſee him. He told them their curioſity would ſoon be gratified; which he effectually did, by aſcending the pulpit, and treating them in a very coarſe manner; ſwearing that he would make the wicked bear his own burden, and fit him with his own ſhoe; and telling them, among other things, that "he imagined he ſaw the *heads* of men ripe and ready to be gathered, and turbants and beards beſprinkled with blood." At Baſra he made a ſpeech much to the ſame purpoſe; and, to give the inhabitants a taſte of his diſcipline, cauſed one of them who had been informed againſt as a rebel to be beheaded on the ſpot without any trial. So great indeed was the abhorrence in which he was held by thoſe over whom he preſided, that having once recommended himſelf to the prayers of a religious Moſlem, the latter inſtantly prayed, that it would pleaſe God to kill Al Hejaj quickly; "for nothing, ſaid he, could be more advantageous for himſelf or the people." In conſequence of theſe cruelties, rebellions were ſoon raiſed againſt him; but they were eaſily ſuppreſſed, and Al Hejaj continued in the full enjoyment of all his employments till he died.

153 Saleh and Shebib rebel.

In the 76th year of the Hegira, one Saleh Ebn Marj, a hot-headed enthuſiaſt, and Shebib Ebn Zeid, a Kharejite, took up arms againſt the khalif. They had conſpired againſt him the year before when on a pilgrimage to Mecca; and Al Hejaj had been ordered to ſeize them; but at that time they found means to make their eſcape; and having now aſſembled about 120 men, Saleh was proclaimed emperor of the faithful at Daras in Meſopotamia. The governor ſoon received intelligence of their motions; and ordered a body of 500 men, under the command of one Adi, to march againſt them: but that general, being afraid to attack them notwithſtanding his ſuperiority in numbers, demanded a reinforcement. He therefore was ſupplied with 500 more troops, with which he advanced to Daras: but being ſtill afraid of the rebels, he entered into negociations with them; during which they attacked him, entirely defeated his army, and made themſelves maſters of his camp.

154 Their bravery.

Upon this the governor ſent a detachment of 1500 horſe againſt them; but the rebels, notwithſtanding the ſmallneſs of their number, defended themſelves in ſuch a manner, that the khalif's troops were forced to diſmount and fight on foot. The engagement continued till night; when the rebels, finding themſelves unable to contend with ſuch numbers, retired to Mawſel. After this, Al Hejaj being informed that they had taken poſt at Daſcara, ſent againſt them an army of 5000 men. The rebels, hearing of this formidable army, abandoned their camp; but were ſo cloſely purſued, that they found themſelves obliged to ſtand an engagement at Modbaj, a ſmall village on the Tigris. Saleh's forces, conſiſting only of three companies of 30 men each, were ſoon thrown into diſorder, and himſelf killed: but Shebib made an excellent retreat to a neighbouring caſtle; from whence he ſallied out at midnight on the khalif's forces, penetrated to the very heart of the camp, where he wounded the general himſelf, and diſperſed the greateſt part of his army.

155 Saleh killed

156 Al Hejaj defeated by Shebib.

After this victory, the rebels became terrible even to Al Hejaj himſelf, whom they afterwards defeated in ſeveral engagements; and taking advantage of his being at Baſra, made themſelves maſters of Cufa with little oppoſition. Al Hejaj was now conſtrained to write to the khalif for a ſtrong detachment of the Syrian troops, with which he advanced againſt Shebib; whoſe army bearing no proportion to that of Al Hejaj, the former was totally defeated, had his wife's brother killed in the action, and was obliged to fly into Kerman. Having refreſhed his men in this province, he again advanced to Ahwaz, where he was met by one of Al Hejaj's generals at the head of the Syrian army. Shebib defended himſelf with incredible valour, and ſeveral times repulſed the khalif's forces; but being overpowered by numbers, as his army conſiſted of no more than 600 men, he was at laſt put to flight, and in paſſing a bridge, was thrown off by his horſe and drowned.

157 Shebib's valour and death.

His body was drawn up by a net, and the head ſent to Al Hejaj, who was not a little pleaſed at the ſight. After his death, the rebels quarrelled among themſelves, ſo that the khalif's troops cut off the greateſt part of them. The remainder, under Katri Ebn Fojat, fled to Tabreſtan. Here they were kindly received by Aſhid the king, who had aſſigned them part of his territories for their habitation. But they

158 Ingratitude of the rebels.

had not been long ſettled before they inſiſted upon Aſhid's either embracing Mahometaniſm, or paying them an annual tribute; which he refuſing, they drove him into Irak, where he implored the khalif's protection. Aſhid afterwards conducted a body of Moſlem troops into Tabreſtan; where they fell upon the rebels with

159 They are all deſtroyed.

ſuch fury, that they killed Katri himſelf, cut a great number of his men to pieces, and took all the reſt priſoners.

This year alſo (the 76th of the Hegira) money was firſt coined in Arabia. Before this time, the dinars, or gold coins, had Greek inſcriptions; and the dirhems, or ſilver ones, Perſic inſcriptions. The firſt erection of a mint in Arabia was occaſioned by the following accident. Abdalmalec added to the letters he wrote to the Greek emperor this ſhort paſſage of the Koran, "Say God is one;" or "Say, there is one God;" and then inſerted the year of the Hegira, with the name of the prophet, in ſuch a manner as gave the emperor great offence. Upon this he wrote to Abdalmalec, deſiring him to alter that manner of writing, or he would ſend him ſome coins in which the name of Mahomet ſhould be mentioned in ſuch a manner as

160 Money firſt coined in Arabia.

would not prove very agreeable. Abdalmalec now reſolved to coin money of his own; and accordingly ſome dirhems were this year ſtamped by Al Hejaj, with the inſcription *Alla Samad*, "God is eternal;" which gave great offence to the ſuperſtitious Moſlems, as they imagined that the name of God would be thereby profaned by the touch of unclean perſons.

In the 77th year of the Hegira, the Arabs made an incurſion into the imperial territories, and had Lazica and Bernucium betrayed to them; and the next year

161 Carthage demoliſhed

they made themſelves maſters of Africa Propria, demoliſhing the city of Carthage ſo effectually, that ſcarce a veſtige of it was left. They were ſoon driven out, however, by John the Patrician, a man of great valour and experience in war; but returning with a ſuperior force, they obliged John in his turn to fly to Conſtantinople.

The 79th year of the Hegira is remarkable for nothing but the rebellion of Abdalrahman in Perſia; who drove the Khakan, or emperor of the Turks, Tartars, or Moguls, out of that country: but the following year, one of the Greek generals named *Heraclius* penetrated into Syria as far as Samoſata, and deſtroyed

162 200,000 Arabs deſtroyed by Heraclius.

200,000 Arabs, ravaging the country in a terrible manner; and Abdalrahman was defeated and killed by Al Hejaj, after a great number of engagements, ſome ſay 81, and others 100. In the 83d year of the Hegira, the nobility of Armenia revolting, drove the Arabs out of that province; but Mahomet, one of the khalif's generals, entering the country with a powerful army, got the authors of the revolt into his hands, and cauſed them all to be burnt alive. Encouraged by this ſucceſs, the Moſlems invaded Cilicia under one Azar; but were, to the number of 10,000, cut in pieces by Heraclius; and the next year, having again entered that country, 12,000 of them were deſtroyed by the ſame general, and the reſt forced to fly into their own country.

163 Abdalmalec dies.

In the 86th year of the Hegira died the khalif Abdalmalec, after a reign of 21 years. He is ſaid to have had ſuch a ſtinking breath, that the flies which accidentally ſettled on his lips were almoſt inſtantly ſtruck dead by it. He was ſucceeded by Al Walid, who greatly extended the Moſlem dominions. The firſt year of his reign, one of his generals having paſſed the Oxus (now the Jihum), defeated a numerous army of Turks and Tartars. He then over-ran and entirely reduced the countries of Sogd or Sogdiana, Bagraſs, Shaſh, Targana, and the whole immenſe tract going under the name of Mawaralnahr, or Great Buckharia.

164 Prodigious conqueſts of the Moſlems.

He alſo conquered the khan of Khowarazm, obliging him to pay an annual tribute of two millions of dinars. About the ſame time another general called *Mahomet* made an irruption into India, and ſubdued a conſiderable part of that country. He alſo entirely ſubdued the kingdom of Al Sind, lying between Perſia and India. In this expedition, Derar king of Al Sind was defeated and killed, and had his head cut off by Mahomet.

In the 90th year of the Hegira, the Moſlems made an irruption into Capadocia, defeated the emperor's army who oppoſed them, and took the city of Tyana. The next year they made another incurſion into the imperial territories, whence they carried off vaſt numbers of ſlaves; and the year following one Othman penetrated into the heart of Cilicia, where he made himſelf maſter of ſeveral cities, but does not appear to have long kept his conqueſts.

165 They make a deſcent on Spain.

In the 93d year of the Hegira, anſwering to that of Chriſt 712, Tarek Ebn Zarka made a deſcent into Spain, defeated Roderic the laſt king of the Goths, reduced the city of Toledo, and over-ran a conſiderable part of the kingdom. Being afterwards joined by Muſa, commander of the African Moſlems, the two generals made themſelves maſters of moſt of the fortreſſes, ſubjugating in a manner the whole country, and obliging it to pay tribute to the khalif.

166 And over-run the whole country.

In theſe expeditions the Moſlems acquired ſpoils of immenſe value; and, amongſt other things, an exceeding rich table, called by the Arab writers "the table of Solomon the ſon of David." According to theſe writers, this table conſiſted entirely of gold and ſilver, and was adorned with three borders of pearls; but Roderic of Toledo, a Spaniſh hiſtorian, ſays it conſiſted of one entire ſtone, of a green colour, and of an immenſe ſize, being no leſs than 365 feet. He adds, that it was found in a certain village or town, near the mountain called in his days *Jibal Soliman*, or "the mountain of Solomon."

After Muſa and Tarik had committed dreadful depredations in Spain, they were both recalled by the khalif; but the next year, Tarik having undertaken another expedition into the ſame country, landed a body of 12,000 men at Gibraltar, with which he plundered the whole province of Bætica, and over-ran the greateſt part of Luſitania. Roderic hearing of theſe depredations, ſent againſt him an army of raw undiſciplined troops, who were eaſily defeated, and moſt of them left dead on the ſpot; which ſo animated the Arab commander, that he reſolved not to lay down his arms till he had made an abſolute conqueſt of Spain. About the ſame time that Tarif made ſuch progreſs in Spain, another Moſlem general entered Piſidia with a powerful army, took the city of Antioch, and, after having ravaged the country, retired into the khalif's territories with very little loſs.

167 Al Hejaj dies.

In the 95th year of the Hegira died Al Hejaj governor of Irak, &c. after he had preſided over that country 20 years. He exerciſed ſuch cruelties upon thoſe who were in ſubjection to him, that he is ſaid to have killed 120,000 men, and to have ſuffered 50,000 men and 30,000 women to periſh in priſon. To excuſe this cruelty, he uſed frequently to ſay, That a ſevere, or even violent government, is better than one too weak and indulgent; as the firſt only hurts particular perſons, but the latter the whole community. This year alſo the Arabs gained a complete victory in Spain over Roderic king of the Goths, who periſhed in the action. In this campaign, Tarif poſſeſſed himſelf of immenſe treaſures; by which means he was enabled to reward not only his officers, but common ſoldiers alſo. In the eaſtern parts of the world alſo, the Arabs were this year very formidable; Moſlema, an Arab general, having entered the imperial territories, ravaged the whole province of Galatia, carrying off with him many rich ſpoils, and a vaſt number of priſoners. The Greek emperor, hearing that Al Walid deſigned to attack him both by ſea and land, ſent ſome of his nobles to treat of a peace; and, among other things, deſired them to bring him a particular account of the force with which the khalif deſigned to invade the Greek empire. This they repreſented as ſo terrible, that it would be next to impoſſible to oppoſe it. The emperor therefore cauſed a great number of light ſhips to be built, the walls to be repaired, and ordered ſuch of the citizens as had not laid up proviſions for three years to depart the city. Al Walid, in the mean time, continued his warlike preparations with the utmoſt vigour, being determined to make himſelf maſter of Conſtantinople in a ſingle campaign.

168 Al Walid dies, and is ſucceeded by Soliman.

In the 96th year of the Hegira died the khalif Al Walid, and was ſucceeded by his brother Soliman. This year the Moſlem conqueſts on the eaſt ſide were increaſed by the reduction of Tabreſtan and Jurgan or Georgiana. In Spain, alſo, the city of Toledo which had revolted was reduced, and Cæſar-Auguſta, now Saragoſſa, as well as ſeveral others.

169 Conſtantinople unſucceſsfully beſieged.

The next year Moſlema ſet out for Conſtantinople, which he beſieged without ſucceſs till the 99th year of the Hegira; at which time he was obliged to return, after having loſt before it 120,000 men. The ſoldiers were reduced to the greateſt extremities of hunger, being forced to live upon hides, the roots and bark of trees, the moſt noiſome animals, and even the dead bodies of their companions.

170 Death of Soliman.

This year alſo (the 99th of the Hegira) is remarkable for the death of the khalif Soliman. According to ſome, he was poiſoned by Yezid his brother, governor of Perſia, who was diſpleaſed with his having appointed his couſin-german, Omar Ebn Abdalaziz as his ſucceſſor, to the excluſion of himſelf. According to others, he died of an indigeſtion; which is not greatly to be wondered at, if, as thoſe authors ſay, he uſed to devour 100 pounds weight of meat every day, and dine very heartily after eating three lambs roaſted for breakfaſt. In the latter part of his reign, the Moſlems were by no means ſucceſsful in Spain; the kingdom of Navarre being founded at this time by Pelagius, or Pelayo, whom the Arabs were never able to reduce.

The new khalif Omar Ebn Abdalaziz was by no means of a martial character; but is ſaid to have been very pious, and poſſeſſed of very amiable qualities. He ſuppreſſed the uſual malediction, which was ſolemnly pronounced by the khalifs of the houſe of Ommiyah againſt the houſe of Ali; and always ſhowed great kindneſs to the latter.

171 New khalif poiſoned.

He was poiſoned by Yezid, after a ſhort reign of two years and five months. It is related, as an inſtance of this khalif's humility, that when Moſlema viſited him in his laſt ſickneſs occaſioned by the poiſon, he lay upon a bed of palm-tree leaves, ſupported by a pillow formed of beaſts ſkins, and covered with an ordinary garment. He had alſo on a dirty ſhirt; for which Moſlema blamed his ſiſter Fatima, Omar's wife; but ſhe excuſed herſelf by telling him, that the emperor of the faithful had not another ſhirt to put on.

Concerning Yezid the ſucceſſor of Omar, we find very little worth mentioning. He did not long enjoy the dignity he had ſo iniquitouſly purchaſed, dying after a reign of little more than four years. He died of grief for a favourite concubine named *Hababah*, who was accidentally choked by a large grape which ſtuck in her throat.

Yezid was ſucceeded by his brother Heſham, who aſcended the throne in the 105th year of the Hegira. In the ſecond and third year of his reign, ſeveral incurſions were made into the imperial territories, but generally without ſucceſs.

172 The Turks defeated.

In the 109th year of the Hegira, Moſlema drove the Turks out of Armenia and Aderbijan, and again confined them within the Caſpian gates. The next year he obliged them to take an oath that they would keep their own country; but this they ſoon violated, and were again driven back by Moſlema.

173 France invaded by the Arabs.

About this time alſo the Arabs, having paſſed the Pyrenees, invaded France to the number of 400,000, including women and ſlaves, under the command of one Abdalrahman. Having advanced to Arles upon the Rhone, they defeated a large body of French that oppoſed them; and having alſo defeated Count Eudo, they purſued him through ſeveral provinces, waſted the whole country with fire and ſword, making themſelves maſters of the city of Tours, moſt of which they reduced to aſhes.

174 They are utterly defeated by Charles Martel.

Here, however, a ſtop was put to their devaſtations by Charles Martel; who, coming up with them near the above-mentioned city, engaged them for ſeven days together, and at laſt gave them a total overthrow. The French general made himſelf maſter of all their baggage and riches; and Abdalrahman, with the ſhattered remains of his army, reached the frontiers of Spain with the utmoſt difficulty. The following year alſo, according to ſome hiſtorians, the Arabs were overthrown at Illiberis, ſcarce any of them making their eſcape. To make amends for this bad fortune, however, the khalif's arms were ſucceſsful againſt the Turks, who had again invaded ſome of the eaſtern provinces.

In the 125th year of the Hegira died the khalif Heſham, after a reign of 19 years ſeven months and eleven days. He was ſucceeded by Al Walid II. who is repreſented as a man of a moſt diſſolute life, and was aſſaſſinated the following year, on account of his profeſſing *Zendiciſm*, a ſpecies of infidelity nearly reſembling Sadduciſm. He was ſucceeded by Yezid the ſon of Al Walid I. who died of the plague after a reign of ſix months; and was ſucceeded by Ibrahim Ebn Al Walid, an imprudent and ſtupid prince. He was depo-

175 Reign of Merwan. ſed in the 127th year of the Hegira by Merwan Ebn Mahomet, the governor of Meſopotamia; who gave out as an excuſe for his revolt, that he intended to revenge the murder of the khalif Al Walid II. He was no ſooner ſeated on the throne, than the people of Hems rebelled againſt him. Againſt them the khalif marched with a powerful army; and aſking them what could excite them to this rebellion, ſummoned them to ſurrender. They aſſured him that they were diſpoſed to admit him into their city; and, accordingly, one of the gates being opened, Merwan entered with about 300 of his troops. The men that entered with him were immediately put to the ſword; and the khalif himſelf eſcaped with great difficulty. However, he afterwards defeated them in a pitched battle, put a great number of them to the ſword, diſmantled the city, and crucified 600 of the principal authors of the revolt.

This, however, was far from quieting the commotions in different parts of the empire. The inhabitants of Damaſcus ſoon followed the example of thoſe of Hems, and depoſed the khalif's governor; but Merwan, immediately after the extinction of the former rebellion, marched to Damaſcus with great celerity, entered the city by force, and brought to condign puniſhment the authors of the revolt. Peace, however, was no ſooner eſtabliſhed at Damaſcus, than Soliman Ebn Heſham ſet up for himſelf at Baſra, where he was proclaimed khalif by the inhabitants. Here he aſſembled an army of 10,000 men, with whom he marched to Kinniſſin, where he was joined by vaſt numbers of Syrians who flocked to him from all parts. Merwan, receiving advice of Soliman's rapid progreſs, marched againſt him with all the forces he could aſſemble, and entirely defeated him. In this engagement Soliman loſt 30,000 men, ſo that he was obliged to fly to Hems, where 900 men took an oath to ſtand by him to the laſt. Having ventured, however, to attack the khalif's forces a ſecond time, he was defeated, and again forced to fly to Hems. But being cloſely purſued by Merwan, he conſtituted his brother Saad governor of the city, leaving with him the ſhattered remains of his troops, and himſelf fled to Tadmor. Soon after his departure Merwan appeared before the town, which he beſieged for ſeven months; during which time he battered it inceſſantly with 80 catapults. The citizens being reduced to the laſt extremity, ſurrendered, and delivered Saad into the khalif's hands. In conſideration of this ſubmiſſion, Merwan pardoned the rebels, and took them all under his protection. About the ſame time, another pretender to the khalifat appeared at Cufa; but Merwan took his meaſures ſo well, that he extinguiſhed this rebellion before it could come to any height.

176 A party formed againſt him in Khoraſan. Notwithſtanding the ſucceſs, however, that had hitherto attended Merwan, a ſtrong party was formed againſt him in Khoraſan by the houſe of Al Abbas. The firſt of that houſe that made any conſiderable figure was named *Mahomet*, who flouriſhed in the reign of Omar Ebn Abdalaziz. He was appointed chief of the houſe of Al Abbas, about the 100th year of the Hegira; and is ſaid to have propheſied, that after his death, one of his ſons named *Ibrahim* ſhould preſide over them till he was killed, and that his other ſon Abdallah ſurnamed *Abul Abbas Al Saffah*, ſhould be khalif, and exterminate the houſe of Ommiyah. Upon this Al Saffah was introduced as the future ſovereign, and thoſe preſent kiſſed his hands and feet.

After the deceaſe of Mahomet, his ſon Ibrahim nominated as his repreſentative in Khoraſan one Abu Moſlem, a youth of 19 years of age; who beginning to raiſe forces in that province, Merwan diſpatched againſt him a body of horſe under the command of Naſr Ebn Sayer: but that general was entirely defeated by Abu Moſlem, and the greateſt part of his men killed. 177 Merwan's forces defeated. The next year (the 128th of the Hegira) Merwan made vaſt preparations to oppoſe Abu Moſlem, who after the late victory began to grow formidable to ſeveral parts of the empire. According to ſome authors, Merwan gained two victories over ſome of Ibrahim's generals: but the year following, Abu Moſlem brought ſuch a formidable army into the field, that the khalif's troops could not make head againſt them; his officers in Khoraſan therefore were obliged either to take an oath of allegiance to Ibrahim, or to quit the province within a limited time.

In the 130th year of the Hegira, the khalif's general Naſr having drawn together another army, was again defeated by Kahtaba another of Ibrahim's generals, and forced to fly to Raya, a town of Dylam, according to ſome, or of Khoraſan, according to others. 178 Ibrahim put to death. The next year Ibrahim, having fooliſhly taken it into his head to go on a pilgrimage to Mecca, attended by a numerous retinue ſplendidly accoutred, was ſeized and put to death by Merwan; and the year following Abul Abbas was proclaimed khalif at Cufa. As ſoon as the ceremony was ended, he ſent his uncle Abdallah with a powerful army to attack Merwan's forces that were encamped near Tubar, at a ſmall diſtance from Moſul, where that khalif was then waiting for an account of the ſucceſs of his troops under Yezid governor of Irak againſt Khatahba, one of Al Saffah's generals. Khatahba receiving advice of Yezid's approach, immediately advanced againſt him, and entirely defeated him; but in croſſing the Euphrates, the waters of which were greatly ſwelled, he was carried away by the current and drowned. The purſuit, however, was continued by his ſon Hamid, who diſperſed the fugitives in ſuch a manner that they could never afterwards be rallied. 179 Merwan himſelf defeated, At the news of this diſaſter, Merwan was at firſt greatly diſpirited; but ſoon recovering himſelf, he advanced to meet Abdallah. In the beginning of the battle, the khalif happened to diſmount; and his troops perceiving their ſovereign's horſe without his rider, concluded that he was killed, and therefore immediately fled; nor was it in the power of the khalif himſelf to rally them again, ſo that he was forced to fly to Damaſcus: but the inhabitants of that city, ſeeing his condition deſperate, ſhut their gates againſt him, 180 And killed. Upon this he fled to Egypt, where he maintained himſelf for ſome time; but was at laſt attacked and killed by Saleh, Abdallah's brother, in a town of Thebair, called *Buſir Kurides*. The citizens of Damaſcus, tho' they had ſhamefully deſerted Merwan, refuſed to open their gates to the victors; upon which Saleh entered the city by force, and gave it up to be plundered for three days by his ſoldiers.

By the total defeat and death of Merwan, Al Saffah remained ſole maſter of the Moſlem throne; but we hear of no very remarkable events that happened during his reign: only that he maſſacred great numbers of the partizans of the houſe of Ommiyah; and that Conſtantine Copronymus, taking advantage of the inteſtine diviſions among the Moſlems, ravaged Syria. The khalif died of the ſmall-pox in the 136th year of the Hegira, in the 33d year of his age; and was ſucceeded by his brother Al Manſur.

181
Reign of Al Manſur.

In the beginning of Al Manſur's reign, hoſtilities continued againſt the houſe of Ommiyah, who ſtill made reſiſtance, but were always defeated. Abdallah, however, the khalif's uncle, cauſed himſelf to be proclaimed khalif at Damaſcus; and having aſſembled a powerful army in Arabia, Syria, and Meſopotamia, advanced with great expedition to the banks of the Maſius near Niſibus, where he encamped. Al Manſur, being informed of this rebellion, diſpatched Abu Moſlem againſt Abdallah. This general, having haraſſed him for five months together, at laſt brought him to a general action; and having entirely defeated him, forced him to fly to Baſra.

182
He murders Abu Moſlem.

Notwithſtanding all his ſervices, however, Abu Moſlem was ſoon after ungratefully and barbarouſly murdered by Al Manſur, on ſome ridiculous pretences of being deficient in reſpect towards him.

After the death of Abu Moſlem, one Sinan a Magian, or adorer of fire, having made himſelf maſter of that general's treaſures, revolted againſt the khalif; but he was ſoon defeated by Jamhur Ebn Morad, who had been ſent againſt him with a powerful army. In this expedition Jamhur having acquired immenſe riches, the covetous diſpoſition of the khalif prompted him to ſend a perſon expreſs to the army to ſeize upon all the wealth. This ſo provoked Jamhur, that he immediately turned his arms againſt his maſter; but was ſoon defeated, and entirely reduced.

183
Abdalrahman proclaimed khalif in Spain.

The following year (the 139th of the Hegira), one Abdalrahman, of the houſe of Ommiyah, after the entire ruin of that family in Aſia, arrived in Spain, where he was acknowledged khalif; nor did he or his deſcendants ever afterwards own ſubjection to the Arabian khalifs.

184
Attempt to aſſaſſinate the khalif.

The 140th year of the Hegira is remarkable for an attempt to aſſaſſinate the khalif. This attempt was made by the Rawandians; an impious ſect, who held the doctrine of metempſychoſis or tranſmigration.—They firſt offered Al Manſur divine honours, by going in proceſſion round his palace, as the Moſlems were wont to do round the Caab; but the khalif, highly incenſed at this impiety, ordered 100 of the principal of them to be impriſoned. Theſe however were ſoon releaſed by their companions; who then went in a body to the palace with an intention to murder their ſovereign: but he being a perſon of uncommon bravery, though he was ſurpriſed with very few attendants, mounted a mule, and advanced towards the mutineers with an intention to ſell his life as dear as poſſible. In the mean time, Maan Ebn Zaidat, one of the chiefs of the Ommiyan faction, who had concealed himſelf in order to avoid the khalif's reſentment, ſallied out of his retreat, and putting himſelf at the head of Al Manſur's attendants, charged the rebels with ſuch fury, that he entirely defeated them. This generoſity of Maan was ſo remarkable, that it afterwards paſſed into a proverb. On this occaſion 6000 of the Rawandians were killed on the ſpot, and the khalif delivered from inſtant death: he was, however, ſo much diſguſted with the Arabs on account of this attempt, that he reſolved to remove the capital of his empire out of their peninſula; and accordingly founded a new city on the banks of the Tigris, which from that time to this has been known by the name of *Bagdad*. The foundations of it were laid in the 145th year of the Hegira, and finiſhed four years after.

185
He removes the ſeat of empire to Bagdad.

On the removal of the ſeat of government to Bagdad, the peninſula of the Arabs ſeems all at once to have loſt its conſequence, and in a ſhort time the inhabitants ſeem even to have detached themſelves from the juriſdiction of the khalifs: for in the 156th year of the Hegira, while Al Manſur was yet living, they made irruptions into Syria and Meſopotamia, as if they had deſigned to conquer theſe countries over again for themſelves; and though the Arabs, properly ſo called, continued nominally ſubject to the khalifs of Bagdad till the abolition of the khalifat by Hulaku the Tartar, yet they did not become ſubject to him when he became maſter of that city. There is even the ſtrongeſt reaſon to believe that the Arabs (i. e. the inhabitants of the peninſula properly called *Arabia*) have remained independent, not only of Hulaku, but of every other conqueror that the world hath yet produced.

Gibbon's Hiſt. vol. v. p. 178.

186
National independence of the Arabs.

The perpetual independence of the Arabs, indeed, "has been the theme of praiſe among ſtrangers and natives. The kingdom of Yemen it is true, has been ſucceſſively ſubdued by the Abyſſinians, the Perſians, the ſultans of Egypt, and the Turks; the holy cities of Mecca and Medina have repeatedly bowed under a Scythian tyrant; and the Roman province of Arabia embraced the peculiar wilderneſs in which Iſmael and his ſons muſt have pitched their tents in the face of their brethren. Yet theſe exceptions are temporary or local; the body of the nation has eſcaped the yoke of the moſt powerful monarchies: the arms of Seſoſtris and Cyrus, of Pompey and Trajan, could never atchieve the conqueſt of Arabia; the preſent ſovereign of the Turks may exerciſe a ſhadow of juriſdiction, but his pride is reduced to ſolicit the friendſhip of a people whom it is dangerous to provoke and fruitleſs to attack. The obvious cauſes of their freedom are inſcribed on the character and country of the Arabs. Many ages before Mahomet, their intrepid valour had been ſeverely felt by their neighbours in offenſive and defenſive war. The patient and active virtues of a ſoldier are inſenſibly nurſed in the habits and diſcipline of a paſtoral life. The care of the ſheep and camels is abandoned to the women of the tribe; but the martial youth, under the banner of the emir, is ever on horſeback, and in the field, to practice the exerciſe of the bow, the javelin, and the ſcymetar. The long memory of their independence is the firmeſt pledge of its perpetuity; and ſucceeding generations are animated to prove their deſcent and to maintain their inheritance. Their domeſtic feuds are ſuſpended on the approach of a common enemy; and in their laſt hoſtilities againſt the Turks, the caravan of Mecca was attacked and pillaged by fourſcore thouſand of the confederates. When they advance to battle, the hope of victory is in the front; and in the rear, the aſſurance of a retreat. Their horſes and camels, who in eight or ten days can perform a march of four or five hundred miles, diſappear before the conqueror; the ſecret waters of the deſart elude his ſearch; and his victorious troops are conſumed with thirſt, hunger and fatigue, in the purſuit of an inviſible foe, who ſcorns his efforts, and ſafely repoſes in the heart of the burning ſolitude. The arms and deſarts of the Bedoweens are not only the ſafeguards of their own freedom, but the barriers alſo of the Happy Arabia, whoſe inhabitants, remote from war, are enervated by the luxury of the ſoil and climate. The legions of Auguſtus melted away in diſeaſe and laſſitude; and it is only by a naval power that the reduction of Yemen has been ſucceſsfully attempted. When Mahomet erected his holy ſtandard, that kingdom was a province of the Perſian empire; yet ſeven princes of the Homerites ſtill reigned in the mountains; and the vicegerent of Choſroes was tempted to forget his diſtant country and his unfortunate maſter. The hiſtorians of the age of Juſtinian repreſent the ſtate of the independent Arabs, who were divided by intereſt or affection in the long quarrel of the Eaſt: the tribe of Gaſſan was allowed to encamp on the Syrian territory: the princes of Hira were permitted to form a city about forty miles to the ſouthward of the ruins of Babylon. Their ſervice in the field was ſpeedy and vigorous; but their friendſhip was venal, their faith inconſtant, their enmity capricious: it was an eaſier taſk to excite than to diſarm theſe roving barbarians; and, in the familiar intercourſe of war, they learned to ſee, and to deſpiſe, the ſplendid weakneſs both of Rome and Perſia. From Mecca to the Euphrates, the Arabian tribes were confounded by the Greeks and Latins, under the general appellation of Saracens; a name which every Chriſtian mouth has been taught to pronounce with terror and abhorrence.

187 Their domeſtic freedom and character.

"The ſlaves of domeſtic tyranny may vainly exult in their national independence; but the Arab is perſonally free; and he enjoys, in ſome degree, the benefits of ſociety, without forfeiting the prerogatives of nature. In every tribe ſuperſtition, or gratitude, or fortune, has exalted a particular family above the heads of their equals. The dignities of ſheich and emir invariably deſcend in this choſen race; but the order of ſucceſſion is looſe and precarious; and the moſt worthy or aged of the noble kinſmen are preferred to the ſimple, though important, office of compoſing diſputes by their advice, and guiding valour by their example. The momentary junction of ſeveral tribes produces an army: their more laſting union conſtitutes a nation; and the ſupreme chief, the emir of emirs, whoſe banner is diſplayed at their head, may deſerve, in the eyes of ſtrangers, the honours of the kingly name. If the Arabian princes abuſe their power, they are quickly puniſhed by the deſertion of their ſubjects, who had been accuſtomed to a mild and parental juriſdiction. Their ſpirit is free, their ſteps are unconfined, the deſart is open, and the tribes and families are held together by a mutual and voluntary compact. The ſofter natives of Yemen ſupported the pomp and majeſty of a monarch; but if he could not leave his palace without endangering his life, the active powers of government muſt have been devolved on his nobles and magiſtrates. The cities of Mecca and Medina preſent, in the heart of Aſia, the form or rather the ſubſtance of a commonwealth. The grandfather of Mahomet, and his lineal anceſtors, appear in foreign and domeſtic tranſactions as the princes of their country; but they reigned like Pericles at Athens, or the Medici at Florence, by the opinion of their wiſdom and integrity; their influence was divided with their patrimony; and the ſceptre was transferred from the uncles of the prophet to a younger branch of the tribe of Koreiſh. On ſolemn occaſions they convened the aſſembly of the people; and, ſince mankind muſt be either compelled or perſuaded to obey, the uſe and reputation of oratory among the ancient Arabs is the cleareſt evidence of public freedom. But their ſimple freedom was of a very different caſt from the nice and artificial machinery of the Greek and Roman republics, in which each member poſſeſſed an undivided ſhare of the civil and political rights of the community. In the more ſimple ſtate of the Arabs, the nation is free, becauſe each of her ſons diſdains a baſe ſubmiſſion to the will of a maſter. His breaſt is fortified with the auſtere virtues of courage, patience, and ſobriety: the love of independence prompts him to exerciſe the habits of ſelf-command; and the fear of diſhonour guards him from the meaner apprehenſion of pain, of danger, and of death. The gravity and firmneſs of the mind is conſpicuous in its outward demeanor: his ſpeech is ſlow, weighty, and conciſe; he is ſeldom provoked to laughter; his only geſture is that of ſtroaking his beard, the venerable ſymbol of manhood; and the ſenſe of his own importance teaches him to accoſt his equals without levity, and his ſuperiors without awe. The liberty of the Saracens ſurvived their conqueſts: the firſt khalifs indulged the bold and familiar language of their ſubjects: they aſcended the pulpit to perſuade and edify the congregation; nor was it before the ſeat of empire was removed to the Tigris, that the Abbaſſides adopted the proud and pompous ceremonial of the Perſian and Byzantine courts.

188 Civil wars and private revenge.

"In the ſtudy of nations and men, we may obſerve the cauſes that render them hoſtile or friendly to each other, that tend to narrow or enlarge, to mollify or exaſperate, the ſocial character. The ſeparation of the Arabs from the reſt of mankind has accuſtomed them to confound the ideas of ſtranger and enemy; and the poverty of the land has introduced a maxim of juriſprudence, which they believe and practiſe to the preſent hour. They pretend, that in the diviſion of the earth the rich and fertile climates were aſſigned to the other branches of the human family; and that the poſterity of the outlaw Iſmael might recover, by fraud or force, the portion of inheritance of which he had been unjuſtly deprived. According to the remark of Pliny, the Arabian tribes are equally addicted to theft and merchandiſe: the caravans that traverſe the deſart are ranſomed or pillaged; and their neighbours, ſince the remote times of Job and Seſoſtris, have been the victims of their rapacious ſpirit. If a Bedoween diſcovers from afar a ſolitary traveller, he rides furiouſly againſt him, crying, with a loud voice, "Undreſs thyſelf, thy aunt (*my wife*) is without a garment." A ready ſubmiſſion intitles him to mercy; reſiſtance will provoke the aggreſſor, and his own blood muſt expiate the blood which he preſumes to ſhed in legitimate defence. A ſingle robber, or a few aſſociates, are branded with their genuine name; but the exploits of a numerous band aſſume the character of lawful and honourable war. The temper of a people, thus armed againſt mankind, was doubly inflamed by the domeſtic licence of rapine, murder, and revenge. In the conſtitution of Europe, the right of peace and war is now confined to a ſmall, and the actual exerciſe to a much ſmaller, liſt of reſpectable potentates; but each Arab, with impunity and renown, might point his javelin againſt the life of his countryman. The union of the nation conſiſted only in a vague reſemblance of language and manners; and in each community the juriſdiction of the magiſtrate was mute and impotent. Of the time of ignorance which preceded Mahomet, 1700 battles are recorded by tradition: hoſtility was embittered with the rancour of civil faction; and the recital, in proſe or verſe, of an obſolete feud was ſufficient to rekindle the ſame paſſions among the deſcendants of the hoſtile tribes. In private life, every man, at leaſt every family, was the judge and avenger of its own cauſe. The nice ſenſibility of honour, which weighs the inſult rather than the injury, ſheds its deadly venom on the quarrels of the Arabs: the honour of their women, and of their *beards*, is moſt eaſily wounded; an indecent action, a contemptuous word, can be expiated only by the blood of the offender; and ſuch is their patient inveteracy, that they expect whole months and years the opportunity of revenge. A fine or compenſation for murder is familiar to the barbarians of every age: but in Arabia the kinſmen of the dead are at liberty to accept the atonement, or, to exerciſe with their own hands the law of retaliation. The refined malice of the Arabs refuſes even the head of the murderer, ſubſtitutes an innocent to the guilty perſon, and transfers the penalty to the beſt and moſt conſiderable of the race by whom they have been injured. If he falls by their hands, they are expoſed in their turn to the danger of repriſals; the intereſt and principal of the bloody debt are accumulated; the individuals of either family lead a life of malice and ſuſpicion, and 50 years may ſometimes elapſe before the account of vengeance be finally ſettled. This ſanguinary ſpirit, ignorant of pity or forgiveneſs, has been moderated, however, by the maxims of honour, which require in every private encounter ſome decent equality of age and ſtrength, of numbers and weapons.

189
Annual truce.

An annual feſtival of two, perhaps of four months, was obſerved by the Arabs before the time of Mahomet; during which their ſwords were religiouſly ſheathed both in foreign and domeſtic hoſtility: and this partial truce is more ſtrongly expreſſive of the habits of anarchy and warfare.

190
Their ſocial qualifications and virtues.

“ But the ſpirit of rapine and revenge was attempered by the milder influence of trade and literature. The ſolitary peninſula is encompaſſed by the moſt civilized nations of the ancient world: the merchant is the friend of mankind; and the annual caravans imported the firſt ſeeds of knowledge and politeneſs into the cities, and even the camps of the deſart. The arts of grammar, of metre, and of rhetoric, were unknown to the freeborn eloquence of the Arabian; but their penetration was ſharp, their fancy luxuriant, their wit ſtrong and ſententious, and their more elaborate compoſitions were addreſſed with energy and effect to the minds of their hearers.

191
Love of poetry.

The genius and merit of a riſing poet was celebrated by the applauſe of his own and the kindred tribes. A ſolemn banquet was prepared, and a chorus of women, ſtriking their tymbals, and diſplaying the pomp of their nuptials, ſung in the preſence of their ſons and huſbands the felicity of their native tribe; that a champion had now appeared to vindicate their rights; that a herald had raiſed his voice to immortaliſe their renown. The diſtant or hoſtile tribes reſorted to an annual fair, which was aboliſhed by the fanaticiſm of the firſt Moſlems; a national aſſembly that muſt have contributed to refine and harmoniſe the barbarians. Thirty days were employed in the exchange, not only of corn and wine, but of eloquence and poetry. The prize was diſputed by the generous emulation of the bards; the victorious performance was depoſited in the archives of princes and emirs; and we may read in our own language the ſeven original poems which were inſcribed in letters of gold and ſuſpended in the temple of Mecca. The Arabian poets were the hiſtorians and moraliſts of the age; and if they ſympathiſed with the prejudices, they inſpired and crowned the virtues, of their countrymen. The indiſſoluble union of generoſity and valour was the darling theme of their ſong; and when they pointed their keeneſt ſatyr againſt a deſpicable race, they affirmed, in the bitterneſs of reproach, that the men knew not how to give, nor the women to deny. The ſame hoſpitality which was practiſed by Abraham, and celebrated by Homer, is ſtill renewed in the camps of the Arabs. The ferocious Bedoweens, the terror of the deſart, embrace, without enquiry or heſitation, the ſtranger who dares to confide in their honour and to enter their tent. His treatment is kind and reſpectful: he ſhares the wealth or the poverty of his hoſt; and after a needful repoſe, he is diſmiſſed on his way, with thanks, with bleſſings, and perhaps with gifts.

192
Ancient idolatry.

“ The religion of the Arabs, as well as of the Indians, conſiſted in the worſhip of the ſun, the moon, and the fixed ſtars; a primitive and ſpecious mode of ſuperſtition. The bright luminaries of the ſky diſplay the viſible image of a deity; their number and diſtance convey to a philoſophic, or even a vulgar eye, the idea of boundleſs ſpace: the character of eternity is marked on theſe ſolid globes, that ſeem incapable of corruption or decay: the regularity of their motions may be aſcribed to a principle of reaſon or inſtinct; and their real or imaginary influence encourages the vain belief that the earth and its inhabitants are the object of their peculiar care. The ſcience of aſtronomy was cultivated at Babylon; but the ſchool of the Arabs was a clear firmament and a naked plain. In their nocturnal marches, they ſteered by the guidance of the ſtars: their names, and order, and daily ſtation, were familiar to the curioſity and devotion of the Bedoween; and he was taught by experience to divide in 28 parts the zodiac of the moon, and to bleſs the conſtellations, who refreſhed, with ſalutary rains, the thirſt of the deſart. The reign of the heavenly orbs could not be extended beyond the viſible ſphere; and ſome metaphyſical powers were neceſſary to ſuſtain the tranſmigration of ſouls and the reſurrection of bodies: a camel was left to periſh on the grave, that he might ſerve his maſter in another life; and the invocation of departed ſouls implies that they were ſtill endowed with conſciouſneſs and power. Each tribe, each family, each independent warrior, created and changed the rites and the object of his fantaſtic worſhip; but the nation, in every age, has bowed to the religion, as well as to the language of Mecca.

193 The Caaba or temple of Mecca.

The genuine antiquity of the Caaba extends beyond the Chriſtian æra: in deſcribing the coaſt of the Red Sea, the Greek hiſtorian Diodorus has remarked, between the Thamaudites and the Sabæans, a famous temple, whoſe ſuperior ſanctity was revered by *all* the Arabians: the linen or ſilken veil, which is annually renewed by the Turkiſh emperor, was firſt offered by a pious king of the Homerites, who reigned 700 years before the time of Mahomet. A tent or a cavern might ſuffice for the worſhip of the ſavages, but an edifice of ſtone and clay has been erected in its place; and the art and power of the monarchs of the Eaſt have been confined to the ſimplicity of the original model. A ſpacious portico incloſes the quadrangle of the Caaba; a ſquare chapel, 24 cubits long, 23 broad, and 27 high: a door and a window admit the light; the double roof is ſupported by three pillars of wood; a ſpout (now of gold) diſcharges the rain-water, and the well Zemzem is protected by a dome from accidental pollution. The tribe of Koreiſh, by fraud or force, had acquired the cuſtody of the Caaba: the ſacerdotal office devolved through four lineal deſcents to the grandfather of Mahomet; and the family of the Haſhemites, from whence he ſprung, was the moſt reſpectable and ſacred in the eyes of their country. The precincts of Mecca enjoyed the rights of ſanctuary; and, in the laſt month of each year, the city and the temple were crowded with a long train of pilgrims, who preſented their vows and offerings in the houſe of God. The ſame rites which are now accompliſhed by the faithful Muſſulman were invented and practiſed by the ſuperſtition of the idolaters. At an awful diſtance they caſt away their garments: ſeven times, with haſty ſteps, they encircled the Caaba, and kiſſed the black ſtone: ſeven times they viſited and adored the adjacent mountains; ſeven times they threw ſtones into the valley of Mina; and the pilgrimage was atchieved, as at the preſent hour, by a ſacrifice of ſheep and camels, and the burial of their hair and nails in the conſecrated ground. Each tribe either found or introduced in the Caaba their domeſtic worſhip: the temple was adorned, or defiled, with 360 idols of men, eagles, lions, and antelopes; and moſt conſpicuous was the ſtatue of Hebal, of red agate, holding in his hand ſeven arrows, without heads or feathers, the inſtruments and ſymbols of profane divination. But this ſtatue was a monument of Syrian arts: the devotion of the ruder ages was content with a pillar or a tablet; and the rocks of the deſart were hewn into gods or altars, in imitation of the black ſtone of Mecca, which is deeply tainted with the reproach of an idolatrous origin.

194 Sacrifices and rites.

From Japan to Peru, the uſe of ſacrifice has univerſally prevailed; and the votary has expreſſed his gratitude or fear by deſtroying or conſuming, in honour of the gods, the deareſt and moſt precious of their gifts. The life of a man is the moſt precious oblation to deprecate a public calamity: the altars of Phœnicia and Egypt, of Rome and Carthage, have been polluted with human gore: the cruel practice was long preſerved among the Arabs; in the third century, a boy was annually ſacrificed by the tribe of the Dumatians; and a royal captive was piouſly ſlaughtered by the prince of the Saracens, the ally and ſoldier of the emperor Juſtinian. The father of Mahomet himſelf was devoted by a raſh vow, and hardly ranſomed for the equivalent of 100 camels. The Arabs, like the Jews and Egyptians, abſtained from the taſte of ſwine's fleſh; and they circumciſed their children at the age of puberty: the ſame cuſtoms, without the cenſure or the precept of the Koran, have been ſilently tranſmitted to their poſterity and proſelytes; and it has been ſagaciouſly conjectured, that the artful legiſlator indulged the ſtubborn prejudices of his countrymen.

195 Introduction of the Sabians.

“ Arabia was free: From the adjacent kingdoms, which were ſhaken by the ſtorms of conqueſt and tyranny, the perſecuted ſects fled to the happy land where they might profeſs what they thought, and practiſe what they profeſſed; and the religions of the Sabians and Magians, of the Jews and Chriſtians, were diſſeminated from the Perſian Gulf to the Red Sea. In a remote period of antiquity, Sabianiſm was diffuſed over Aſia by the ſcience of the Chaldæans and the arms of the Aſſyrians. From the obſervations of 2000 years, the prieſts and aſtronomers of Babylon deduced the eternal laws of nature and providence. They adored the ſeven gods or angels who directed the courſe of the ſeven planets, and ſhed their irreſiſtible influence on the earth. The attributes of the ſeven planets, with the twelve ſigns of the zodiac, and the twenty-four conſtellations of the northern and ſouthern hemiſphere, were repreſented by images and taliſmans; the ſeven days of the week were dedicated to their reſpective deities; the Sabians prayed thrice each day; and the temple of the moon at Haran was the term of their pilgrimage. But the flexible genius of their faith was always ready either to teach or to learn.

196 The Magians.

The altars of Babylon were overturned by the Magians; but the injuries of the Sabians were revenged by the ſword of Alexander; Perſia groaned above 500 years under a foreign yoke; and the pureſt diſciples of Zoroaſter eſcaped from the contagion of idolatry, and breathed with their adverſaries the freedom of the deſart.

197 The Jews.

Seven hundred years before the death of Mahomet the Jews were ſettled in Arabia: and a far greater multitude was expelled from the holy land in the wars of Titus and Hadrian. The induſtrious exiles aſpired to liberty and power: they erected ſynagogues in the cities and caſtles in the wilderneſs; and their Gentile converts were confounded with the children of Iſrael, whom they reſembled in the outward mark of circumciſion.

197 The Chriſtians.

The Chriſtian miſſionaries were ſtill more active and ſucceſsful: the Catholics aſſerted their univerſal reign; the ſects whom they oppreſſed ſucceſſively retired beyond the limits of the Roman empire; the Marcionites and Manichæans diſperſed their *fantaſtic* opinions and apocryphal goſpels; the churches of Yemen, and the princes of Hira and Gaſſen, were inſtructed in a purer creed by the Jacobite and Neſtorian biſhops.” Such was the ſtate of religion in Arabia previous to the appearance of Mahomet. See nº 22. *ſupra.*

As the Arabs are one of the moſt ancient nations in the world, having inhabited the country they at preſent poſſeſs almoſt from the deluge, without intermixing with other nations, or being ſubjugated by any foreign power, their language muſt have been formed ſoon after, if not at, the confuſion of Babel. The two principal dialects of it were, that ſpoken by the Hamyarites and other genuine Arabs, and that of the Koreiſh, in which Mahomet wrote the Koran. The firſt is ſtyled by the Oriental writers the *Arabic* of *Hamyar*, and the other *the pure* or *defecated*. As Yarab, grandfather of Hamyar, is ſuppoſed by the Oriental writers to have been the firſt whoſe tongue deviated from the Syriac to the Arabic, the Hamyaritic dialect, according them, muſt have approached nearer to the purity of the Syriac; and conſequently have been more remote from the true genius of the Arabic than that of any other tribe. The dialect of the Koreiſh, termed by the Koran *the perſpicuous and clear Arabic*, is referred to Iſhmael as its author; who, ſay the above-mentioned writers, firſt ſpoke it; and, as Dr Pocock believes, after he had contracted an alliance with the family of Jorham by marriage, formed it of their language and the original Hebrew. As, therefore, the Hamyaritic dialect partook principally of the Syriac, ſo that of the Koreiſh was ſuppoſed to conſiſt chiefly of the Hebrew. But, according to Jallalo'ddin, the politeneſs and elegance of the dialect of the Koreiſh ought rather to be attributed to their having, from the remoteſt antiquity, the cuſtody of the Caaba, and dwelling in Mecca the centre of Arabia. The Arabs are full of the commendations of their language, which is very harmonious, expreſſive, and, as they ſay, ſo immenſely copious, that no man uninſpired can be a perfect maſter of it in its utmoſt extent. How much, in this laſt article, it is ſuperior to the Greek and Latin tongues, in ſome meaſure appears from hence, that ſometimes a bare enumeration of the Arabic names of one particular thing, and an explication of them, will make a conſiderable volume. Notwithſtanding this, the Arabs believe the greateſt part of their language to be loſt; which will not ſeem improbable, when we conſider how late the art of writing became generally practiſed among them. For though it was known to Job their countryman, to the Edomites, as well as the other Arabian nations bordering upon Egypt and Phœnicia, and to the Hamyarites many centuries before Mahomet, as appears from ſome ancient monuments ſaid to be remaining in their character; yet the other Arabs, and thoſe of Mecca in particular, unleſs ſuch of them as were either Jews or Chriſtians, were to the time of Moramer perfectly ignorant of it. It was the ancient Arabic language preceding the reign of Juſtinian, which ſo nearly reſembled the Ethiopic; for ſince that time, and eſpecially ſince the age of Mahomet, all the Arabic dialects have been not a little corrupted. This is now the learned language of the Mahometans, who ſtudy it as the European Chriſtians do the Hebrew, Greek, and Latin.

199 Letters. The character uſed by them, the moſt ancient of any peculiar to the Arabs, wherein the letters were not diſtinctly ſeparate, went by the appellation of *Al Moſnad*, from the mutual dependency of its letters or parts upon one another. This was neither publickly taught, nor ſuffered to be uſed, without permiſſion firſt obtained. Could we depend upon what Al Firauzabadius relates from Ebn Haſhem, this character muſt have been of a very high antiquity; ſince an inſcription in it, according to the laſt author, was found in Yaman, as old as the time of Joſeph. Be that as it will, Moramer Ebn Morra of Anbar, a city of Irak, who lived not many years before Mahomet, was the inventor of the preſent Arabic character, which Baſhar the Kendian, who married the ſiſter of Abu Soſian, is ſaid to have learned from the houſe of Anbar, and to have introduced at Mecca but a little time before the inſtitution of Mahometiſm. Moramer's alphabet the Oriental authors agree to have been very different from the ancient one of the Hamyarites, ſince they diſtinguiſh the Hamyaritic and Arabic pens. In Mahomet's time, the Morameric alphabet had made ſo ſmall a progreſs, that no one in Yaman could either write or read it; nay, Mahomet himſelf was incapable of doing either; for which reaſon he was called the *illiterate prophet*. The letters of this alphabet were very rude; being either the ſame with, or very much like, the Cufic; which character is ſtill found in inſcriptions and the titles of ancient books; nay, for many years it was the only one uſed by the Arabs, the Koran itſelf being at firſt written therein. In order to perpetuate the memory of Moramer's invention, ſome authors call the Arabic letters *al Moramer*, i. e. *the progeny of Moramer*. The moſt remarkable ſpecimens of the *Cufic* character (ſo denominated from Cufa, a city of Irak, where ſome of the firſt copies of the Koran were written) are the following: Part of that book in it on vellum, brought from Egypt by Mr Greaves; ſome other fragments of the ſame book in it publiſhed by Sir John Chardin; certain paſſages of a MS. in the Bodleian library the legends on ſeveral Saracenic coins dug up not many years ago on the coaſt of the Baltic, not far from Dantzick; and, according to Mr Profeſſor Hunt, thoſe noble remains of it that are, or were lately, to be ſeen in Mr Joſeph Ames's valuable collection of antique curioſities. As to the true origin of the ancient and modern Arabic alphabets, we muſt own ourſelves pretty much in the dark. See Alphabet.

200 Learning, &c. The Arabian learning may be divided into two periods, viz. *Ante-Mahometan* and *Mahometan*.

The Arab learning, in this firſt period, conſiſted, according to Abulpharagius, in the knowledge of their language, the propriety of diſcourſe, the compoſition of verſe, and the ſcience of the ſtars: but their chief attention ſeems to have been directed to oratory and poetry.

The ſecond period is more diſtinguiſhed, at leaſt from the time of Al-Mamon, the ſeventh caliph of the family of the Abaſſides, who flouriſhed about the year 820, and has the honour of being the founder of the modern Arabian learning. He ſent for all the beſt books out of Chaldea, Greece, Egypt, and Perſia, relating to phyſic, aſtronomy, coſmography, muſic, chronology, &c. and penſioned a number of learned men, ſkilled in the ſeveral languages and ſciences, to tranſlate them into Arabic. By this means, divers of the Greek authors, loſt in their own country and language, have been preſerved in Arabic. From that time Arabia became the chief ſeat of learning; and we find mention by Abulpharagius, Pococke, D'Herbelot, and Hottinger, of learned men, and books without number.

The revival of learning in the 10th century, by Gerbert, known after his elevation to the pontificate by the title of Silveſter II. and afterwards among the Europeans in general, may be aſcribed to the inſtructions and writings of the Arabian doctors and philoſophers, and to the ſchools which they founded in ſeveral parts of Spain and Italy. And in the 12th century, the inquiſitive of different countries frequented the ſchools of the Saracens in Spain, and diſſeminated the knowledge which they obtained there after their return. At this time, many of the learned productions of the Arabians were tranſlated into Latin, which facilitated the general progreſs of ſcience.

The philoſophy of the Arabians, before Mahomet, was Sabian, and included the ſyſtem and ceremonies of that ſect of idolaters. This it was that Mahomet ſet himſelf to decry; and he is even ſaid by ſome to have carried his oppoſition ſo far, as to prohibit, if not puniſh, all ſtudy of philoſophy. But his followers, by degrees, got over this reſtraint; the love of learning increaſed; till, under the memorable caliphate of Al-Mamon, Ariſtotle's philoſophy was introduced and eſtabliſhed among them; and from them propagated, with their conqueſts, through Egypt, Africa, Spain, and other parts. As they choſe Ariſtotle for their maſter, they chiefly applied themſelves to that part of philoſophy called *logic,* and thus became proficients in the knowledge of words rather than things. Whence they have been ſometimes denominated, *Maſters of the wiſdom of words;* ſometimes the *Talking ſect.* Their philoſophy was involved in quaint arbitrary terms and notions, and their demonſtrations drawn from thence as from certain principles, &c. *Walch Hiſt. Log.* lib. ii. ſec. 2. § 1.

Their phyſic ſucceeded the Grecian; and their phyſicians handed down the art to us, having made conſiderable improvements, chiefly in the pharmaceutical and chemical parts.

It is certain we owe to them moſt of our ſpices and aromatics, as nutmegs, cloves, mace, and other matters of the produce of India. We may add, that moſt of the gentle purgatives were unknown to the Greeks, and firſt introduced by the Arabs, as manna, ſenna, rhubarb, tamarinds, caſſia, &c. They likewiſe brought ſugar into uſe in phyſic, where, before, only honey was uſed. They alſo found the art of preparing waters and oils, of divers ſimples, by diſtillation and ſublimation. The firſt notice of the ſmall-pox and the meaſles is likewiſe owing to them. Laſtly, the reſtoration of phyſic in Europe took its riſe from their writings. M. Le Clerc has given a ſketch, and Dr Freind an ample hiſtory of the Arabian phyſic. We have alſo a *notitia* of all the Arabian phyſicians by Fabricius.

Their poetry may be divided into two ages. The ancient, according to Voſſius, was no other than rhiming; was a ſtranger to all meaſure and rule; the verſes looſe and irregular, confined to no feet, number of ſyllables, or any thing elſe, ſo that they rhimed at the end; oftentimes all the verſes in the poem ended with the ſame rhime. It is in ſuch verſe that the alcoran is ſaid to be written.

The modern Arabian poetry takes its date from the caliphate of Al Raſchid, who lived toward the cloſe of the eight century. Under him poetry became an art, and laws of proſody were laid down. Their compariſons, in which they abound, are taken, with little choice, from tents, camels, hunting, and the ancient manners of the Arabs.

201 Mechanical arts.

That ſome of the Arabs had a good degree of knowledge in ſeveral mechanical arts, appears from Strabo, who informs us, that the people of Tamna and the adjacent provinces had magnificent temples, and elegant houſes, built in the Egyptian taſte. The ſame author likewiſe relates, that in Arabia Felix, beſides the huſbandmen, there were many artificers; and, among others, thoſe which made palm-wine, which he intimates, was much uſed by the Arabs. As for the exerciſe of arms and horſemanſhip, they looked upon this as one of their principal accompliſhments, being obliged to practiſe and encourage it by reaſon of the independency of their tribes, whoſe frequent jarring made wars almoſt continual amongſt them, which for the moſt part ended in field-battles. Hence it became an uſual ſaying amongſt them, that God had beſtowed four peculiar things on the Arabs, viz. *turbans inſtead of diadems, tents inſtead of walls and houſes, ſwords inſtead of intrenchments, and poems inſtead of written laws.* The principal arms uſed by the ancient Arabs were bows and arrows, darts or javelins, and broad ſwords or ſcymitars. The bows and arrows were the moſt ancient of theſe; being uſed by Iſhmael himſelf, according to Scripture. It is probable alſo, that ſome of them were acquainted with every branch of the military art cultivated by their neighbours the Egyptians, Syrians, and Phœnicians.

202 Commerce.

Before the Portugueſe interrupted the navigation of the Red ſea, the Arabs were the factors of all the trade that paſſed thro' that channel. Aden, which is ſituated at the moſt ſouthern extremity of Arabia upon the Indian ocean, was the mart in theſe parts. The ſituation of its harbour, which opened an eaſy communication with Egypt, Ethiopia, India, and Perſia, had rendered it, for many ages, one of the moſt flouriſhing factories in Aſia. Fifteen years after it had repulſed the great Albuquerque, who attempted to demoliſh it in 1513, it ſubmitted to the Turks, who did not long remain maſters of it. The king of Yemen, who poſſeſſed the only diſtrict in Arabia that merits the title of *Happy,* drove them from thence, and removed the trade to Mocha, a place in his dominions which till then was only a village.

This trade was at firſt inconſiderable; conſiſting principally in myrrh, incenſe, aloes, balm of Mecca, ſome aromatics, and medicinal drugs. Theſe articles, the exportation of which is continually retarded by exorbitant impoſts, and does not exceed at preſent 30,625 l. were at that time more in repute than they have been ſince: but muſt have been always of little conſequence. Soon after a great change enſued from the introduction of coffee.

Though this article is generally uſed in the Arabian entertainments, none but the rich citizens have the pleaſure of taſting the berry itſelf. The generality are obliged to content themſelves with the ſhell and the huſk of this valuable production. Theſe remains, ſo much deſpiſed, make a liquor of a pretty clear colour, which has a taſte of coffee without its bitterneſs and ſtrength. Theſe articles may be had at a low price at Betelfagui, which is the general market for them. Here likewiſe is ſold all the coffee which comes out of the country by land. The reſt is carried to Mocha, which is 35 leagues diſtant, or to the nearer ports of Lohia or Hodeida, from whence it is tranſported in ſmall veſſels to Jodda. The Egyptians fetch it from the laſt mentioned place, and all other nations from the former.

The quantity of coffee exported may be eſtimated at twelve millions five hundred and fifty thouſand weight. The European companies take off a million and a half; the Perſians three millions and a half; the fleet from Suez ſix millions and a half; Indoſtan, the Maldives, and the Arabian colonies on the coaſt of Africa, fifty thouſand; and the caravans a million.

As the coffee which is bought up by the caravans and the Europeans is the beſt that can be procured, it coſts about 8¼d. a pound. The Perſians, who content themſelves with that of an inferior quality, pay no more than about 6¼d. a pound. The Egyptians purchaſe it at the rate of about 8d. their cargoes being compoſed partly of good and partly of bad coffee. If we eſtimate coffee at about 7⅜d. a pound, which is the mean price, the profits accruing to Arabia from its annual exportation will amount to 384,343 l. 15 s. This money does not go into their coffers; but it enables them to purchaſe the commodities brought from the foreign markets to their ports of Jodda and Mocha.

Mocha receives from Abyſſinia, ſheep, elephants teeth, muſk, and ſlaves. It is ſupplied from the eaſtern coaſt of Africa with gold, ſlaves, amber, and ivory; from the Perſian Gulph, with dates, tobacco, and corn; from Surat, with a vaſt quantity of coarſe, and a few fine linens; from Bombay and Pondicherry, with iron, lead, and copper, which are carried thither from Europe; from Malabar, with rice, ginger, pepper, Indian ſaffron, with coire, cardamom, and alſo with planks; from the Maldives, with gum, benzoin, aloes-wood, and pepper, which theſe iſlands take in exchange; from Coromandel, with 400 or 500 bales of cottons, chiefly blue. The greateſt part of theſe commodities, which may fetch 262,500l. are conſumed in the interior part of the country. The reſt, particularly the cottons, are diſpoſed of in Abyſſinia, Socotora, and the eaſtern coaſt of Africa.

None of the branches of buſineſs which are managed at Mocha, as well as throughout all the country of Yaman, or even at Sanaa the capital, are in the hands of the natives. The extortions with which they are perpetually threatened by the government deter them from interfering in them. All the warehouſes are occupied by the Banians of Surat or Guzaret, who make a point of returning to their own country as ſoon as they have made their fortunes. They then reſign their ſettlements to merchants of their own nation, who retire in their turn, and are ſucceeded by others.

The European companies, who enjoy the excluſive privilege of trading beyond the Cape of Good Hope, formerly maintained agents at Mocha. Notwithſtanding it was ſtipulated by a ſolemn capitulation, that the impoſts demanded ſhould be rated at two and a quarter *per cent.* they were ſubject to frequent extortions: the governor of the place inſiſting on their making him preſents, which enabled him to purchaſe the favour of the courtiers, or even of the prince himſelf. However, the profits they obtained by the ſale of European goods, particularly clothes, made them ſubmit to theſe repeated humiliations. When theſe ſeveral articles were furniſhed by Grand Cairo, it was then impoſſible to withſtand the competition, and the fixed ſettlements were therefore given up.

The trade was carried on by ſhips that ſailed from Europe with iron, lead, copper, and ſilver, ſufficient to pay for the coffee they intended to buy. The ſupercargoes, who had the care of theſe tranſactions, ſettled the accounts every time they returned. Theſe voyages, which at firſt were pretty numerous and advantageous, have been ſucceſſively laid aſide. The plantations of coffee, made by the European nations in their colonies, have equally leſſened the conſumption and the price of that which comes from Arabia. In proceſs of time, theſe voyages did not yield a ſufficient profit to anſwer the high charges of undertaking them on purpoſe. The companies of England and France then reſolved, one of them to ſend ſhips from Bombay, and the other from Pondicherry, to Mocha, with the merchandiſe of Europe and India. They even frequently had recourſe to a method that was leſs expenſive. The Engliſh and French viſit the Red ſea every year. Tho' they diſpoſe of their merchandiſe there to good advantage, they can never take in cargoes from thence for their return. They carry, for a moderate freight, the coffee belonging to the companies who lade the veſſels with it, which they diſpatch from Malabar and Coromandel to Europe. The Dutch company, who prohibit their ſervants from fitting out ſhips, and who ſend no veſſels themſelves, to the gulph of Arabia, are deprived of the ſhare they might take in this branch of commerce. They have alſo given up a much more lucrative branch, that of Jodda.

Jodda is a port ſituated near the middle of the gulph of Arabia, 20 leagues from Mecca. The government there is of a mixed kind: the grand Signior and the Xeriff of Mecca ſhare the authority and the revenue of the cuſtoms between them. Theſe impoſts are levied upon the Europeans at the rate of 8 *per cent.* and upon other nations at 13. They are always paid in merchandiſe, which the managers oblige the merchants of the country to buy at a very dear rate. The Turks, who have been driven from Aden, Mocha, and every part of the Yaman, would long ago have been expelled from Jodda, if there had not been room to apprehend that they might revenge themſelves in ſuch a manner as to put an end to their pilgrimages and commerce.

203 Coins.

The coins, which are current at Mocha, the principal port of the Red Sea, are dollars of all kinds; but they abate five per cent. on the pillar dollars, becauſe they are reckoned not to be the pureſt ſilver, and the dollar weight with them is 17 drams 14 grains. All their coins are taken by weight, and valued according to their pureneſs. The gold coins current here are ducats of Venice, Germany, Turkey, Egypt, &c. The comaſſes are a ſmall coin, which are taken at ſuch a price as the government ſets on them; and they keep their accounts in an imaginary coin, called *cabeers*, of which 80 go to a dollar. For an account of the ancient coins called *dinars* and *dirhems*, ſee theſe two articles.

Gum ARABIC. See GUM.

ARABICI, a ſect who ſprung up in Arabia, about the year 207, whoſe diſtinguiſhing tenet was, that the ſoul died with the body, and alſo roſe again with it.

Euſebius, lib. vi. c. 38. relates, that a council was called to ſtop the progreſs of this riſing ſect; and that Origen aſſiſted at it; and convinced them ſo thoroughly of their error that they abjured it.

ARABIS, BASTARD TOWER-MUSTARD: A genus of the ſiliquoſa order, belonging to the tetradynamia claſs of plants; and in the natural method ranking under the 39th order, *Siliquoſæ*. The generic mark conſiſts in 4 nectiferous glands which lie on the inſide of each leaf of the calyx. There are 8 ſpecies; but none of them remarkable for their beauty or other properties. Only one of theſe, the thaliana or mouſe-ear, is a native of Britain. It is a low plant, ſeldom riſing more than four or five inches high, branching on every ſide, having ſmall white flowers growing alternately, which have each four petals in form of a croſs, that are ſucceeded by long ſlender pods filled with ſmall round ſeeds. It grows naturally on ſandy ground or old walls. Sheep are not fond of it, and ſwine refuſe it.

ARABISM, ARABISMUS, an idiom or manner of ſpeaking peculiar to the Arabs or the Arabic language.

ARABIST, a perſon curious of, and ſkilled in, the learning and languages of the Arabians: ſuch were Erpenius and Golius. The ſurgeons of the 13th century are called *Arabiſts* by Severinus.

ARABLE LANDS, thoſe which are fit for tillage, or which have been formerly tilled.

ARACAN, the capital of a ſmall kingdom to the north-eaſt of the Bay of Bengal, ſituated in E. Long. 93. 0. N. Lat. 20. 30. It has the conveniency of a ſpacious river, and a harbour large enough to hold all the ſhips in Europe. It is ſaid by Schouten to be as large as Amſterdam; but the houſes are ſlight, being made with palm-trees and bomboo-canes, and covered with leaves of trees. They are ſeldom above ſix feet high, but have many windows or air-holes. But the people of the higheſt rank are much better accommodated. They have no kitchens, chimneys, or cellars, which oblige the women to dreſs the victuals out of doors. Some of the ſtreets are on the ridges of rocks, wherein are a great many ſhops. Their orchards and gardens contain all the fruit common to the Indies, and their trees are green all the year. Their common drink is toddy; which is the ſap of the cocoa-tree, and when new will intoxicate like wine, but ſoon grows ſour. Elephants and buffaloes are very numerous here, and are made uſe of inſtead of horſes. They have plenty of proviſions, and but little trade: for when Mr Channoch was here in 1686, with ſix large ſhips, there was nothing to be had in the way of commerce; and yet the country produces lead, tin, ſtick-lac, and elephants teeth. The Mogul's ſubjects come here to purchaſe theſe commodities; and ſometimes meet with diamonds, rubies, and other precious ſtones. They were formerly governed by a king of their own, called the king of the *White Elephant*; but this country has been conquered by the king of Pegu. They pay little or no regard to the chaſtity of their women, and the common ſailors take great liberties among them. Their religion is Paganiſm; and the idols, temples, and prieſts are very numerous. The dreſs of the better ſort is very ſlight, for it conſiſts chiefly of a piece of white cotton over their arms, breaſt, and belly, with an apron before. The complexion of the women is tolerable; they wear thin flowered guaze over their breaſt and ſhoulders, and a piece of cotton, which they roll three or four times round their waiſt, and let it hang as low as their feet. They curl their hair, and put glaſs rings in their ears, and ſtretch them of a monſtrous length. On their arms and legs they have hoops of copper, ivory, ſilver, &c. The country produces great quantities of rice, and the water is good. Their flocks of ſheep and herds of cattle are alſo numerous near Aracan; but what they ſay of the towns and villages, with which the country is pretended to be overſpread, may be doubted. Captain Hamilton affirms, that there are but few places inhabited, on account of the great number of wild elephants and buffaloes, which would deſtroy the fruits of the ground; and that the tigers would deſtroy the tame animals. There are ſome iſlands near the ſea, inhabited by a few miſerable fiſhermen, who can juſt keep themſelves from ſtarving, tho' they are out of the reach of oppreſſion. The rich burn the dead bodies; but the poor, who are not able to buy wood, throw them into the river.

ARACHIS, in botany: A genus of the diadelphia order, belonging to the decandria claſs of plants; and, in the natural method, ranking under the 32d order, *Papillionaceæ*. There is only one ſpecies, the hypogæa, an annual plant, and a native of Braſil and Peru. The ſtalks are long, trail upon the ground, and are furniſhed with winged leaves, compoſed of four hairy lobes each. The flowers are produced ſingly on long peduncuis; they are yellow, of the pea kind, and each contains ten awl-ſhaped ſtamina, nine of which are tied together, and the upper one ſtands off. In the centre is an awl-ſhaped ſtylus, crowned with a ſimple ſtigma. The germen is oblong, and becomes an oval oblong pod, containing two or three oblong blunt ſeeds.—This plant is cultivated in all the American ſettlements for the ſeeds, which make a conſiderable part of the food of the ſlaves. The manner of perfecting them is very ſingular: for as the flowers fall off, the young pods are forced into the ground by a natural motion of the ſtalks, and there they are entirely buried, and not to be diſcovered without digging for them; whence they have taken the name of *ground nuts*.

ARACHNE, in fabulous hiſtory, a young maid of Lydia, ſaid to have been the inventreſs of ſpinning. She is fabled to have been ſo ſkilful in this art, as to challenge Minerva at it; who tore her work, and ſtruck her; which diſgrace driving her to deſpair, ſhe hanged herſelf. Minerva, from compaſſion, brought her to life, and transformed her into a ſpider, which ſtill employs itſelf in ſpinning.

ARACHNOIDES, in anatomy, an appellation given to ſeveral membranes; as the tunic of the cryſtalline humour of the eye, the external lamina of the pia mater, and one of the coverings of the ſpinal marrow.

ARACK, ARRACK, or RACK, a ſpirituous liquor imported from the Eaſt Indies, uſed by way of dram and in punch.

The word *arack*, according to Mr Lockyer, is an Indian name for ſtrong waters of all kinds; for they call our ſpirits and brandy *Engliſh arack*. But what we underſtand by the name *arack*, he affirms is really no other than a ſpirit procured by diſtillation from a vegetable juice called *toddy*, which flows by inciſion out of the cocoa-nut tree, like the birch-juice procured among us. The toddy is a pleaſant drink by itſelf, when new, and purges thoſe who are not uſed to it; and, when ſtale, it is heady, and makes good vinegar.

The Engliſh at Madraſs uſe it as leaven to raiſe their bread with.

Others are of opinion, that the arack, or arrack, is a vinous ſpirit obtained by diſtillation, in the Eaſt Indies, from rice or ſugar, fermented with the juice of cocoa-nuts.

The Goa arack is ſaid to be made from the toddy, the Batavia arack from rice and ſugar; and there is likewiſe a kind of ſhrub from which arack is made.

Goa and Batavia are the chief places for arack.—At Goa there are divers kinds; ſingle, double, and treble diſtilled. The double diſtilled, which is that commonly ſent abroad, is but a weak ſpirit in compariſon with Batavia arack; yet, on account of its peculiar and agreeable flavour, is preferred to all the other aracks of India. This flavour is attributed to the earthen veſſels which they uſe at Goa to draw the ſpirit; whereas at Batavia they uſe copper ſtills.

The Parier arack made at Madraſs, and the Columbo and Quilone arack at the other places, being fiery hot ſpirits, are little valued by the Europeans, and therefore rarely imported; though highly prized among the natives. In the beſt Goa arack, the ſpirits of the cocoa-juice do not make above a ſixth or eighth part.

The manner of making the Goa arack is this: The juice of the trees is not procured in the way of tapping, as we do; but the operator provides himſelf with a parcel of earthen pots, with bellies and necks like our ordinary bird-bottles: he makes faſt a number of theſe to his girdle, and any way elſe that he commodiouſly can about him. Thus equipped, he climbs up the trunk of a cocoa tree; and when he comes to the boughs, he takes out his knife, and cutting off one of the ſmall knots or buttons, he applies the mouth of the bottle to the wound, faſtening it to the bough with a bandage; in the ſame manner he cuts off other buttons, and faſtens on his pots, till the whole number is uſed: this is done in the evening, and deſcending from the tree, he leaves them till the next morning; when he takes off the bottles, which are moſtly filled, and empties the juice into the proper receptacle. This is repeated every night, till a ſufficient quantity is produced; and the whole being then put together, is left to ferment, which it ſoon does. When the fermentation is over, and the liquor or waſh is become a little tart, it is put into the ſtill, and a fire being made, the ſtill is ſuffered to work as long as that which comes over has any conſiderable taſte of ſpirit.

The liquor thus procured is the low wine of arack; and this is ſo poor a liquor, that it will ſoon corrupt and ſpoil, if not diſtilled again, to ſeparate ſome of its phlegm; they therefore immediately after pour back this low wine into the ſtill, and rectify it to that very weak kind of proof-ſpirit, in which ſtate we find it. The arack we meet with, notwithſtanding its being of a proof-teſt, according to the way of judging by the crown of bubbles, holds but a ſixth, and ſometimes but an eighth, part of alcohol or pure ſpirit; whereas our other ſpirits, when they ſhow that proof, are generally eſteemed to hold one half-pure ſpirit. *Shaw's Eſſay on Diſtilling.*

There is a paper of obſervations on arack, in the *Melanges d'Hiſtoire Natur.* tome v. p. 302. By fermenting, diſtilling, and rectifying the juice of the American maple, which has much the ſame taſte as that of the cocoa, the author ſays, he made arack not in the leaſt inferior to any that comes from the Eaſt Indies; and he thinks the juice of the ſycamore and of the birch trees would equally anſwer the end.

Beſides the common ſorts of Goa and Batavia arack, there are two others leſs generally known; theſe are the bitter arack and the black arack.

By ſtat. 11th Geo. I. c. 30. arack on board a ſhip within the limits of any port of Great Britain, may be ſearched for and ſeized, together with the package; or if found unſhipping or unſhipped, before entry, may be ſeized by the officers of exciſe, in like manner as by the officers of the cuſtoms.—Upon an exciſe-officer's ſuſpicion of the concealment of arack, and oath made of the grounds of ſuch ſuſpicion before the commiſſioners or a juſtice of peace, they may empower him to enter ſuch ſuſpected places, and ſeize the liquors, with the caſks, &c. If the officers are obſtructed, the penalty is 100 l.

Arack is not to be ſold but in warehouſes, entered as directed in the 6th of Geo. I. c. 21. upon forfeiture, and the caſks, &c. If permits are not returned which are granted for the removal of arack, or if the goods are not ſent away within the time limited, the penalty is treble the value. If the permits are not returned, and the decreaſe is not found to be ſufficient, the like quantity is forfeited. Permits are not to be taken out but by direction in writing of the proprietor of the ſtock, or his known ſervant, upon forfeiture of 50 l. or three months impriſonment.

By ſtat. 9th Geo. II. c. 35. if arack is offered for ſale without a permit, or by any hawker, pedlar, &c. with a permit, the perſon to whom it is offered may ſeize and carry it to the next warehouſe belonging to the cuſtoms or exciſe, and bring the perſon offering the ſame before any juſtice of the peace, to be committed to priſon, and proſecuted for the penalties incurred by ſuch offence. The perſon ſeizing ſuch goods may proſecute in his own name; and on recovery is entitled to one-third part of the groſs produce of the ſale: and the commiſſioners are, if deſired, upon a certificate from the juſtice of the offender's being committed to priſon, to advance to the ſeizer 15s. per gallon for the arack ſo ſeized.

Arack (except for the uſe of ſeamen, two gallons each) found in any ſhip or veſſel arrived from foreign parts, at anchor, or hovering within the limits of any port, or within two leagues of the ſhore; and not proceeding on her voyage (unleſs in caſe of unavoidable neceſſity and diſtreſs of weather, notice whereof muſt be given to the collector or chief officer of the port upon the ſhip's arrival), is forfeited, with the boxes, caſks, or other package, or the value thereof.

Arack is alſo the name of a ſpirituous liquor made by the Tartars of Tunguſia, of mare's milk, left to ſour, and afterwards diſtilled twice or thrice between two earthen pots cloſely ſtopped, whence the liquor runs through a ſmall wooden pipe. It is more intoxicating than brandy.

ARAD (anc. geog.), a city lying to the ſouth of Judah and the land of Canaan, in Arabia Petræa. The Iſraelites having advanced towards the land of Canaan (Numb. xxi. 1.), the king of Arad oppoſed their paſſage, defeated them, and took a great booty from them; but they deſtroyed his country as ſoon as they became maſters of the land of Canaan (Numb. xxxiii.) Arad was rebuilt, and Euſebius places it in the neighbourhood of Kades, at the diſtance of 20 miles from Hebron. The Iſraelites, in their paſſage through the wilderneſs, having departed from Sepher, came to Arad, and from thence to Makkelath.

ARADUS (anc. geog.), an iſland between the borders of Phœnicia and Seleucis, at the diſtance of 20 ſtadia from a dangerous coaſt: all of it a rock ſurrounded by the ſea, in compaſs ſeven ſtadia; and forming a very powerful city and republic. It is now called *Ronad;* but not a ſingle wall is remaining of all that multitude of houſes which, according to Strabo, were built with more ſtories than even thoſe of Rome. The liberty enjoyed by the inhabitants had rendered it very populous; and it ſubſiſted by a naval commerce, manufactures, and arts. As preſent the iſland is deſerted; nor has tradition even retained the memory of a ſpring of freſh water in its environs, which the people of Aradus diſcovered at the bottom of the ſea, and from which they drew water in time of war by means of a leaden bell and a leathern pipe fitted to its bottom.

ARÆ PHILÆNON, or PHILÆNORUM (Strabo); to the ſouth of the Syrtis major; but in Peutinger; more weſterly, to the ſouth almoſt of the Syrtis Minor. In Strabo's time, the altars were not extant, but a village of the ſame name ſtood on the ſpot. On a diſpute about limits, between the Cyrenians and Carthaginians, it was agreed that two of each people ſhould ſet out on the ſame day, and that where they ſhould happen to meet, there the limits of both ſhould be fixed. The Philæni, two brothers, Carthaginians, undertook it for Carthage: theſe, after having advanced a great many miles into the territory of the Cyreneans, were met by their antagoniſts; who, enraged at their being beforehand with them ſo far, gave them the option of either returning back, or of being buried alive on the ſpot. Like zealous patriots, they choſe the latter; and there the Carthaginians raiſed two altars in honour of the Philæni. (Salluſt, Valerius Maximus.)

ARÆOMETER, an inſtrument wherewith to meaſure the denſity or gravity of fluids.

The aræometer, or water-poiſe, is uſually made of glaſs; conſiſting of a round hollow ball, which terminates in a long ſlender neck hermetically ſealed at top; there being firſt as much running mercury put into it as will ſerve to balance or keep it ſwimming in an erect poſition.

The ſtem is divided into degrees (as repreſented Plate XXXIV. fig. 23.); and by the depth of its deſcent into any liquor, the lightneſs of that liquor is concluded: for that fluid in which it ſinks leaſt muſt be heavieſt; and that in which it ſinks loweſt, lighteſt.

M. Homberg has invented a new aræometer, deſcribed in Phil. Tranſact. N° 262. thus: *A* is a glaſs bottle or matraſs, with ſo ſlender a neck that a drop of water takes up in it about five or ſix lines, or half of an inch. Near that neck is a ſmall capillary tube *D*, about ſix inches long, and parallel to the neck.—To fill the veſſel, the liquor is poured in at the mouth *B*, (which is widened to receive a tunnel), till it run out at *D*, that is, till it riſe in the neck to the mark *C*, by which means you have always the ſame bulk or quantity of liquor; and conſequently, by means of the balance, can eaſily tell, when different liquors fill it, which weighs moſt, or is moſt intenſely heavy.

Some regard, however, is to be had in theſe trials to the ſeaſon of the year and degree of heat and cold in the weather; becauſe ſome liquors rarefy with heat and condenſe with cold more than others, and accordingly take up more or leſs room.

By means of this inſtrument, the ingenious author has made a table to ſhow the different weights of the ſame bulk of the moſt conſiderable chemical liquors both in ſummer and winter, as follows:

	Weighed in ſummer.				in winter.		
The aræometer full of	*oz.*	*dr.*	*gr.*		*oz.*	*dr.*	*gr.*
Quickſilver,	11	00	06	-	11	00	32
Oil of tartar,	01	03	08	-	01	03	31
Spirit of urine,	01	00	32	-	01	00	43
Oil of vitriol,	01	03	58	-	01	04	03
Spirit of nitre,	01	01	40	-	01	01	70
Spirit of ſalt,	01	00	39	-	01	00	47
Aquafortis,	01	01	38	-	01	01	55
Vinegar,	00	07	55	-	00	07	60
Spirit of wine,	00	06	47	-	00	06	61
River water,	00	07	53	-	00	07	57
Diſtilled water,	00	07	50	-	00	07	54

The inſtrument itſelf weighed, when empty, one dram twenty-eight grains. See HYDROMETER.

ARÆOPAGUS. See AREOPAGUS.

ARÆOSTYLE, in architecture, a term uſed by Virtruvius, to ſignify the greateſt interval which can be made between columns.

ARÆOTICS, in medicine, remedies which rarefy the humours, and render them eaſy to be carried off by the pores of the ſkin.

ARAF, among the Mahometans. See ALARAF.

ARAFAH, the ninth day of the laſt month of the Arabic year, named *Dhoulhegiat;* on which the pilgrims of Mecca perform their devotions on a neighbouring mountain called *Arafat.* The Mahometans have a very great veneration for this mountain, becauſe they believe that Adam and Eve, after they were baniſhed out of Paradiſe, having been ſeparated from each other during 120 years, met afterwards on this mountain.

ARAFAT, or GIBEL EL ORPHAT, *the mountain of knowledge*, a mountain in Arabia, near Mecca. The Mahometans ſay this was the place where Adam firſt met with and knew his wife Eve after their expulſion from Paradiſe. This mountain not being large enough to contain all the devotees that come annually in pilgrimage to Mecca, ſtones are ſet up all round it to ſhow how far it reaches. The pilgrims are clad in robes of humility and mortification, with their heads uncovered. They ſeem to be very much affected; for the tears flow down their cheeks, and they ſob and ſigh moſt bitterly, begging earneſtly for remiſſion of ſins, and promiſing to lead a new life. They continue here about four or five hours, and at half an hour after ſunſet they all decamp to perform a religious duty called *Aſham nomas.* After this, they all receive the honourable title of *hadgees*, which is conferred upon them by the imam or prieſt. This being pronounced, the trumpet ſounds, and they all return to Mecca.

ARAGON. See ARRAGON.

ARAL, a great lake in the kingdom of Khowarazm, lying a little to the eaſtward of the Caſpian ſea. Its length from north to ſouth is ſaid to be near 150 miles, and its breadth from eaſt to weſt about 70. The ſhore on the weſt ſide is high and rocky, and deſtitute of good water: yet there are abundance of wild horſes, aſſes, antelopes, and wolves; as alſo a fierce creature called a *jolbart*, which the Tartars ſay is of ſuch a prodigious ſtrength as to carry off a horſe. It is ſurpriſing that this lake ſhould be quite unknown to geographers till within theſe few years. Several great rivers, which were ſuppoſed to run into the Caſpian ſea, are now known to fall into this lake, particularly the Sihun or Sirr, and the Gihun or Amo, ſo often mentioned by the Oriental hiſtorians. This lake, like the Caſpian ſea, has no viſible outlet. Its water is alſo very ſalt; and for that reaſon is conveyed by the neighbouring inhabitants by ſmall narrow canals into ſandy pits, where the heat of the ſun, by exhaling the water, leaves them a ſufficient quantity of ſalt. The ſame kinds of fiſh are found in Aral that are found in the Caſpian ſea. The former is alſo called the *Lake of Eagles*.

ARAHUM, or HARAHUM, in ancient writers, denotes a place conſecrated or ſet apart for holy purpoſes. Hence the phraſe *in araho jurare*, or *conjurare*, "to make oath in the church;" becauſe, by the Ripuarian laws, all oaths were to be taken in the church on the relics of the ſaints.

ARALIA, the ANGELICA TREE; A genus of the pentagynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 46th order, *Hederaceæ*. The eſſential characters are: The involucrum is an umbella; the calyx is quinquedentated, and above the fruit; the corolla conſiſts of five petals; and the berry has five ſeeds.

Species. There are five ſpecies of aralia, all natives of the Indies. The principal are, 1. The nudicaulis, having a naked ſtalk. This grows three or four feet high; the leaves have two large trifoliate lobes, which are ſawed on their edges. The flower-ſtalks ariſe between theſe, immediately from the root, and are terminated by round umbels of ſmall four-leaved flowers of a whitiſh colour. The roots of this ſpecies were brought over from North America, and ſold here for ſarſaparilla, and it is ſtill uſed as ſuch by the inhabitants of Canada; though it is very different from the true ſort. 2. The ſpinoſa, with a prickly ſtem, is a very ornamental ſhrub, and a native of Virginia. The height to which this tree will grow, if the ſoil and ſituation wholly agree with it, is about twelve feet; and the ſtem, which is of a dark brown colour, is defended by ſharp ſpines, which fall off; even the leaves, which are branching, and compoſed of many wings, and are of a pleaſant green colour, have theſe defenders, which are both crooked and ſtrong, and ſtand as guards to them till the leaves fall off in the autumn. The flowers are produced in large umbels from the ends of the branches: They are of a greeniſh yellow colour; and their general characters indicate their ſtructure. They make their appearance the end of July or beginning of Auguſt; but are not ſucceeded by ripe ſeeds in our gardens.

Propagation and culture of the ſpinoſa. This tree will what gardeners call *ſpawn*; i. e. after digging among the roots, young plants will ariſe, the broken roots ſending forth freſh ſtems; nay, if the roots are planted in a warm border, and ſhaded in hot weather, they will grow; but if they are planted in pots, and aſſiſted by a moderate warmth of dung, or tanner's bark, they will be pretty ſure of ſucceſs; ſo that the propagation of this tree is very eaſy. But the general method of propagating it, and by which the beſt plants may be had, is from ſeeds, which muſt be procured from America, for they do not ripen in Britain; and, after having obtained them, they muſt be managed in the following manner: The time that we generally receive them is in the ſpring; ſo that againſt their coming we muſt be furniſhed with a ſufficient number of large pots. Theſe, when the ſeeds are come, muſt be filled with fine mould, which, if taken from a rich border, will do very well. The ſeeds muſt be ſown in theſe pots as ſoon as poſſible after their arrival, hardly half an inch deep, and then the pots ſhould be plunged in a warm place their whole depth in the ſoil. Care muſt be taken to break the mould in the pots, and water them as often as it has a tendency to cruſt over; and if they are ſhaded in hot weather, the plants will frequently come up the firſt ſummer. But as this does not often happen, if the young plants do not appear by midſummer, the pots ſhould be taken and plunged in a ſhady place; nay, if they ſhould, there will be ſtill more occaſion for this being done; for they will flouriſh after that better in the ſhade; and the deſign of plunging them in a warm place at firſt was only with a view of ſetting the powers of vegetation at work, that, having natural heat, artificial ſhade alſo may be given them, and water likewiſe, the three grand neceſſaries for the purpoſe. The pots, whether the plants are come up in them or not, ſhould be removed into ſhelter in October, either into a greenhouſe, ſome room, or under an hotbed-frame; and in the ſpring, when all danger of froſt is over, they ſhould be plunged into the natural ground their own depth in a ſhady place. Thoſe that were already come up will have ſhot ſtrong by the autumn following; and if none of them have appeared, they will come up this ſpring; and whether they are young ſeedlings, or ſmall plants of a former ſummer's growth, they muſt be conſtantly kept clean of weeds, and duly watered in the time of drought; and this care muſt be obſerved until the autumn. In October they muſt again be removed into ſhelter, either into a greenhouſe, &c. as before, or fixed in a warm place, and hooped, that they may be covered with mats in froſty weather. In the latter end of March following, they ſhould be planted in the nurſery way, to gain ſtrength before they are finally planted out. The ground for this purpoſe, beſides the natural ſhelter, ſhould have a reed hedge, or ſomething of the like nature, the more effectually to prevent the piercing winds from deſtroying the young plants. In this ſnug place the plants may be ſet in rows: in each of which rows furze-buſhes ſhould be ſtuck the whole length; and all theſe together will enſure their ſafety. But here one caution is to be obſerved; not to ſtick the furze ſo thick, but that the plants may enjoy the free air in mild weather, and not to take them away too early in the ſpring, leſt, being kept warm the whole winter, and being deprived of their protection, a cutting froſt ſhould happen, as it ſometimes does even in April, and deſtroy them. Weeding and watering in dry weather muſt be their ſummer's care. They may be ſtuck again with furze-buſhes in the winter; though it will not be neceſſary to do it in ſo cloſe a manner; and with this care, ſtill diminiſhing in proportion the number of furze-buſhes, they may continue for three or four years, when they may be planted out into the warmeſt parts of the plantation. With this management theſe plants will be inured to bear our winters in well-ſheltered places.

The ſpines which grow on the branches and the leaves admoniſh us, for our own ſafety, not to plant this tree too near the ſides of frequented walks; and the conſideration of the nature of the tree, which is rather tender at the beſt, directs us (if we have a mind to retain the ſort) to plant it in a warm and well-ſheltered ſituation; where the piercing froſts, come from what point they will, will loſe their edge: for without this, they will be too tender to ſtand the teſt of a ſevere winter; though it has often happened, that after the main ſtem of the plant has been deſtroyed, it has ſhot out again from the root, and the plant by that means been both increaſed and preſerved.

ARAM, or *Aramæa Regio*, (anc. geog.) the Hebrew name of Syria, ſo called from Aram the ſon of Shem, (Moſes, Joſephus.)

Aram Beth-Rehob, (anc. geog.) was that part of Syria lying to the north of Paleſtine; becauſe Rehob was its boundary towards that quarter, (Moſes); allotted to the tribe of Aſher, (Judges); where it joins Sidon, (Joſhua).

Aram-Dammeſek, or Syria Damaſcena, (anc. geog.) a principal part of Syria, and more powerful than the reſt, (2 Sam.) taking its name from Damaſcus, the principal city.

Aram-Maacha, (anc. geog.) a diſtrict of Syria, at the foot of mount Hermon, (2 Samuel, 1 Chronicles); on the borders of the half tribe of Manaſſeh, on the other ſide the Jordan, called the coaſt of *Maachathi*, (Moſes, Joſhua.)

Aram-Naharaim, (anc. geog.) i. e. Aram, or Syria of the Rivers, or Meſopotamia, ſituated between the Euphrates and Tigris; which is the reaſon of the name.

Aram-Soba, or *Zoba*, (anc. geog.) which David conquered, was a country near the Euphrates, where afterwards Palmyra ſtood: the Euphrates bounded it on the eaſt, as the land of Canaan and Syria Damaſcena did on the weſt, (2 Samuel.)

ARAMONT, a town of Languedoc in France, ſeated on the river Rhone. E. Long. 4. 52. N. Lat. 43. 54.

ARANEA, the SPIDER; a genus of inſects belonging to the order of aptera, or inſects without wings. All the ſpecies of ſpiders have eight legs, with three joints in each, and terminating in three crooked claws; eight eyes, two before, two behind, and the reſt on the ſides of the head. In the fore-part of the head, at the mouth, there is a pair of ſharp crooked claws or forceps: theſe ſtand horizontally; and, when not exerted for uſe, are concealed in two caſes contrived for their reception, in which they fold like a claſp-knife, and there lie between two rows of teeth. A little below the point of each claw, there is a ſmall hole, through which Liewenhoeck ſuppoſes the ſpider emits a kind of poiſon (A.) Theſe claws are the weapons with which they kill flies, &c. for their food. The belly or hinder part is ſeparated from the head and breaſt by a ſmall thread-like tube. The ſkin or outer ſurface is a hard poliſhed cruſt.

Spiders have five tubercles or nipples at the extremity of the belly, whoſe apertures they can enlarge or contract at pleaſure. It is through theſe apertures that they ſpin a gluey ſubſtance with which their bellies are full. They fix the end of their threads by applying theſe nipples to any ſubſtance, and the thread lengthens in proportion as the animal recedes from it. They can ſtop the iſſuing of the threads by contracting the nipples, and re-aſcend by means of the claws on their feet, much in the ſame manner as ſome men warp up a rope. When the common houſe-ſpider begins her web, ſhe generally chooſes a place where there is a cavity, ſuch as the corner of a room, that ſhe may have a free paſſage on each ſide, to make her eſcape in caſe of danger. Then ſhe fixes one end of her thread to the wall, and paſſes on to the other ſide, dragging the thread along with her (or rather the thread follows her as ſhe proceeds), till ſhe arrives at the other ſide, and there fixes the other end of it. Thus ſhe paſſes and repaſſes, till ſhe has made as many parallel threads as ſhe thinks neceſſary for her purpoſe. After this, ſhe begins again and croſſes theſe by other parallel threads, which may be named the *woof*. Theſe are the toils or ſnares which ſhe prepares for entangling flies, and other ſmall inſects, which happen to light upon it. But, beſides this large web, ſhe generally weaves a ſmall cell for herſelf, where ſhe lies concealed watching for her prey. Betwixt this cell and the large web ſhe has a bridge of threads, which, by communicating with the threads of the large one, both give her early intelligence when any thing touches the web, and enables her to paſs quickly in order to lay hold of it. There are many other methods of weaving peculiar to different ſpecies of ſpiders; but as they are all intended

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(A) Dr Mead, in his Eſſay on Poiſons, diſſents wholly from this opinion, having never been able, on repeated examinations, to diſcover any ſuch opening, not even in the claws of the largeſt foreign ſpiders; which being above fifty times bigger than any of the European ſpiders, would more eaſily have afforded a view of this opening, if nature had allotted any to this part of the animal. Beſides, repeated obſervations alſo convinced him that nothing dropped out of the claws, which were always dry while the ſpider bit any thing, but that a ſhort white proboſcis was at the ſame inſtant thruſt out of the mouth, which inſtilled a liquor into the wound. And the ſame author obſerves, that the quantity of liquor emitted by our common ſpiders when they kill their prey, is viſibly ſo great, and the wounding weapons ſo minute, that they ſhould contain but a very inconſiderable portion thereof, if it were to be diſcharged that way. Baker's Microſcope, p. 196. Spiders frequently caſt their ſkins, which may be found in the webs perfectly dry and tranſparent; and from ſuch ſkins the forceps, or claws, for they are always ſhed with the ſkins, may eaſier be ſeparated, and examined with much greater exactneſs, than in the common ſpider while living.

ed for the ſame purpoſe, it is needleſs to give particular deſcriptions of them.

That darting-out of long threads, however, which has been obſerved by naturaliſts, and by means of which ſome ſpecies can convey themſelves to great diſtances, deſerves particular notice.

Dr Liſter tells us, that attending cloſely to a ſpider weaving a net, he obſerved it ſuddenly to deſiſt in the mid-work: and turning its tail to the wind, it darted out a thread with the violence and ſtream we ſee water ſpout out of a jet: this thread, taken up by the wind, was immediately carried to ſome fathoms long; ſtill iſſuing out of the belly of the animal. By-and-by the ſpider leaped into the air, and the thread mounted her up ſwiftly. After this diſcovery, he made the like obſervation in near thirty different ſorts of ſpiders; and found the air filled with young and old, ſailing on their threads, and doubtleſs ſeizing gnats and other inſects in their paſſage, their being often manifeſt ſigns of ſlaughter, legs and wings of flies, &c. on theſe threads, as well as in their webs below. Dr Hulſe diſcovered the ſame thing about the ſame time.

Dr Liſter thinks there is a fair hint of the darting of ſpiders in Ariſtotle, Hiſt. An. lib. ix. cap. 39. and in Pliny, lib. x. cap. 74. But with regard to their ſailing, the ancients are ſilent, and he thinks it was firſt ſeen by him. He alſo obſerves of thoſe ſailing ſpiders, that they will often dart, not a ſingle thread only, but "a whole ſheaf at once, conſiſting of many filaments; yet all of one length, all divided each from the other, and diſtinct until ſome chance either ſnap them off or entangle them. But for the moſt part you may obſerve that the longer they grow, the more they ſpread, and appear to a diligent obſerver like the numerous rays in the tail of a blazing ſtar. As for that which carries them away in the air, ſo ſwift off-hand, it is (as I have already hinted) partly their ſudden leap; partly the length and number of the threads projected, the ſtream of the air and wind beating more forcibly upon them; and partly the poſture and management of their feet, which, at leaſt by ſome ſort of them, I have obſerved to have been uſed very like wings or oars, the ſeveral legs (like our fingers) being ſometimes cloſe joined, at other times opened, again bent, extended, &c. according to the ſeveral neceſſities and will of the ſailor. To fly they cannot be ſtrictly ſaid, they being carried into the air by external force; but they can, in caſe the wind ſuffer them, ſteer their courſe, and perhaps mount and deſcend at pleaſure: and to the purpoſe of rowing themſelves along the air, it is obſervable that they ever take their flight backwards; that is, their head looking a contrary way, like a ſculler upon the Thames. It is ſcarce credible to what height they will mount; which yet is preciſely true, and I think eaſily to be obſerved by one that ſhall fix his eye ſome time on any part of the heavens, the white webs, at a vaſt diſtance, very diſtinctly appearing from the azure ſky; but this is in autumn only, and that in very fair and calm weather." In a letter to Mr Ray, dated January 1670, ſpeaking of the height ſpiders are able to fly to, he ſays, "Laſt October, &c. I took notice, that the air was very full of webs; I forthwith mounted to the top of the higheſt ſteeple on the Minſter (in York), and could there diſcern them yet exceeding high above me."

He further obſerves, that they not only thus ſhoot their threads upward, and mount with it in a line almoſt perpendicular; they alſo project them in a line parallel to the horizon, as may be ſeen by their threads running from one wall to another in a houſe, or from one tree to another in the field, and even from wall to wall acroſs gardens of conſiderable extent.

The matter of which the ſpider's threads are formed, we have obſerved, is a viſcid juice, elaborated in the body of the animal, and emitted from papillæ ſituated at the extremity of the belly; which papillæ are furniſhed with numerous apertures that do the buſineſs of wire-drawers, as it were, in forming the threads. Of theſe apertures Mr. Reaumur obſerves, there are enough in the compaſs of the ſmalleſt pin's head to yield a prodigious quantity of diſtinct threads. The holes are perceived by their effects: take a large garden-ſpider ready to lay its eggs, and applying the finger on a part of its papillæ, as you withdraw that finger it will take with it an amazing number of different threads. M. Reaumur has often counted 70 or 80 with a microſcope, but has perceived that there were infinitely more than he could tell. In effect, if he ſhould ſay that each tip of a papillæ furniſhed a thouſand, he is perſuaded he would ſay much too little. The part is divided into an infinity of little prominences, like the eyes of a butterfly, &c. Each prominence no doubt makes its ſeveral threads; or rather between the ſeveral protuberances there are holes that give vent to threads; the uſe of the protuberances, in all probability, being to keep the threads at their firſt exit, before they are yet hardened by the air, aſunder. In ſome ſpiders thoſe protuberances are not ſo ſenſible; but in lieu thereof there are tufts of hair which may ſerve the ſame office, viz. to keep the threads a-part. Be this as it will, there may threads come out at above a thouſand different places in every papillæ; conſequently the ſpider, having five papillæ, has holes for above five thouſand threads.

Such is the tenuity of the threads in the larger ſort of ſpiders. But if we examine the young produced by thoſe, we ſhall find that they no ſooner quit their egg than they begin to ſpin. Indeed their threads can ſcarce be perceived, but the webs may: they are frequently as thick and cloſe as thoſe of houſe ſpiders; and no wonder, there being often four or five hundred little ſpiders concurring in the ſame work. How minute muſt their holes be! the imagination can ſcarce conceive that of their papillæ! The whole ſpider is perhaps leſs than a papilla of the parent which produced it. But there are even ſome kinds of ſpiders ſo ſmall at their birth, that they are not viſible without a microſcope. There are uſually found an infinity of theſe in a cluſter, and they only appear like a number of red points: And yet there are webs found under them, though well nigh imperceptible. What muſt be the tenuity of one of theſe threads? Mr Lievenhoek has computed that 100 of the ſingle threads of a full grown ſpider are not equal to the diameter of the hair of his beard; and conſequently, if the threads and hair be both round, ten thouſand ſuch threads are not bigger than ſuch a hair. He calculates further, that when young ſpiders firſt begin to ſpin, four hundred of them are not larger than one which is of a full growth; allowing which, four millions of a young ſpider's threads are not ſo big as the ſingle hair of a man's beard.

Garden-ſpiders, particularly the ſhort-legged ſpecies, yield a kind of ſilk, which has by ſome been judged ſcarce inferior to that of the ſilk-worm. Mr Bon of Languedoc, about 70 years ago, contrived to manufacture from it a pair of ſilk ſtockings and mittens, of a beautiful natural grey colour, which were almoſt as handſome and ſtrong as thoſe made with common ſilk: And he publiſhed a diſſertation concerning the diſcovery. But M. Reaumur, being appointed by the Royal Academy to make a farther enquiry into this new ſilk-work, raiſed ſeveral objections and difficulties againſt it, which are found in the Memoirs of the Academy for the year 1710. The ſum of what he has urged amounts to this. The natural fierceneſs of the ſpiders renders them unfit to be bred and be kept together. Four or five thouſand being diſtributed into cells, fifty in ſome, one or two hundred in others, the big ones ſoon killed and eat the leſs, ſo that in a ſhort time there were ſcarce left one or two in each cell; and to this inclination of mutually eating one another M. Reaumur aſcribes the ſcarcity of ſpiders, conſidering the vaſt number of eggs they lay.

But this is not all: he even affirms that the ſpider's bag is inferior to that of the ſilk-worm both in luſtre and ſtrength, and that it produces leſs matter to be manufactured. The thread of the ſpider's web, he ſays, only bears a weight of two grains without breaking; and that of the bag bears thirty-ſix. The latter, therefore, in all probability, is eighteen times thicker than the former; yet it is weaker than that of the ſilk-worm, which bears a weight of two drams and a half. So that five threads of the ſpider's bag muſt be put together to equal one thread of the ſilk-worm's bag. Now it is impoſſible theſe ſhould be applied ſo juſtly over one another as not to leave little vacant ſpaces between them, whence the light will not be reflected; and, of conſequence, a thread thus compounded muſt fall ſhort of the luſtre of a ſolid thread. Add to this, that the ſpider's thread cannot be wound off as that of the ſilk worm may, but muſt of neceſſity be carded; by which means, being torn in pieces, its evenneſs, which contributes much to its luſtre, is deſtroyed. In effect, this want of luſtre was taken notice of by M. de la Hire, when the ſtockings were preſented to the academy. Again, ſpiders furniſh much leſs ſilk than the worms: the largeſt bags of theſe latter weigh four grains, the ſmaller three grains; ſo that 2304 worms produce a pound of ſilk. The ſpider-bags do not weigh above one grain; yet when cleared of their duſt and filth, they loſe two-thirds of their weight. The work of twelve ſpiders, therefore, only equals that of one ſilk-worm; and a pound of ſilk will require at leaſt 27,648 ſpiders. But as the bags are wholly the work of the females, who ſpin them to depoſit their eggs in, there muſt be kept 55,296 ſpiders to yield a pound of ſilk. Yet will this only hold of the beſt ſpiders; thoſe large ones ordinarily ſeen in gardens, &c. ſcarce yielding a twelfth part of the ſilk of the others. Two hundred and eighty of theſe, he ſhows would not yield more than one ſilk-worm; 663,552 of them would ſcarce yield a pound.

The act of generation among ſpiders varies in different ſpecies. As theſe inſects prey upon each other, except during the time of their amours, they dare not come within reach of one another but with the utmoſt caution. They may ſometimes be ſeen ſtretching out their legs, ſhaking the webs, and tampering with each other by a ſlight touch with the extremity of their feet; then, in a fright, dropping haſtily down their thread, and returning in a few moments to make freſh trial by feeling. When once both parties are well aſſured of the ſex they have to deal with, the approaches of their feet, in order to feel, become more frequent, confidence takes place, and the inſtant of amorous dalliance enſues. "We cannot," ſays Lyonnet, "but admire how careful they are not to give themſelves up blindly to a paſſion, or venture on an imprudent ſtep, which might become fatal to them." A caveat this to the human kind. Liſter and Lyonnet, two accurate obſervers, ſay, that the extremity of thoſe arms, or claws, which the ſpider uſes to graſp his prey with, ſuddenly opens, as it were by a ſpring, and lets out a white body, which the male applies beneath the abdomen of the female to fulfil the wiſh of nature. In the water-ſpider, the ſexual organs are ſituated at the hinder parts of the male, are curve, and act as it were by a ſpring; thoſe of the females are diſtinct. Nature by a thouſand varied methods accompliſhes her purpoſe.

Spiders frequently change their colour, which varies much, in reſpect to ſeaſon, ſex, age, &c. but they are in general more beautifully variegated in autumn, a ſeaſon not only the moſt opportune and plentiful repecting their prey, but the time when they arrive at their greateſt magnitude, and are in their height of vigour.

The ſpecies of aranea enumerated by naturaliſts amount to upwards of 50; of which it may here ſuffice to mention a few of the moſt remarkable.

1. The calycina, with a round pale yellow belly, and two hollow points. It lives in the cups of flowers, af- the flower-leaves have fallen off; and catches bees, and other flies, when they are in ſearch of honey.

2. The avicularia, has a convex round breaſt, hollowed tranſverſely in the middle. It is a native of America, and feeds upon ſmall birds, inſects, &c. The bite of this ſpider is as venomous as that of the ſerpent.

3. The ocellata, has three pair of eyes on its thighs. It is about the ſame ſize with the tarantula, of a pale colour, with a black ring round the belly, and two large black ſpots on the ſides of the breaſt. It is a native of China.

4. The Saccata, has an oval belly, of a duſky iron colour. It lives in the ground, and carries a ſack with its eggs where-ever it goes. This ſack it glues to its belly, and will rather die than leave it behind.

5. Diadema is the largeſt ſpider which this country produces. The abdomen is of an oval form, downy, and of a ruddy yellow colour, which is very variable in different ſeaſons; being ſometimes paler, at others very dark coloured. The upper part is beautifully adorned with black and white circles and dots, having a longitudinal band in the middle, compoſed of oblong and oval-ſhaped pearl-coloured ſpots, ſo arranged as to reſemble a fillet, ſimilar to thoſe worn by the eaſtern kings. The ground upon which this fillet, and the white dots are laid, when viewed with a glaſs, and the ſun ſhining thereon, is beautiful and rich beyond all deſcription. There are varieties in colour of this ſpider

der when young: ſome have their abdomen purple, ornamented with white dots, the legs yellow and annulated with a deeper colour: others have their abdomen of a fine red likewiſe ornamented with white, but the legs of a fine pale green colour: annulated with dark purple or black. It inhabits the birch-tree.

6. The cucurbitina, has a globular yellow belly, with a few black ſpots. It lives in the leaves of trees, and incloſes its eggs in a ſoft net.

7. The labyrinthica, with a duſky oval belly, a whitiſh indented line, and a forked anus. The web of this ſpecies is horizontal, with a cylindrical well or tube in the middle.

8. The fimbriata, has a black oblong belly, with a white line on each ſide, and duſky-coloured legs. It lives in water, upon the ſurface of which it runs with great ſwiftneſs.

9. The holoſericea, has an ovaliſh belly covered with a down-like velvet; at the baſe, or under part, it has two yellow ſpots. It is found in the folded leaves of plants.

10. The viatica, or wanderer, is generally of a yellow colour more or leſs deep. Sometimes it is whitiſh and even rather green. The abdomen is large, broad, almoſt ſquare, with two bands of dark orange, which ariſing from the thorax deſcend obliquely on the ſides towards the middle. Between the bands are a few ſmall black dots forming a kind of triangle upon the middle of the abdomen. On the thorax are ſeen two longitudinal bands ſomewhat green, one on each ſide. The two foremoſt pair of legs are very long, and the hinder ſhort; which makes it walk like a crab. It is found upon plants; and is a lively, active, indefatigable hunter. Without any motion of the head, which is furniſhed with immovable eyes, it perceives all the flies that hover round about, does not ſcare them, but ſtretches over them its arms furniſhed with feathers, which prove nets in which their wings intangle. It is ſaid to ſit on its eggs; which however it often carries about with it, wrapt up in a ball of white ſilk.

11. The aquatica, is of a livid colour, with an oval belly, and a tranſverſe line, and two hollowed points. It frequents the freſh waters of Europe. But it is in ſome ſort amphibious: for it can live on land as well as in the water, and comes often on ſhore for its food; yet it ſwims well in water, both on its belly and back; it is diſtinguiſhable by its brightneſs. In the water its belly appears covered with a ſilver varniſh, which is only a bubble of air attached to the abdomen by means of the oily humours which tranſpire from its body, and prevent the immediate contact of the water. This bubble of air is made the ſubſtance of of its dwelling, which it conſtructs under water; for it fixes ſeveral threads of ſilk, or ſuch fine matter, to the ſtalks of plants in the water; and then aſcending to the ſurface, thruſts the hinder part of its body above water, drawing it back again with ſuch rapidity, that it attaches underneath a bubble of air, which it has the art of detaining under water, by placing it underneath the threads abovementioned, and which it binds like a covering almoſt all around the air-bubble. Then it aſcends again for another air-bubble; and thus proceeds until it has conſtructed a large aerial apartment under water, which it enters into or quits at pleaſure. The male conſtructs for himſelf one near to the female; and when love invites, he breaks through the thread walls of the female's dwelling, and the two bubbles attached to the bellies of both unite into one, forming one large nuptial chamber. The female is ſometimes laid for a whole day together ſtretched on her back, waiting for the arrival of the male, without motion, and ſeemingly as if dead. As ſoon as he enters and glides over her, ſhe ſeems to be brought to life again, gets on her legs and runs after the male, who makes his eſcape with all poſſible ſpeed. The female takes care of the young, and conſtructs ſimilar apartments on purpoſe for them. The figure of this ſpider has nothing remarkable; and would be overlooked among a croud of curioſities, if the ſpectator be unacquainted with its ſingular art of conſtructing an aerial habitation under water, and thus uniting together the properties of both elements. It lodges during the winter in empty ſhells, which it dexterouſly ſhuts up with a web.

12. The faſciata, with yellow bands round the belly, and duſky rings on the legs, is a native of Barbary, and is as large as the thumb. It inhabits hedges and thickets: its webs have large meſhes, and it reſides in the centre. The ſnares are ſpread for large flies, waſps, drones, and even locuſts: the leſſer inſects can eſcape through the meſhes. The animal which it entangles is ſoon bound with ſtrong threads; killed by the ſpider's jaws; and partly eat, if the ſpider is hungry: the reſt is concealed under ſome neighbouring dry leaves, covered with a kind of web and a blackiſh glue in great abundance. Its larder is ſaid to be often plentifully ſtored: —Its neſt is of the ſize of a pigeon's egg, divided horizontally, and ſuſpended by the threads of the inſect, which are of a ſilvery white, and ſtronger than ſilk. The young ones live in amity; but when grown up, are mortal enemies. They never meet but they fight with violence, and their battle only ends with the death of the weakeſt. The dead body is carefully ſtored in the larder. Twelve of theſe ſpiders, by way of experiment, were ſhut up together; and, after a battle of eight days, the ſtrongeſt only remained alive.

13. The tarantula, has the breaſt and belly of an aſh-colour; the legs are likewiſe aſh-coloured, with blackiſh rings on the under part; the fangs or nippers are red on the inner ſide, the reſt being blackiſh: Two of its eyes are larger than the other, red, and placed in the front; four other eyes are placed in a tranſverſe direction towards the mouth; the other two are nearer the back: It has two antennæ or feelers. It is a native of Italy, Cyprus, Barbary, and the Eaſt Indies. It lives in bare fields, where the lands are fallow, but not very hard, and from its antipathy to damp and ſhade, chooſes for its reſidence the riſing part of the ground facing the eaſt Its dwelling is about four inches deep, and half an inch wide; at the bottom it is curved, and there the inſect ſits in wet weather, and cuts its way out if water gains upon it. It weaves a net at the mouth of the hole. Theſe ſpiders do not live quite a year. In July they ſhed their ſkin, and proceed to propagation; which, from a mutual diſtruſt, as they frequently devour one another, is a work undertaken with great circumſpection. They lay about ſeven hundred and thirty eggs, which hatch in the ſpring; but the parent does not live to ſee her progeny, having expired early in the winter. The Ichneumon fly is their moſt formidable enemy.

Plate XVII. (in Vol. I.)

The bite of the tarantula is ſaid to occaſion an inflammation in the part, which in a few hours brings on ſickneſs, difficulty of breathing, and univerſal faintneſs. The perſon afterwards is affected with a delirium, and ſometimes is ſeized with a deep melancholy. The ſame ſymptoms return annually, in ſome caſes for ſeveral years; and at laſt terminate in death. Muſic, it has been pretended, is the only cure. A muſician is brought, who tries a variety of airs, till at laſt he hits upon one that urges him to dance; the violence of which exerciſe produces a proportionable agitation of the vital ſpirits, attended with a conſequent degree of perſpiration, the certain conſequence of which is a cure. Such are the circumſtances that have been generally related, and long credited, concerning the bite of this animal. Kircherus, in his *Muſurgia*, gives a very particular account of the ſymptoms and cure, illuſtrated by hiſtories of caſes. Among theſe, he mentions a girl, who, being bitten by this inſect, could be cured only by the muſic of a drum. He then proceeds to relate, that a certain Spaniard, truſting to the efficacy of muſic in the cure of the frenzy occaſioned by the bite of the tarantula, ſubmitted to be bitten on the hand by two of theſe creatures, of different colours, and poſſeſſed of different qualities. The venom was no ſooner diffuſed about his body, than the ſymptoms of the diſorder began to appear; upon which harpers, pipers, and other muſicians, were ſent for, who by various kinds of muſic endeavoured to rouſe him from that ſtupor into which he was fallen: but here it was obſerved that the bites of the two inſects had produced contrary effects; for by one he was incited to dance, and by the other he was reſtrained therefrom; and in this conflict of nature the patient expired. The ſame account is given in his *Phonurgia Nova*, with the addition of a cut reſpreſenting the inſect in two poſitions, the patient in the action of dancing, together with the muſical notes of the tune or air by which in one inſtance the cure was affected.

In his *Muſurgia*, this author, attempting mechanically to account for the cure of the bite of the tarantula by muſic, ſays of the poiſon, That it is ſharp, gnawing and bilious; and that it is received and incorporated into the medullary ſubſtance of the fibres. With reſpect to the muſic, he ſays, That the ſounds of chords have a power to rarefy the air to a certain harmonical pitch; and that the air thus rarefied, penetrating the pores of the patient's body, affects the muſcles, arteries, and minute fibres, and incites him to dance; which exerciſe begets a perſpiration, in which the poiſon evaporates.

Unſatisfactory as this theory appears, the belief of this ſtrange phenomenon has prevailed among the ableſt of modern phyſicians. Sir Thomas Brown, ſo far from diſputing it, ſays, That ſince many atteſt the fact from experience, and that the learned Kircherus hath poſitively averred it, and ſet down the ſongs and tunes ſolemnly uſed for the cure of the diſeaſe, and ſince ſome alſo affirm that the tarantula itſelf will dance at the ſound of muſic, he ſhall not at all queſtion it*. Farther, that eminent Italian phyſician of the laſt century, Baglivi, a native of Apulia, the country where the tarantula is produced, has written a diſſertation *De anatomia, morſu, et effectibus tarantulæ*. In this he deſcribes the region of Apulia where the tarantula is produced, with the anatomy and figure of the inſect and its eggs, illuſtrated by an engraving; he mentions particularly the ſymptoms that follow from the bite, and the cure of the diſeaſe by muſic, with a variety of hiſtories of cures thus wrought, many of them communicated by perſons who were eye-witneſſes of the proceſs.

Ludovicus Valetta, a Celeſtine monk of Apulia, publiſhed at Naples, in the year 1706, a treatiſe upon this ſpider, in which he not only anſwers the objections of thoſe who deny the whole thing, but gives, from his own knowledge, ſeveral inſtances of perſons who had ſuffered this way, ſome of whom were of great families, and ſo far from being diſſemblers, that they would at any rate, to avoid ſhame, have concealed the misfortune which had befallen them.

The honourable Mr Robert Boyle, in his treatiſe of Languid and Unheeded Motions, ſpeaking of the bite of the tarantula, and the cure of the diſeaſe which follows it by means of muſic, ſays, That, having himſelf had ſome doubts about the matter, he was, after ſtrict inquiry, convinced that the relations in the main were true.

Laſtly, Dr Mead, in his Mechanical Account of Poiſons, has given an eſſay on the tarantula, containing the ſubſtance of the above relations, which he endeavours to confirm by his own reaſoning thereon.

Notwithſtanding the number and weight of theſe authorities, and the general acquieſcence of learned and ingenious men in the opinion that the bite of the tarantula is poiſonous, and that the cure of the diſorder occaſioned by it is effected by muſic, we have reaſon to apprehend that the whole is a miſtake.

In the Philoſophical Tranſactions for the year 1672, p. 406, is an extract of a letter from Dr Thomas Cornelio, a Neapolitan phyſician, to John Doddington, Eſq; his majeſty's reſident at Venice, communicated by the latter, in which, ſpeaking of his intention to ſend to Mr Doddington ſome tarantulas, he ſays, "Mean while I ſhall not omit to impart to you what was related to me a few days ſince by a judicious and unprejudicate perſon; which is, that being in the country of Otranto, where thoſe inſects are in great numbers, there was a man, who, thinking himſelf ſtung by a tarantula, ſhowed in his neck a ſmall ſpeck, about which in a very ſhort time there aroſe ſome pimples full of a ſerous humour; and that in a few hours after, the poor man was ſorely afflicted with very violent ſymptoms, as ſyncopes, very great agitations, giddineſs of the head, and vomiting; but that, without any inclination at all to dance, and without a deſire of having any muſical inſtruments, he miſerably died within two days. The ſame perſon affirmed to me, that all thoſe that think themſelves bitten by tarantulas, except ſuch as for evil ends feign themſelves to be ſo, are for the moſt part young wanton girls, whom the Italian writers call *Dolce di Sale*; who, by ſome particular indiſpoſition falling into this melancholy madneſs, perſuade themſelves, according to the vulgar prejudice, to have been ſtung by a tarantula."

Dr Serao, an Italian phyſician, has written an ingenious book, in which he has effectually exploded this opinion as a popular error; and in the Philoſophical Tranſactions, N° LX. for the year 1770, p. 236, is a letter from Dominico Cirillo, M. D. pro-

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* *Inquiries into Vulgar Errors*, B. iii. c. 28.

feſſor of natural hiſtory in the univerſity of Naples, wherein, taking notice of Serao's book, he ſays, That having had an opportunity of examining the effects of this animal in the provine of Taranto, where it is found in great abundance, he finds that the ſurpriſing cure of the bite of the tarantula by muſic has not the leaſt truth in it; and that it is only an invention of the people, who want to get a little money by dancing when they ſay the tarantiſm begins. He adds, "I make no doubt but ſometimes the heat of the climate contributes very much to warm their imaginations, and throw them into a delirium, which may be in ſome meaſure cured by muſic; but ſeveral experiments have been tried with the tarantula, and neither men nor animals after the bite have had any other complaint than a very trifling inflammation upon the part, like that produced by the bite of a ſcorpion, which goes off by itſelf without any danger at all. In Sicily, where the ſummer is ſtill warmer than in any part of the kingdom of Naples, the tarantula is never dangerous; and muſic is never employed for the cure of the pretended tarantiſm."

Mr Swinburn, when in the country of the tarantula, was deſirous of inveſtigating minutely every particular relative to that inſect; but the ſeaſon was not far enough advanced, and no *tarantati* (perſons bitten, or pretending to be bitten, by the tarantula) had begun to ſtir. He prevailed, however, upon a woman who had formerly been bitten, to act the part, and dance the tarantata before him. A great many muſicians were ſummoned, and ſhe performed the dance, as all preſent aſſured him, to perfection. At firſt ſhe lolled ſtupidly on a chair, while the inſtruments were playing ſome dull muſic. They touched, at length, the chord ſuppoſed to vibrate to her heart; and up ſhe ſprang with a moſt hideous yell, ſtaggered about the room like a drunken perſon, holding a handkerchief in both hands, raiſing them alternately, and moving in very true time. As the muſic grew briſker, her motions quickened, and ſhe ſkipped about with great vigour and variety of ſteps, every now and then ſhrieking very loud. The ſcene was far from pleaſant; and, at his deſire, an end was put to it before the woman was tired. Wherever the tarantati are to dance, he informs us, a place is prepared for them, hung round with bunches of grapes and ribbons. The patients are dreſſed in white, with red, green, or yellow ribbons, for thoſe are their favourite colours; on their ſhoulders they caſt a white ſcarf, let their hair fall looſe about their ears, and throw their heads as far back as they can bear it. They are exact copies of the ancient prieſteſſes of Bacchus. The orgies of that god, whoſe worſhip, under various ſymbols, was more widely ſpread over the globe than that of any other divinity, were no doubt performed with energy and ethuſiaſm by the lively inhabitants of this warm climate. The introduction of Chriſtianity aboliſhed all public exhibitions of theſe heatheniſh rites, and the women durſt no longer act a frantic part in the character of Bacchantes. Unwilling to give up ſo darling an amuſement, they deviſed other pretences; and poſſeſſion by evil ſpirits may have furniſh them with one. Accident may alſo have led them to a diſcovery of the tarantula; and, upon the ſtrength of its poiſon, the Puglian dames ſtill enjoy their old dance, though time has effaced the memory of its ancient name and inſtitution: and this Mr Swinburn takes to be the origin of ſo ſtrange a practice. If at any time theſe dances are really and involuntarily affected, he ſuppoſes it can be nothing more than an attack upon their nerves, a ſpecies of St Vitus's dance: and he inclines the more to the idea, as there are numberleſs churches and places throughout theſe provinces dedicated to that ſaint.

Many ſenſible people of the country, however, differ in opinion from Dr Serao and other authors, who have ridiculed the pretended diſorder, and affirmed that the venom of this ſpecies of ſpider can produce no effects but ſuch as are common to all others. The Brindiſians ſay, that the tarantulas ſent to Naples for the experiment were not of the true ſort, but a much larger and more innocent one; and that the length of the journey, and want of food, had weakened their power ſo much, as to ſuffer the Doctor or others to put their arm into the bag where they were kept with impunity. They quote many examples of perſons bitten as they ſlept out in the fields during the hot months, who grew languid, ſtupid, deprived of all courage and elaſticity, till the ſound of ſome favourite tune rouſed them to dance, and throw off the poiſon. Theſe arguments of theirs, however, Mr Swinburn thinks of little weight: for they acknowledged that elderly perſons were more frequently infected than young ones; and that moſt of them were women, and thoſe unmarried. No perſon above the loweſt rank in life was ever ſeized with this malady, nor is there an inſtance of its cauſing death. The length of the dance, and the patient's powers of bearing ſuch exceſſive fatigue in the canicular ſeaſon, prove nothing; becauſe every day, at that time of the year, peaſants may be ſeen dancing with equal ſpirit and perſeverance, though they do not pretend to be ſeized with the tarantiſm. The illneſs may therefore be attributed to hyſterics, exceſſive heat, ſtoppage of perſpiration, and other effects of ſleeping out of doors in a hot ſummer air, which is always extremely dangerous, if not mortal, in moſt parts of Italy. Violent exerciſe may have been found to be a certain cure for this diſorder, and continued by tradition, though the date and circumſtances of this diſcovery have been long buried in oblivion; a natural paſſion for dancing, imitation, cuſtom of the country, and a deſire of raiſing contributions upon the ſpectators, are probably the real motives that inſpire the tarantati. Before Serao's experiments, the tarantula had been proved to be harmleſs, from trials made in 1693 by Clarizio, and in 1740 at Lucera by other naturaliſts.

ARANJUEZ, a town in the province of New Caſtile, where the king of Spain has a palace and gardens which are reckoned the moſt delightful in the world.

This place is 20 miles from Madrid, by a noble road, planted on each ſide with trees, lately made at the expence of 120,000l. Sterling. It is delightfully ſituated at the conflux of the rivers Tagus and Jarama; which run through the gardens, and add new beauty to this charming ſpot, where art and nature ſeem to go hand in hand with the moſt pleaſing and rural ſimplicity. On one ſide, fine avenues of ſtately oaks and lofty elms convey the trueſt ideas of magnificence, while they afford the moſt reviving ſhade; on the other, the ſudden tranſitions to lawns and wilderneſs,

neſs, the caſcades of water breaking through the thickets, the tuneful ſongs of numberleſs birds ſheltered in theſe cool receſſes, the occaſional appearance and paſſage of the monarch attended by the grandees of his kingdom ; all theſe objects united, and concentered in one point, fill the imagination with pleaſing ideas, and impreſs the mind of a traveller with a thouſand agreeable ſenſations.

The general ſituation is in a very large plain ſurrounded with large hills, of a moſt diſagreeable aſpect indeed, but ſeldom appearing, being well hidden by the noble rows of trees that extend acroſs the flat in every direction. The main body of the palace is an old building, to which have been lately added two new wings. The firſt part of the building was erected by Philip II. who purchaſed the eſtate, planted many of the avenues, and, in order to extend his chaſe, or to indulge his ſplenetic diſpoſition, had all the vines that grew on the hills rooted up. By that means he drove away the inhabitants, and rendered the environs of his villa a perfect deſart.—The apartments are good; but contain nothing very particular to take off from the enjoyment of ſo many fine objects abroad. In one of the new wings is a play-houſe, and in the other a chapel. Part of the ceiling of the former was painted by Mengs, who was alſo ſent to Rome to paint a holy family for the principal altar in the chapel. There are ſeven fine pictures of Luca Jordano in the apartment called El Cabinete Antiguo, and ſix others in that De los Mayordomos. The portraits of the grand duke and ducheſs of Tuſcany, by Mengs, are in a new apartment called the *king's dreſſing-room.* In the chapel, over the great altar, there is a fine picture of the Annunciation, by Titian, preſented to him by Charles V. and brought from the convent of Juſte, after the death of that emperor. The porcelain cabinet, where there are ſeveral large pieces of the king's own manufactory, is alſo an object of curioſity to a traveller.

As to the gardens, the whole of them may be thrown into three grand diviſions, diſtinguiſhed by the names of La Huerta Valenciana, Los Deleites, and El Cortijo. In the Huerta Valenciana, agriculture and gardening are carried on in the ſame manner as in that fruitful province, and they plough with horſes. In the Cortijo they uſe oxen, as in Andaluſia ; and in other places they ſcratch up the ground with mules, as is ſtill practiſed in ſome parts of Spain. Which ever way one looks round, a conſtant variety pleaſes the eye, and enraptures the mind. At one moment the ſturdy buffalo moves before you, drawing his heavy burden ; ſoon after, the ſlow camel, with his ponderous load ; while the ſwift zebra with his ſtriped garment friſks over the plains. If you approach the farm, every object of convenience is conſulted, and in the dairy every degree of neatneſs. The Dutch cow enjoys a luxuriant paſture, the brood mares greatly enliven the landſcape, and ſtables are filled with the moſt excellent horſes. And an immenſe nurſery furniſhes all manner of trees and plants. The fine avenue, which ſerves alſo for a public walk, called Calle de Reyna, has nothing equal to it at Verſailles. It is three miles long, quite ſtraight from the palace gate, croſſing the Tagus twice before it loſes itſelf in the thickets, where ſome noble ſpreading elms and weeping poplars hang beautifully over the deep ſtill pool. Near this road is a flower-garden for the ſpring, laid out with great taſte by Mr Wall during his miniſtry. The gay variety of flowers at this time of year is particularly pleaſing to the eye; but its beauty ſoon fades on the approach of ſummer. As the weather grows hot, the company that chooſes to walk retires to a garden in an iſland of the Tagus, on the north ſide of the palace. This is an heavenly place, cut into various walks and circular lawns, which in their primitive ſtate may have been very ſtiff and formal : but in the courſe of a century, Nature has obliterated the regular forms of art ; the trees have ſwelled out beyond the line traced for them, and deſtroyed the enfilade by advancing into the walls or retiring from them. The ſweet flowering-ſhrubs, inſtead of being clipped and kept down, have been allowed to ſhoot up into trees, and hang over the ſtatues and fountains they were originally meant to ſerve as humble fences to. The jets-d'eau daſh up among the trees, and add freſh verdure to the leaves. The terraces and baluſtrades built along the river, are now overgrown with roſes, and other luxuriant buſhes, hanging down into the ſtream, which is darkened by the large trees growing on the oppoſite banks. Many of the ſtatues, groupes, and fountains, are handſome, ſome maſterly, the works of Algardi : all are placed in charming points of view, either in open circular ſpots, at a diſtance from the trees, or elſe in gloomy arbours, and retired angles of the wood. The banks of this wood, called the Ila, are alſo enlivened by elegant yachts for the amuſement of the royal family.

The town or village formerly conſiſted of the palace, its offices, and a few miſerable huts, where the ambaſſadors, and the attendants of the court, endeavoured to lodge themſelves as well as they could, but always very uncomfortable ; many of the habitations were vaults half under ground. What determined the king to build a new town, and to embelliſh the environs, was an accident that happened at the nuncio's ; a coach broke through the cieling of his dining-room, and fell in upon the table. The court then began to apply very conſiderable ſums to the purpoſe of errecting proper dwellings for the great number of perſons that flock to the place where the ſovereign reſides ; near 10,000 are ſuppoſed to live here two or three months in ſpring ; the king keeps 115 ſets of mules, which require a legion of men to to take care of them. Above a million Sterling has been laid out at Aranjuez ſince the year 1763 ; and it muſt be acknowledged, that wonders have been performed : ſeveral fine ſtreets drawn in ſtraight lines with broad pavements, a double row of trees before the houſes, and a very noble road in the middle ; commodious hotels for the miniſters and ambaſſadors ; great ſquares, markets, churches, a theatre, and an amphitheatre for bull-feaſts, have been raiſed from the ground ; beſides the acceſſion of two new wings to the palace. Neatneſs and convenience have been more ſtudied and ſought for than ſhow in the architecture, but altogether the place has ſomething truly magnificent in the coup d'œil.

ARAR, (Cæſar, Strabo) ; *Araris,* (Dio Caſſius) ; *Saucona,* (Ammian) : A river of Celtic Gaul, now the *Saone ;* which riſes out of mount Vogeſus on the confines of Lorrain, runs through the Franche Comte and Burgundy, and below Lyons falls into the Rhone. It is ſo incredibly ſlow, that the eye cannot diſtinguiſh which

Ararat.

Ararat, Aratus.

which way it moves, (Cæſar); and therefore Pliny calls it the *Sluggiſh river*. Its courſe is from north to ſouth. It is famous for a bridge of Cæſar, which was built by the ſoldiers in one day. It is navigable equally with the Rhone.

ARARAT, the name of the mountain on which Noah's ark reſted, after the abatement of the waters of the univerſal deluge. Concerning this mountain there are various conjectures; though it is almoſt univerſally allowed to be in Armenia Major. Some are of opinion that it is one of the mountains which divide Armenia on the ſouth from Meſopotamia and that part of Aſſyria inhabited by the *Curds*; from whom theſe mountains took the name of *Curdu* or *Cardu*; by the Greeks turned into *Gordyæi*, &c. Others, that it lies towards the middle of Armenia, near the river Araxes, above 280 miles diſtant from the abovementioned mountains, making it belong to mount Taurus; but the Armenians are poſitive that Noah's Ararat is no other than a mountain to which they now give the name of *Maſis*, which lies about 12 leagues to the eaſt of Erivan, and four leagues from the Aras. It is encompaſſed by ſeveral petty hills: on the tops of them are found many ruins, thought to have been the buildings of the firſt men, who were, for ſome time, afraid to deſcend into the plains. It ſtands by itſelf, in form of a ſugar-loaf, in the midſt of a very large plain, detached, as it were, from the other mountains of Armenia, which make a long chain. It conſiſts, properly ſpeaking, of two hills; the leſſer of which is the more ſharp and pointed: the higher, on which it is ſaid the ark reſted, lies to the north-weſt of it, and riſes far above the neighbouring mountains. It ſeems ſo high and big, that, when the air is clear, it may be ſeen four or five days journey off; yet travellers think the height is not extraordinary. Chardin is of opinion that he paſſed a part of mount Caucaſus which is higher; and Poullet thinks the height of mount Maſis, or Ararat, not above twice as great as that of mount Valerian near Paris. They therefore think that its being viſible at ſuch a great diſtance is owing to its lonely ſituation in a vaſt plain, and upon the moſt elevated part of the country, without any mountains before it to obſtruct the view. Nor is the ſnow with which it is always covered from the middle upwards any argument of its height; for, in this country, ice hath often been obſerved in the mornings of the middle of July. (See ARMENIA). Certain it is, however, that this mountain hath never yet been aſcended; which the Armenians pretend was owing to the interpoſition of angels, in order to diſappoint the curioſity of thoſe who wanted to advance to ſuch a ſacred place as that whereon the ark reſted: but the exceſs of cold may very reaſonably be ſuppoſed able to fruſtrate all ſuch attempts, without any ſupernatural interpoſition. The moſt diſtinct account we have of this mountain is that given by Mr Tournefort; which, however, being much ſwelled with immaterial circumſtances, it is needleſs to trouble our readers with at length. He tells us, that this mountain is one of the moſt diſagreeable ſights upon earth, without either houſes, convents, trees, or ſhrubs; and ſeems as if continually waſting and mouldering away. He divides it into three regions: The lowermoſt, he ſays, is the only one which contains any human creatures, and is occupied by a few miſerable ſhepherds that tend ſcabby flocks; and here are alſo found ſome partridges; the ſecond is inhabited by crows and tigers; and all the reſt is covered with ſnow, which half the year is involved in thick clouds. On the ſide of the mountain that looks towards Erivan is a prodigious precipice, from whence rocks of an immenſe ſize are continually tumbling down with a hideous noiſe. This precipice ſeems quite perpendicular; and the extremities are rough and blackiſh, as if ſmutted with ſmoke. The ſoil of the mountain is looſe, and on the ſandy parts it is impoſſible to take a firm ſtep; ſo that our traveller encountered great difficulties in his aſcent and deſcent of this mountain; being often obliged, in order to avoid the ſand, to betake himſelf to places where great rocks were heaped on one another, under which he paſſed as through caverns, or to places full of ſtones, where he was forced to leap from one ſtone to another. If we may believe Struys, a Dutch writer, however, all theſe difficulties may be ſurmounted. He aſſures us, he went five days journey up mount Ararat, to ſee a Romiſh hermit: that he paſſed through three regions of clouds; the firſt dark and thick, the next cold and full of ſnow, and the third colder ſtill: that he advanced five miles every day; and when he came to the place where the hermit had his cell, he breathed a very ſerene and temperate air: that the hermit told him, he had perceived neither wind nor rain all the 25 years he had dwelt there; and that on the top of the mountain there ſtill reigned a greater tranquility, whereby the ark was preſerved uncorrupted. He farther pretends, that the hermit gave him a croſs made out of the wood of the ark, together with a certificate; a formal copy of which the author has given in his ſham relation.

ARASSI, a maritime, populous, and trading town of Italy, in the territory of Genoa. E. Long. 7. 20. N. Lat. 44. 3.

ARATEIA, in antiquity, a yearly feſtival celebrated at Sicyon, on the birth-day of Aratus, wherein divers honours were paid by a prieſt conſecrated to this ſervice, who for diſtinction's ſake wore a ribband beſpangled with white and purple ſpots. The arateia were ſolemnized with much pomp of muſic, the choiriſters of Bacchus attending.

ARATUS, general of the Achæans, conquered Niocles tyrant of Sicyon. Two years after, he ſurpriſed the caſtle called *Acrocorinthus*, and drove out the king of Macedonia: he delivered Argos from its tyrants, and was poiſoned by Philip II. king of Macedonia, whom he had newly reſtored: he was about 62 when he died, the ſecond year of the 141ſt Olympiad. He was intered at Sicyon, and received the greateſt honours from his countrymen. His ſon, who had alſo been prætor, was poiſoned by king Philip. Polybius gives us ſo great a character of Aratus the father's Commentaries or Hiſtory, that the loſs of ſo valuable a work is highly to be regretted.

ARATUS, a Greek poet, born at Soli, or Solæ, a town in Cilicia, which afterwards changed its name, and was called *Pompeiopolis*, in honour Pompey the Great. He flouriſhed about the 124th, or, according to ſome, the 126th Olympiad, in the reign of Ptolemy Philadelphus king of Egypt. He diſcovered in his youth a remarkable poignancy of wit, and capacity for improvement; and having received his education under Dionyſius Heracleotes, a Stoic philoſopher, he eſpouſed the principles of that ſect. Aratus was phyſician to Antigonus Gonatus, the ſon of Demetrius Poliorcetes, king of Macedon: this prince, being a great encourager of learned men, ſent for him to court, admitted him to his intimacy, and encouraged him in his ſtudies. The *phænomena* of Aratus, which is ſtill extant, gives him a title to the character of an aſtronomer as well as a poet; in this piece he deſcribes the nature and motion of the ſtars, and ſhows the particular influences of the heavenly bodies, with their various diſpoſitions and relations. He wrote this poem in Greek verſe: it was tranſlated into Latin by Cicero; who tells us in his firſt book, *De oratore*, that the verſes of Aratus are very noble. This piece was tranſlated by others as well as Cicero; there being a tranſlation by Germanicus Cæſar, and another into elegant verſe by Feſtus Avienus. An edition of the *phænomena* was publiſhed by Grotius, at Leyden, in quarto, 1600, in Greek and Latin, with the fragments of Cicero's verſion, and the tranſlation of Germanicus and Avienus, all which the editor has illuſtrated with curious notes. He was certainly much eſteemed by the ancients, ſince we find ſo great a number of ſcholiaſts and commentators upon him. There are ſeveral other works alſo aſcribed to Aratus. Suidas mentions the following: Hymns to Pan; Aſtrology and Aſtrotheſy; a compoſition of antidotes; an Επιθυτικον on Theopropus; an Ηθοποια on Antigonus; an epigram on Phila, the daughter of Antipater, and wife of Antigonus; an Epicedium of Cleombrotus; a correction of the Odyſſey; and ſome Epiſtles, in proſe. Virgil, in his Georgics, has imitated or tranſlated many paſſages from this author; and St. Paul has quoted a paſſage of Aratus. It is in his ſpeech to the Athenians (Acts xvii. 28.) wherein he tells them, that ſome of their own poets have ſaid, Τȣ γαρ και γενος εσμεν: "For we are alſo his offspring." Theſe words are the beginning of the fifth line of the *phænomena* of Aratus.

ARAVA, a fortreſs of Upper Hungary, in a county and on a river of the ſame name. E. Long. 20. 0. N. Lat. 49. 20.

ARAUCO, a fortreſs and town of Chili, in South America; ſituated in a fine valley, on a river of the ſame name. The natives are ſo brave, that they drove the Spaniards out of their country, though they had no fire arms. W. Long. 71. 20. S. Lat. 42. 30.

ARAUSIO, or *Civitas Arauſienſis*, or *Arauſicorum* (Notitiæ); *Colonia Secundanorum* (Mela, Pliny, Coins); ſo called becauſe the veterans of the ſecond legion were there ſettled: The capital of the Cavares, in Gallia Narbonenſis. Now *Orange*, in the weſt of Provence, on an arm of the river Egue, which ſoon after falls into the Rhone, from which it is diſtant a league to the eaſt, at the foot of a mountain. Here is an ancient amphitheatre to be ſtill ſeen. E. Long. 4. 45. Lat. 44. 10.

ARAW, a town of Swiſſerland, in Argow, ſeated on the river Aar. It is handſome, large, and remarkable for its church, its fountain, and the fertility of the ſoil. E. long. 18. 0. N. Lat. 47. 25.

ARAXES, now the Aras, a river of Armenia Major, which takes its riſe in a mountain called *Abos*, where the Euphrates alſo hath its origin. From this mountain it runs eaſtward with a ſerpentine courſe, diſcharging itſelf into the Caſpian ſea, after a run of upwards of 500 miles, during which it receives ſome conſiderable rivers. Some have imagined that it hath its riſe in mount Ararat; but Tournefort aſſures us that it comes no nearer that mountain than 12 miles. The Araxes is a very rapid river, and is ſuppoſed to be the Gihon mentioned by Moſes. Beſides this extreme rapidity, it is very apt to overflow after rains; ſo that they have in vain endeavoured to build bridges over it; tho' ſome of them appear, from the few arches remaining, to have been built of the beſt materials, and in the ſtrongeſt manner. Such is the vehemence of its current after the thawing of the adjacent ſnows, or ſome fierce rains, that neither banks nor dykes can reſiſt it; ſo that nothing can be more terrible than the noiſe and violence of its waves at ſuch times: but in winter, when its waters are low, it is fordable in ſome places on camels.

ARBA (anc. geog.), an iſland and city of Illyria. Now *Arbe*, in the gulph of Quarnaro. Of this iſland, which has been but ſlightly noticed by geographers, we have the following deſcription by the Abbé Fortis.

In the Roman times, it is probable that there were no other cities in Arbe but that which bears the name of the iſland, in the neighbourhood of which ancient monuments are frequently dug up.

This city of Arbe, though the capital of a ſmall iſland, not above thirty miles round, wholly uncultivated, and uninhabitable in the higheſt part that faces the channel of Morlacca, has always maintained itſelf with decorum. That it was inhabited by civilized people in the Roman times, is evident, by the inſcriptions that have been frequently diſcovered there, and others ſtill remain at Arbe. In the lower times it ſuffered all the calamities to which the neighbouring countries were ſubjected, but it always recovered itſelf with honour even after diſſolution.

The archives of the community of Arbe contain ſome ancient papers that are truly valuable, and they are kept with great jealouſy; by them it appears, that, in the eleventh century, gold and ſilk were not rare among the inhabitants. Arbe was ſubject to the kings of Hungary; afterwards it became dependent on Venetian feudatories; and at laſt was taken under the immediate dominion of the moſt ſerene republic, by which a governor is appointed who has the title of count and captain. The number of people on the iſland does not much exceed three thouſand ſouls, diſtributed in a few pariſhes, which might be officiated by a ſmall number of prieſts: yet, through a monſtrous inconſiſtency that falls very heavy on the poor inhabitants, they have to maintain no leſs than three convents of friars, and as many of nuns, beſides the conſiderable charge of near ſixty prieſts, who have a very ſcanty proviſion.

The climate of Arbe is none of the happieſt; the winter ſeaſon is horrid, eſpecially when agitated by the violent northerly winds, which ſometimes transform the intermediate ſeaſons into winter, and cauſe the ſummer itſelf to diſappear. Theſe furious winds do great damage to the iſland, particularly in the winter and ſpring. Two years ago, about twelve thouſand ſheep periſhed in one night, of cold, in the common paſtures of the mountain; where, according to the cuſtom over all Dalmatia, they are left in the open air the whole year round. The ſalt fog raiſed by the dreadful commotion of the waves, which often roar, between the mountains of Arbe and the oppoſite Alps, in the narrow channel of Morlacca, conſumes all the buds of the plants and corn, if it happens to be driven upon the iſland by the wind; and it is followed by a cruel ſcarcity of every kind of produce. This calamity communicates its baneful influence even to the fleſh of the animals left on the paſtures, that becomes ill-taſted, in conſequence of the bitterneſs and bad nouriſhment of the food. Abſtracting from theſe irregularities, the air of Arbe is healthful; nor ought the conſtant ſummer fevers among the inhabitants to be attributed to its influence as they are, more probably, derived from unwholeſome food, and a way of life differing little from that of the Hottentots.

The appearance of the iſland is exceedingly pleaſant. On the eaſt it has a very high mountain, of the ſame ſubſtance as the Morlacca, of which it was at once a part. At the foot of this mountain, the reſt of the iſland is extended to the weſtward, and divided into beautiful and fruitful plains interſperſed with little hills fit to bear the richeſt products. At the extremity that looks to the north, a delightful promontory, called Loparo, ſtretches into the ſea; it is crowned with little hills, which almoſt quite incloſe a fine cultivated plain. Near this promontory are the two ſmall iſlands of S. Gregorio and Goli, very uſeful to ſhepherds and fiſhers. The coaſt of Arbe, that faces the Morlacca mountains, is quite ſteep and inacceſſible; and the channel between them is extremely dangerous, being expoſed to furious winds, and without a ſingle port on either ſide. The long and narrow iſland of Dolin, lying parallel to the iſland of Arbe, along the coaſt of Barbado, forms a channel leſs dangerous, though by no means ſo ſecure as it is beautiful to look at. There are ſeveral harbours in the neighbourhood of the city of Arbe, by which the trade of the beſt part of the iſland is facilitated.

The city ſtands on a riſing ground between two harbours, which form a peninſula; it contains about a thouſand inhabitants, among whom are many noble families, but few of them are rich. Among the moſt remarkable curioſities of the iſland, the Arbegiani are proud of many egregious reliques, and particularly of the head of S. Criſtofano their protector; but the lovers of ſacred antiquity will find ſomething much more ſingular in the three heads of Shadrach, Meſhech, and Abednego, which are venerated there with great devotion. Four of the principal gentlemen are keepers of the ſanctuary, and to their care the precious records of the city are alſo committed. Among theſe records there is a tranſaction of MXVIII. by which the city of Arbe promiſes to the Doge of Venice, Ottone Orſeolo, a tribute of ſome pounds *de ſeta ſerica*, "of wrought ſilk," and in caſe of contravention, pounds *de auro obrizo* "of pure gold."

In the laſt age there was a learned biſhop of Arbe, named Ottavio Spaderi, who would not permit the reliques of S. Criſtofano to be expoſed to the public veneration, on the ſolemnity of the ſaint's day, becauſe he doubted of their authenticity. The mob roſe, and was going to throw him down from the top of the hill on which the cathedral ſtands; nor did the tumult ceaſe after the day was paſt. The government ſent an armed veſſel to deliver the prelate from the danger he was in; and the pope thought proper to give him a more tractable ſpouſe in Italy.

The nature of the ſoil of Arbe is not the ſame in every ſituation; nay it would be difficult to find a country where there is ſo great a variety in ſo little ſpace. There is a very great difference between the ground of the extremity of the mountain above the channel of Barbado, and the ſides of it on the one part towards the iſland, and on the other facing the ridge of Morlacca. Nor is the top of the mountain itſelf always of the ſame ſtructure: for in ſome parts it is extended in a fine level plain, partly woody and partly cultivable; in other places it is quite rocky, and compoſed of bare marble. The ground at the foot of the mountain, where it ſtretches towards the ſhore, oppoſite to Jablanaz, is nothing but marble; and, in the diſtrict of Barbado it is gravelly, and a good ſoil for vines. The wine of Barbado is of excellent quality, and in great eſtimation; hardly any other product is cultivated along that coaſt, as the vines ſucceed ſo well, notwithſtanding the negligent culture. Below the pretended ruins of Colento the land bears vines, olives, mulberry, and other fruit-trees, and alſo corn in the loweſt parts. All the lower part of the iſland is compoſed alternatively of little hills and valleys, and of a ſubſtance for the moſt part very different from that of the mountain and its adjacencies. As the organization of the mountain is wholly of marble, ſo that of the hills is generally arenaceous. The whetſtone forms a lage part, and frequently contains *oſtracites* and *lenticulares*; the exterior ſtratum is commonly friable. The valleys, which according to appearances ſhould be full of ſand, are provided with an excellent ſoil, with ſuch a mixture of very minute ſand as is requiſite to keep it light. Springs of freſh water are by nature well diſtributed over the iſland, and maintain a proper humidity when the ſummer is not exceſſively dry; ſo that the dark verdure of the hills covered with wood, the luxuriance of the vines, and freſhneſs of the corn-ground, form a ſpectacle extremely cheerful and agreeable.

The iſland of Arbe would have every thing requiſite for the ſubſiſtence of its ſmall population, if the land was cultivated by a people leſs ſtupid and lazy. It produces, however, fire-wood, of which many cargoes are annually ſent to Venice; corn, oil, excellent wine, brandy, and ſilk, ſince very ancient times; it alſo exports hides, wool, ſheep, hogs, and horſes of a good breed. There is alſo abundance of good ſalt made on the iſland; and the fiſhing of tunny and mackrel, notwithſtanding it is managed in a ſlovenly and aukward manner, makes no inconſiderable article of trade to the Arbegiani, who, like all their neighbours, find their account in ſelling this commodity to ſtrangers rather than to the Venetians. Yet, with all theſe natural products, the iſland is very far from being rich, or even in a tolerable flouriſhing ſtate; becauſe there is much land left uncultivated, and the peaſants are lazy.

ARBACES governed Media under Sardanapalus. Seeing him ſpinning among a company of his women, he ſtirred up his people to revolt, and dethroned Sardanapalus; who thereupon burnt himſelf in his palace. Arbaces being crowned, began the monarchy of the Medes, which laſted 317 years under nine kings, till

Aſtyages was expelled by Cyrus. Arbaces reigned 22 years, and died A. M. 3206. See MEDIA.

ARBALEST, or CROSS-BOW. See *CROSS-BOW*.

ARBELA, now IRBIL, a city of Aſſyria, lying in E. Long. 44. 5. N. Lat. 35. 15. It is famous for the laſt and deciſive battle fought in its neighbourhood between Alexander the Great and Darius Codomannus. This battle was fought 331 years before Chriſt, and the event of it determined the fate of the Perſian empire. Arrian relates, that Darius's army conſiſted of a million of foot and 40,000 horſe; according to Diodorus, there were 200,000 horſe, and 800,000 foot; Plutarch relates, that the horſe and foot together made up a million; and Juſtin gives us exactly half Diodorus's number. The Macedonian army, according to Arrian, conſiſted of 40,000 foot and 7000 horſe.

Gillies's Hiſt. of Greece.

Upon receiving notice of the vaſt ſtrength of the enemy, Alexander expreſſed neither ſurpriſe nor apprehenſion; but having "commanded a halt, he encamped four days, to give his men reſt and refreſhment. His camp being fortified by a good intrenchment, he left in it the ſick and infirm, together with all the baggage; and on the evening of the fourth day, prepared to march againſt the enemy with the effective part of his army, which was ſaid to conſiſt of 40,000 infantry and 7000 horſe, unincumbered with any thing but their proviſions and armour. The march was undertaken at the ſecond watch of the night, that the Macedonians, by joining battle in the morning, might enjoy the important advantage of having an entire day before them, to reap the full fruits of their expected victory. About half way between the hoſtile camps, ſome eminences intercepted the view of either army. Having aſcended the riſing ground, Alexander firſt beheld the Barbarians, drawn up in battle array, and perhaps more ſkilfully marſhalled than he had reaſon to apprehend. Their appearance, at leaſt, immediately determined him to change his firſt reſolution. He again commanded a halt, ſummoned a council of war; and different meaſures being propoſed, acceded to the ſingle opinion of Parmenio, who adviſed that the foot ſhould remain ſtationary until a detachment of horſe had explored the field of battle, and carefully examined the diſpoſition of the enemy. Alexander, whoſe conduct was equalled by his courage, and both ſurpaſſed by his activity, performed thoſe important duties in perſon at the head of his light horſe and royal cohort. Having returned with unexampled celerity, he again aſſembled his captains, and encouraged them by a ſhort ſpeech. Their ardour correſponded with his own; and the ſoldiers, confident of victory, were commanded to take reſt and refreſhment.

"Meanwhile Darius, perceiving the enemy's approach, kept his men prepared for action. Notwithſtanding the great length of the plain, he was obliged to contract his front, and form in two lines, each of which was extremely deep. According to the Perſian cuſtom, the king occupied the centre of the firſt line, ſurrounded by the princes of the blood and the great officers of his court, and defended by his horſe and foot guards, amounting to 15,000 choſen men. Theſe ſplendid troops, who ſeemed fitter for parade than battle, were flanked on either ſide by the Greek mercenaries and other war-like battalions, carefully ſelected from the whole army. The right wing conſiſted of the Medes, Parthians, Hyrcanians, and Sacæ; the left was chiefly occupied by the Bactrians, Perſians, and Carduſians. The various nations compoſing this immenſe hoſt were differently armed, with ſwords, ſpears, clubs, and hatchets; while the horſe and foot of each diviſion were promiſcuouſly blended, rather from the reſult of accident than by the direction of deſign. The armed chariots fronted the firſt line, whoſe centre was farther defended by the elephants. Choſen ſquadrons of Scythian, Bactrian, and Cappadocian cavalry advanced before either wing, prepared to bring on the action, or after it began to attack the enemy in flank and rear. The unexpected approach of Alexander within ſight of his tents prevented Darius from fortifying the wide extent of his camp; and, as he dreaded a nocturnal aſſault from enemies who often veiled their deſigns in darkneſs, he commanded his men to remain all night under arms. This unuſual meaſure, the gloomy ſilence, the long and anxious expectation, together with the fatigue of a reſtleſs night, diſcouraged the whole army, but inſpired double terror into thoſe who had witneſſed the miſerable diſaſters on the banks of the Granicus and the Iſſus.

"At day-break Alexander diſpoſed his troops in a manner ſuggeſted by the ſuperior numbers and deep order of the enemy. His main body conſiſted in two heavy-armed phalanxes, each amounting to above 16,000 men. Of theſe the greater part formed into one line; behind which he placed the heavy-armed men, reinforced by his targeteers, with orders, that when the out-ſpreading wings of the enemy prepared to attack the flanks and rear of of his firſt line, the ſecond ſhould immediately wheel to receive them. The cavalry and light infantry were ſo diſpoſed on the wings, that while one part reſiſted the ſhock of the Perſians in front, another, by only facing to the right or left, might take them in flank. Skilful archers and darters were poſted at proper intervals, as affording the beſt defence againſt the armed chariots, which (as Alexander well knew) muſt immediately become uſeleſs whenever their conductors or horſes were wounded.

"Having thus arranged the ſeveral parts, Alexander with equal judgment led the whole in an oblique direction towards the enemy's left; a manœuvre which enabled the Macedonians to avoid contending at once with ſuperior numbers. When his advanced battalions, notwithſtanding their nearneſs to the enemy, ſtill ſtretched towards the right, Darius alſo extended his left, till fearing that by continuing this movement his men ſhould be drawn gradually off the plain, he commanded the Scythian ſquadrons to advance, and prevent the farther extenſion of the hoſtile line. Alexander immediately detached a body of horſe to oppoſe them. An equeſtrian combat enſued, in which both parties were reinforced, and the barbarians finally repelled. The armed chariots then iſſued forth with impetuous violence; but their appearance only was formidable; for the precautions taken by Alexander rendered their aſſault harmleſs. Darius next moved his main body, but with ſo little order, that the horſe, mixed with the infantry, advanced, and left a vacuity in the line, which his generals wanted time or vigilance to ſupply. Alexander ſeized the deciſive moment, and penetrated into the void with a wedge of ſquadrons. He was followed by the neareſt ſections of the phalanx, who ruſhed forward with loud ſhouts, as if they had already purſued the enemy. In this part of the field, the victory was not long doubtful; after a feeble reſiſtance, the barbarians gave way; and the puſillanimous Darius was foremoſt in the flight.

“ The battle, however, was not yet decided. The more remote diviſions of the phalanx, upon receiving intelligence that the left wing, commanded by Parmenio, was in danger, had not immediately followed Alexander. A vacant ſpace was thus left in the Macedonian line, through which ſome ſquadrons of Perſian and Indian horſe penetrated with celerity, and advanced to the hoſtile camp. It was then that Alexander derived ſignal and well-earned advantages from his judicious order of battle. The heavy-armed troops and targeteers, which he had ſkilfully poſted behind the phalanx, ſpeedily faced about, advanced with a rapid ſtep, and attacked the barbarian cavalry, already entangled among the baggage. The enemy, thus ſurpriſed, were deſtroyed or put to flight. Meanwhile, the danger of his left wing recalled Alexander from the purſuit of Darius. In advancing againſt the enemy's right, he was met by the Parthian, Indian, and Perſian horſe, who maintained a ſharp conflict. Sixty of the *Companions* fell: Hephæſtion, Cœnus, and Menidas, were wounded. Having at length diſſipated this cloud of cavalry, Alexander prepared to attack the foot in that wing. But the buſineſs was already effected, chiefly by the Theſſalian horſe; and nothing remained to be done, but to purſue the fugitives, and to render the victory as deciſive as poſſible.

“ According to the leaſt extravagant accounts, with the loſs of 500 men he deſtroyed 40,000 of the barbarians, who never thenceforth aſſembled in ſufficient numbers to diſpute his dominion in the Eaſt. The invaluable provinces of Babylonia, Suſiana, and Perſis, with their reſpective capitals of Babylon, Suſa, and Perſepolis, formed the prize of his ſkill and valour. The gold and ſilver found in thoſe cities amounted to thirty millions Sterling; the jewels and other precious ſpoil, belonging to Darius, ſufficed, according to Plutarch, to load 20,000 mules and 5000 camels.” The conſequence of this victory the reader will find narrated under the article PERSIA.

ARBERG, a town of Swiſſerland, in the canton of Bern, with a handſome caſtle, where the bailiff reſides. It is ſeated on the river Aar, in a kind of iſland. E. Long. 17. 15. N. Lat. 47. 0.

ARBITER, in the civil law, implies a judge nominated by the magiſtrate, or choſen voluntarily by the two contending parties, in order to decide their differences.

The civilians make a difference between *arbiter* and *arbitrator*, though both found their power on the compromiſe of the parties; the former being obliged to judge according to the cuſtoms of the law, whereas the latter is at liberty to uſe his own diſcretion, and accommodate the difference in the manner that appears to him moſt juſt and equitable.

ARBITRARY, that which is left to the choice or arbitration of men, or not fixed by any poſitive law or injunction.

ARBITRARY Puniſhment, in law, denotes ſuch puniſhments as are by ſtatute left to the diſcretion of the judge. It is a general rule in arbitrary puniſhments, that the judge cannot inflict death. Hence all puniſhments that are not capital have acquired the name of *arbitrary puniſhments*, even although they be expreſsly pointed out by ſtatute.

ARBITRATION is where the parties, injuring and injured, ſubmit all matters in diſpute, concerning any perſonal chattels, or perſonal wrong, to the judgment of two or more arbiters or arbitrators; who are to decide the controverſy: and if they do not agree, it is uſual to add, that another perſon be called in as umpire, (*imperator* or *impār*), to whoſe ſole judgment it is then referred; or frequently there is only one arbitrator originally appointed. This deciſion, in any of theſe caſes, is called an *award*. And thereby the queſtion is as fully determined, and the right transferred or ſettled, as it could have been by the agreement of the parties or the judgment of a court of juſtice. See alſo LAW, Part III. N° clxxxv. 15, &c.

ARBITRATOR, a private extraordinary judge, choſen by the mutual conſent of parties, to determine controverſies between them. See ARBITER and ARBITRATION.

ARBOIS, a ſmall populous town of France, in the Franche Compte, famous for its wines. E. Long. 5. 40. N. Lat. 46. 55.

ARBON, an ancient town in Swiſſerland, on the ſouth banks of the lake Conſtance, in Thurgaw. It has a caſtle built by the Romans, and is under the juriſdiction of the biſhop of Conſtance. In the time of war, the Swiſs have a right to put in a garriſon. The Popiſh and Proteſtant religions are equally tolerated in this town. E. Long. 9. 30. N. Lat. 4. 38.

ARBOR, in botany, a tree. Trees are by Linnæus claſſed in the ſeventh family of the vegetable kingdom, and are diſtinguiſhed from ſhrubs in that their ſtems come up with buds on them; but this diſtinction holds not univerſally, there being rarely any buds on the large trees in India.

ARBOR, in mechanics, the principal part of a machine, which ſerves to ſuſtain the reſt; alſo the axis or ſpindle on which a machine turns, as the *arbor* of a crane, windmill, &c.

ARBOR Dianæ. See CHEMISTRY-*Index*.

ARBOR Vitæ. See THUYA.

ARBORESCENT, an epithet applied to ſuch objects as reſemble trees.

ARBORESCENT Star-fiſh, in zoology, a ſpecies of aſterias. See ASTERIAS.

ARBORIBONZES, in modern hiſtory, prieſts of Japan, who live an erratic life, and ſubſiſt on alms. They dwell in caverns, and cover their heads with bonnets made of the bark of trees.

ARBORIST, a perſon ſkilled in that part of botany which treats of trees.

ARBOUR, in gardening, a kind of ſhady bower, formerly in great eſteem; but of late rejected on account of its being damp and unwholeſome.

Arbours are generally made of lattice-work, either of wood or iron; and covered with elms, limes, hornbeams; or with creepers, honeyſuckles, jaſmines, or paſſion-flowers; either of which will anſwer the purpoſe very well, if rightly managed.

ARBROATH, See ABERBROTHIC.

ARBURG, a town of Swiſſerland, in the canton of Bern, on the river Aar. It is ſmall, but very ſtrong, being ſeated on a rock, and defended by a good fortreſs cut out of the rock. E. Long. 17. 55. N. Lat. 47. 10.

ARBUSCULA is uſed by Bradley to denote a little or dwarf tree, above the rank of ſhrubs but below that of trees; ſuch e. gr. as the elder.

ARBUSTUM implies a number or multitude of trees planted for the fruit ſake.

The word was more peculiarly applied to a place planted with trees for faſtening vines to, which are hence called by Columella *arbuſtivæ*.

Arbustum is ſometimes alſo uſed to denote an orchard, or field wherein trees are planted at ſuch diſtance that there is room for ploughing and growing corn between.

ARBUTHNOT (Alexander), principal of the univerſity of Aberdeen in the reign of James VI. of Scotland, was born in the year 1538. He ſtudied firſt at Aberdeen; and was afterwards ſent over to France, where, under the famous Cujacius, he applied himſelf to the ſtudy of the civil law. In the year 1563, he returned to Scotland, and took orders. Whether he was ordained by a biſhop or by preſbyters, is a matter of uncertainty. In 1568, he was appointed miniſter of Arbuthnot and Logy-Buchan; and in the following year, Mr Alexander Anderſon being deprived, our author was made principal of the king's college at Aberdeen in his room. In the general aſſembly which met at Edinburgh in the years 1573 and 1577, he was choſen moderator; and to the end of his life was an active ſupporter of the reformed religion. He died in 1583, in the 45th year of his age; and was buried in the college church of Aberdeen. We are told in the Biographia, that he was eminent as a poet, a philoſopher, a mathematician, a lawyer, a divine, and a phyſician. He wrote *Orationes de origine & dignitate juris*, printed at Edinburgh, 1572, 4to. His cotemporary Thomas Maitland wrote a copy of Latin verſes on the publication of this book: they are printed in the *Delic. Poetar. Scot.* He publiſhed Buchanan's hiſtory of Scotland in the year 1582.

Arbuthnot (Dr John), was born in Kincardinſhire, near Montroſe, and was educated at Aberdeen, where he received his degree in phyſic. The difficulties in which his family was involved on account of their political principles, making it neceſſary that he ſhould court preferment in another country than his own, he went to London. The firſt character in which he acted there was a teacher of the mathematics; and while he was employed in this manner, he had occaſion to publiſh his *Examination of Dr Woodward's account of the deluge*. This tract, which abounded with learning and good ſenſe, ſerved to make him known. He publiſhed ſoon after his *Eſſay on the uſefulneſs of mathematics*. In the profeſſion of phyſic he advanced by ſlow but ſure degrees; and his reputation in it was at length fully eſtabliſhed, by a ſucceſsful cure which he performed on Prince George of Denmark. Queen Anne, in conſequence of it, appointed him one of her phyſicians in ordinary in 1709; and, ſome years before this, his extenſive knowledge had procured his admiſſion into the Royal Society. His talents and worth were the ſtrongeſt recommendations of him to the men of wit and learning of his day; and he entered into particular connection with Pope and Swift, with whom he joined in publiſhing ſeveral volumes of miſcellanies; among which are the well-known *Memoirs of Martinus Scriblerus*, a ſatire of infinite humour on the abuſes of human learning. In 1715, he aſſiſted Pope and Gay in the *Three hours after marriage*; a dramatic performance, which was brought upon the ſtage without ſucceſs. In 1727, he publiſhed *Tables of ancient coins, weights, and meaſures*; a work of great uſe, and real erudition. In 1732, his valuable tract concerning *The nature and choice of aliments* appeared; which, the year after, was followed by his remarks on *The effects of air on human bodies.* A conſtitutional aſthma had diſtreſſed him at different periods of his life, and proved fatal to him in 1734.—Dr Arbuthnot appears to have been in all reſpects a moſt accompliſhed and amiable perſon. He has ſhowed himſelf equal to any of his cotemporaries in wit and learning, and he was ſuperior to moſt men in the moral duties of life, in acts of humanity and benevolence. His letter to Mr Pope, written as it were upon his death-bed, and which no one can read without the tendereſt emotion, diſcovers ſuch a noble fortitude of mind at the approach of his diſſolution, as could be inſpired only by a clear conſcience, and the calm retroſpect of an uninterrupted courſe of virtue. In 1751, came out in two vols. 8vo. printed at Glaſgow, *The miſcellaneous works of the late Dr Arbuthnot;* which are ſaid to comprehend, with what is inſerted in Swift's miſcellanies, all the pieces of wit and humour of this admirable author.

ARBUTUS, the strawberry tree: a genus of the monogynia order, belonging to the decandria claſs of plants; and in the natural method ranking under the 18th order, *Bicornes*. The calyx is divided into five parts; the corolla is ovated; and the fruit is a berry with five cells.

Species. 1. The unedo, or common ſtrawberry-tree, is a native of Italy, Spain, and alſo of Ireland; and is now very common in the Britiſh gardens. Of this ſpecies there are four varieties, viz. The oblong-fruited, the round-fruited, the red-flowered, and the double-bloſſomed. One deſcription is nearly common to them all; and their inconſiderable variation is almoſt ſufficiently ſhewn in their reſpective appellations.

The oblong-fruited ſort will grow to be a middling-ſized tree in ſome countries; for we read of the large uſes its wood has been applied to; ſuch as, *arbutæ crates*, &c. Arbutean harrows, &c. With us it may be kept down to any ſize. The main ſtems are covered with a light-brown bark, rough, and falling. The younger branches are of a kind of purple colour, whilſt the laſt year's ſhoots are of a fine red, and a little hairy. The leaves grow alternately on the branches, and are of an oblong oval figure. They ſtand on ſhort footſtalks, and the oldeſt leaves make a contraſt with the younger by having their footſtalk and mid-rib of a fine ſcarlet colour. They are ſmooth, and beautifully ſerrated. Their upper ſurface (as in moſt trees) is of a ſtronger green than their under; and the young twigs are garniſhed with them in plenty. Theſe are beauties in common to moſt trees, in ſome degree or other; but every thing elſe almoſt of this tree that preſents itſelf to conſideration is ſingular: the time of its flowering will be in November and December; when it is rather ſingular to ſee a tree in the open ground in full blow; and the fruit ripens by that time twelvemonth after. The manner and nature of the fruit, which look like very large red ſtrawberries, give it alſo a ſingular and delightful look; and this is heightened as they appear all over the tree among the flowers; for that is the time of its being ripe, when the flowers for the ſucceeding crop are fully out. The flowers themſelves make no great figure; they are of a kind of whitiſh-yellow colour; and are ſucceeded by the abovementioned ſtrawberry-fruit, which will require a revolution of twelve months before they perfectly arrive at their maturity and colour. The flowers of the firſt ſort are larger than thoſe of the ſecond; and the fruit is oval, and much larger than our common ſcarlet ſtrawberry.

The round-fruited ſort has its pitcher-ſhaped flowers, which are ſucceeded by round ſcarlet fruit, as wide as they are long; and this is all the difference between theſe ſorts.

The red-flowered ſort differs in no reſpect from the common ſort, only the flowers are red, and theſe conſtitute a variety from the other ſorts of flowers; but the contraſt is not ſo great between their fruit and them as of the other ſorts, their colour approaching too near to a ſameneſs.

The double-bloſſomed ſort differs in no reſpect, only that the flowers are double; but this difference is ſo inconſiderable, that it will not be ſeen without looking into the flower; and even then the doubleneſs will appear ſo trifling as ſcarcely to merit notice; ſo that a plant or two, to have it ſaid that the collection is not without it, will be ſufficient. Neither ought any more to be admitted; for they will not produce the ſame plenty of fruit, which conſtitutes the greateſt beauty of theſe trees, as the ſingle ſorts.

The above ſorts thrive beſt in a wet ſoil, and are ſeldom hurt by hard winters, though the young and tender branches are often deſtroyed by froſt; but, however dead the trees may appear, they ought always to be ſuffered to remain till the following ſummer ſhows what are living and what are dead.

The method of propagating the varieties of the unedo is by layers and cuttings: the ſpecies itſelf may be raiſed from ſeed.—1. *Propagation by layers.* The operation muſt be performed on the youngeſt twigs; and in ſome ſoils they will ſtrike root pretty freely, whilſt in others they can hardly be made to grow at all: But before they have lain two ſummers, you may ſcarcely venture to look for any. When the roots are ſtruck, the layers ſhould be carefully taken off in the ſpring, and planted in ſeparate pots; and after well watering them, they ſhould be plunged up to the rims in an hotbed, and this will ſet them forward; for without this aſſiſtance many of the layers will be loſt; ſince they are difficult plants to make grow. After the hotbed has forced the ſeeds into a ſtate of vegetation, the pots may be taken out, and plunged up to the rims in ſome natural mould, to keep them cool and moiſt; and here they may ſtand for two or three years, or longer, if the pots are large enough, without ever removing or ſheltering in winter; for they are hardy enough to reſiſt our ſevereſt cold. When they are to be finally ſet out, all the mould may be turned out of the pots hanging to the roots; and having proper holes made ready, they may be planted in them, and the plant will be ignorant of its new ſituation.

2. *By cuttings.* Theſe muſt be planted in pots, and have the benefit of a good bark-bed; in which being conſtantly ſhaded and duly watered, many of them will grow. As the plants raiſed this way will be rather tender by being forced in the bark-bed, it will be neceſſary to remove them into the greenhouſe, or to place them under a hotbed-frame during the firſt winter: and after that, the pots may be ſet up to the rims in the ground, and, like the layers, the plants may be turned out at a convenient time into the places where they are to remain.

1. *Raiſing from ſeeds.* Let theſe be taken from the oblong or round-fruited ſort. The ſeeds, which will be ripe ſome time in November or the beginning of December, for they will not be ripe at the ſame time in all places, muſt be then gathered; and as they ſhould not be ſowed until the ſpring, it will be proper to put them into a pot or jar, mixing with them a quantity of drift-ſand; and this will preſerve them ſound and good. The beginning of March is the beſt time for ſowing the ſeeds; and the beſt ſoil for them is maiden earth, taken from a rich paſture at leaſt a year before, with the ſward; and this, by conſtant turning, being well rotted and mixed, will be ready to receive them. Having filled a different quantity of pots with this fine mould, let the ſeeds be ſown, and but juſt covered, ſcarcely a quarter of an inch deep. A dry day ſhould be choſen for the buſineſs; and no watering by the hand ſhould be given them, as it will endanger the ſetting the mould hard in the pots. Leave them abroad until ſome rain falls, which at that time may be hourly expected; and after that, having an hotbed ready, plunge the pots therein. In leſs than ſix weeks you may expect your plants to appear; when much air ſhould be afforded them, and frequent waterings, in ſmall quantities, gently ſprinkled over them. After this, they may be hardened to the air by degrees, and the pots ſet up to the rims in the natural mould, in a ſhady place. In October they ſhould be removed into the greenhouſe, or ſome ſhelter, in froſty weather; though they ſhould always be ſet abroad in mild open weather. In the ſpring they may be taken out, and planted in ſeparate pots; and they ſhould have the advantage alſo of a hotbed to ſet them a-growing: their future management may be the ſame as was directed for the layers. When theſe trees are to be planted out, very little regard need be paid to the ſoil or ſituation; for they will grow almoſt any where, and reſiſt our ſevereſt northern blaſts. One thing, however, the gardener muſt conſtantly obſerve, in order to continue his trees in their beauty, viz. As often as a heavy ſnow falls, ſo conſtantly ſhould he go and ſhake the boughs; for it will lodge amongſt the leaves and branches in ſuch great quantity as to weigh down and ſplit the largeſt branches; the deformity of which afterwards may be eaſily conceived. Beſides, many years muſt expire before the tree will, if ever it ſhould, grow to its former beauty; to preſerve this, therefore, makes the narrowly watching theſe trees in ſnowy weather highly neceſſary.

2. The andrachne will grow to a larger ſize than the arbutus. The leaves are ſmooth, and nearly of the ſame figure as the preceding ſort; though they are larger, and have their edges undivided. The flowers grow like the other ſorts; are of the ſame colour; and

they are ſucceeded by large, oval, ſcarlet fruit. It is called the *Oriental Strawberry-tree*, becauſe this ſort grows plentifully in many parts of the Eaſt, and is uſeful to the inhabitants for many purpoſes in life.

The andrachne may be propagated in the ſame manner as the arbutus: But the plants muſt be preſerved in pots for three or four years till they have obtained ſtrength; and may be then planted in a warm ſituation and on a dry ſoil, for this ſpecies will not thrive on wet ground.

Beſides the above, there are three other ſpecies of arbutus, viz. The acadienſis, a native of Acadia; the alpina, or mountain ſtrawberry-tree, a native of Britain; and the uva urſi, a plant lately diſcovered in the Highlands of Scotland, and which formerly was thought not to be a native of Britain.

ARCADE, in architecture, is uſed to denote any opening in the wall of a building formed by an arch.

ARCADI, or ARCADIANS, the name of a learned ſociety at Rome. See the article ACADEMY.

ARCADIA, an inland diſtrict in the heart of Peloponneſus (Strabo). It is mountainous, and fitter for paſture than corn; and therefore chiefly celebrated by bucolic or paſtoral poets, who feign Pan, the god of ſhepherds, to be the guardian of it (Virgil.) It has to the north Achaia, to the eaſt Argos and Laconia, Meſſenia to the ſouth, and Elis to the weſt. According to Pliny, the wine of this country cured barenneſs in women, and inſpired the men with rage; and the berries of the yew gathered there were ſo ſtrong a poiſon, that whoever ſlept or took refreſhment under that tree were ſure to die. In Strabo's time there were few cities remaining in it, moſt of them being deſtroyed in the Grecian wars. Euſtathias ſays, that the country was anciently called *Pelaſgia*, from Pelaſgos, who brought the people, from roots, herbs, and leaves of trees, to feed on acorns, eſpecially beech-maſt; as Artemidorus obſerves, that the Arcadians uſually lived on acorns. It was alſo called *Lycaonia*, *Gigantis*, and *Parrhaſia* (Stephanus). The Arcadians are greatly commended for their love of, and ſkill in, muſic (Virgil, Polybius). To imitate the Arcadians, is to labour and toil for the benefit of others, never conquering their own, but the enemies of others (Heſychius). This probably took its riſe from the ancient Arcadians being accuſtomed to hire themſelves out as mercenaries to foreign nations. Homer commends their martial prowefs, their paſtures, their ſheep, and their country well-watered. The gentilitious name is *Arcades;* who boaſted of their great antiquity, and that they were older than the ſun and moon (Apollonius Rhodius, Nonnius, Plutarch, Ovid, Statius). They were the firſt who had a year of three months, and therefore called *Proceleni*, becauſe their year was prior to that adjuſted in Greece to the courſe of the moon (Cenſorinus).

ARCANGIS, in the Turkiſh armies, an inferior kind of infantry, which ſerve as *enfans perdus*, and to harraſs and pillage the enemy's frontiers. The Arcangis are an order inferior to the Janiſaries; and when any of them diſtinguiſh themſelves, are uſually preferred into the Janiſaries order. They have no pay, but are to ſubſiſt on their plunder.

ARCANUM, among phyſicians, any remedy, the preparation of which is induſtriouſly concealed, in order to enhance its value.

ARCANUM (anc. geog.), a villa of Q. Cicero, Tully's brother, in Latinum, (Cicero). Now Arce, in the Terra di Lavoro, in the kingdom of Naples, on the borders of the Campagnia di Roma, on the river Melpis, between Arpinum and Aquinum.

ARCBOUTANT, in building, an arched buttreſs. See BUTTRESS.

ARCESILAUS, a celebrated Greek philoſopher, about 300 years before the Chriſtian æra, was born at Pitane, in Eolis. He founded the ſecond academy, which is called the *ſecond ſchool*. He was a man of great erudition, and well verſed in the writings of the ancients. He was remarkable for the ſeverity of his criticiſms; but nevertheleſs he knew how to accommodate himſelf to the age, and purſue the allurements of pleaſure. He had a great number of diſciples. His doctrines were different in ſeveral reſpects from thoſe of the ancient ſchool: and perhaps he was led into this diverſity of opinions by many capital errors in the ancient ſchool, ſuch as the incredible arrogance of the dogmatiſts, who pretended to aſſign cauſes for all things; the myſterious air they had thrown upon the doctrine of ideas; the entirely diſcarding the teſtimony of the ſenſes; the objections of the Pyrrhoniſts, who now began to broach their opinions; the powerful oppoſition of the Stoics and Peripatetics, who diſcovered the feeble parts of the academic philoſophy. Theſe might have given cauſe to reform the ancient ſchool, and to found a new one. The middle ſchool, therefore, laid it down as a principle, that we could know nothing, nor even aſſure ourſelves of the certainty of this poſition; from whence they inferred, that we would affirm nothing, but always ſuſpend our judgment. They advanced, that a philoſopher was able to diſpute upon every ſubject, and bring conviction with him, even upon contrary ſides of the ſame queſtion; for there are always reaſons of equal force both in the affirmative and negative of every argument. According to this doctrine, neither our ſenſes, nor even our reaſon, are to have any credit: and therefore, in common affairs, we are to conform ourſelves to received opinions. Arceſilaus was ſucceeded by his diſciple Lacydes.

ARCH, in geometry, any part of the circumference of a circle or curved line, lying from one point to another, by which the quantity of the whole circle or line, or ſome other thing ſought after, may be gathered.

ARCH, a concave or hollowed piece of building, conſtructed in ſuch a manner that the ſeveral ſtones of which it is compoſed keep one another in their places. The terms *arch* and *vault* properly differ only in this, that the arch expreſſes a narrower, and the vault a broader, piece of the ſame kind. The principal difference in the form of arches is, that ſome are circular, and others elliptical; the former having a larger or ſmaller part of a circle, the other of an ellipſis. What are called *ſtrait arches*, are thoſe frequently uſed over doors and windows, the upper and under edges of which are ſtrait and parallel, and the ends and joints all pointing toward a centre. The ſpace between two piers of a bridge is called an *arch*, becauſe uſually arched over.

Triumphal ARCHES are magnificent entries into cities, erected to adorn a triumph, and perpetuate the memory of the action. The arches of Titus and Conſtantine make at this time a great figure among the ruins of old Rome.

Arch, in compoſition, ſignifies *chief*, or of the *firſt* claſs; as archangel, archbiſhop, &c.

ARCHÆUS, or Archeus. See Archeus.

ARCHANGEL, an angel occupying the eighth rank in the celeſtial hierarchy. See Angel and Hierarchy.

Archangel, a city of Ruſſia, in the province of Dwina, ſituated on the eaſt ſide of the river Dwina, about ſix miles from the White Sea, in E. Long. 40. 21. N. Lat. 64. 30. The city extends about three miles in length and one in breadth. It is rich, populous, built in the modern taſte, and is a metropolitan ſee. It roſe from a caſtle built on the ſpot by Baſilowitz II. to protect the increaſing trade brought there by the diſcovery of the White Sea by the Engliſh, and took its name from a monaſtery built in honour of the archangel Michael. Before this period the commercial intercourſe between Ruſſia and the northern parts of Europe had been long carried on by the Hanſeatic towns; which uſually ſailed to Revel or Narva, and from thence paſſed through Dorpt to Pleſcof and Novogorod, where their factories were eſtabliſhed. The accidental diſcovery of archangel, in 1553, deprived the Hanſeatic towns of a great part of this lucrative commerce, and transferred it to the Engliſh. On the 11th of May, in the abovementioned year, three ſhips ſailed from Deptford, in order to explore the northern ſeas, under the command of Sir Hugh Willoughby. Two of theſe veſſels penetrated as high as the 72d degree of latitude, to the coaſt of Spitzbergen; and being afterwards forced by ſtreſs of weather into the bay of the river Arzina in Ruſſian Lapland, both their crews were frozen to death. Richard Chancellor, who commanded the other ſhip, called the Bonaventure, diſcovering the country bordering upon the White Sea, landed near the mouth of the Dwina, in a bay, which he denominated the *Bay of St Nicholas*, from a convent of that name, near the preſent port of Archangel. The czar Iwan Baſilowitz, being informed of his arrival, invited him to his court, where he was hoſpitably entertained; and the czar indulged the Engliſh with a free trade in his dominions: in conſequence of this permiſſion, a company of merchants was incorporated in London; and being encouraged by particular privileges from the czar, ſet on foot a conſiderable commerce, to the mutual advantage of both nations. This traffic the Engliſh for ſome time enjoyed without competition. The Dutch, however, and other nations, gradually inſinuated themſelves into this commerce; which they carried on to a very great diſadvantage, as not being favoured with thoſe privileges which the czar had granted to the Engliſh company. Theſe were at laſt ſuddenly annihilated by Alexis Michaelovitch; who in 1648 baniſhed the Engliſh merchants from all his dominions. The cauſe of this expulſion is generally imputed to the reſentment which the czar conceived againſt the Engliſh for the execution of Charles I. with whom he was cloſely connected by leagues of amity and alliance: but in effect he aboliſhed the company's privileges in the year before that event; and his indignation againſt the Engliſh for their rebellion, Mr Coxe affirms, was only a political pretext; the real motive being derived from the offers made by the Dutch to pay duties of export and import, to the amount of 15 *per cent.* if they were indulged with the liberty of carrying on as free a trade as the Engliſh throughout his dominions. For not long afterwards, the czar ſuffered William Prideaux, Cromwell's agent, to reſide at Archangel; and permitted the Engliſh to renew their commerce in that port upon the ſame footing with other foreigners. And upon this footing alone our merchants ever after continued to trade.

The commodities chiefly imported into Archangel, were gold and ſilver ſtuffs and laces, gold wire, cochineal, indigo, and other drugs for dyeing; wine, brandy, and other diſtilled ſpirits. The cuſtoms ariſing to the czar were computed at 200,000 rubles a-year, and the number of foreign ſhips at 400 annually. But upon the building of Peterſburg, Peter the Great aboliſhed the immunities of Archangel, and removed the commerce of the White Sea to the havens of the Baltic. Still, however, its exports of tar were conſiderable; in 1730, to the amount of 40,000 laſts, of 11 barrels each. It ſends, during winter, great quantities of the rawaga, a ſmall ſpecies of three-finned cod, to Peterſburg frozen.

In 1752 Elizabeth again reſtored the ancient immunities of Archangel; and its preſent trade is not inconſiderable. It ſupplies the government of Archangel, part of thoſe of Niſhnei-Novogorod and Caſan, with European commodities; and draws in exchange from thoſe parts corn, flax, hemp, coarſe linen, cordage, ſails, maſts, and tallow, which are moſtly conveyed by the Dwina: it forms alſo a principal communication with the northern and weſtern parts of Siberia, from whence the merchants procure furs, ſkins, and iron.

The houſes of Archangel are generally of wood, but well contrived; and every chamber is provided with a ſtove, as a fence againſt the cold, which is here exceſſive in the winter. The ſtreets are paved with broken pieces of timber and rubbiſh, diſpoſed ſo unſkilfully, that one cannot walk over it without running the riſk of falling, except when the ſtreets are rendered ſmooth and equal by the ſnow that falls and freezes in the winter. Notwithſtanding the ſeverity of the cold in this place, there is always plenty of good proviſions; butcher's meat, poultry, wild fowl, and fiſh, in great variety, are ſold ſurpriſingly cheap.

The moſt remarkable edifice in Archangel is a large town-houſe, built of ſquare ſtones in the Italian manner, and divided into three parts. One of theſe conſiſts of large commodious apartments, for the accommodation of merchants, ſtrangers as well as natives: here they are permitted to reſide with their merchandiſe till the month of October, when all the foreign ſhips ſet ſail for the reſpective countries to which they belong. Then the traders are obliged to remove their quarters from the town-houſe or palace, which hath a ſpacious court, that reaches down to the river.

ARCHBISHOP, the name of a church dignitary of the firſt claſs. Archbiſhops were not known in the eaſt till about the year 320; and though there were ſome ſoon after this who had the title, yet that was only a perſonal honour, by which the biſhops of conſiderable cities were diſtinguiſhed. It was not till of late that archbiſhops became metropolitans, and had ſuffragans under them. Athanaſius appears to be the firſt who uſed the title *Archbiſhop*, which he gave occaſionally to his predeceſſor; Gregory Nazianzen, in like manner, gave it to Athanaſius; not that either of them were intitled to any juriſdiction, or even any precedence in virtue of it. Among the Latins, Iſidore Hiſpalenſis is the firſt that ſpeaks of archbiſhops. He diſtinguiſhes four orders or degrees in the eccleſiaſtial hierarchy, viz. patriarchs, archbiſhops, metropolitans, and biſhops.

The archbiſhop, beſide the inſpection of the biſhops and inferior clergy in the province over which he preſides, exerciſes epiſcopal juriſdiction in his own dioceſe. He is guardian of the ſpiritualites of any vacant ſee in his province, as the king is of the temporalities; and exerciſes eccleſiaſtical juriſdiction in it. He is intitled to preſent by lapſe to all the eccleſiaſtical livings in the diſpoſal of his dioceſan biſhop, if not filled within ſix months. He has likewiſe a cuſtomary prerogative, upon conſecrating a biſhop, to name a clerk or chaplain to be provided for by ſuch biſhop; in lieu of which it is now uſual to accept an option. He is ſaid to be enthroned when veſted in the archbiſhopric; whereas biſhops are ſaid to be inſtalled.

The eccleſiaſtical government of England is divided into two provinces, viz. Canterbury and York. Canterbury hath the following ſuffragan biſhoprics appertaining to it, St Aſaph, Bangor, Bath and Wells, Briſtol, Chicheſter, Litchfield and Coventry, St David's, Ely, Exeter, Glouceſter, Hereford, Landaff, Lincoln, London, Norwich, Oxford, Peterborough, Rocheſter, Saliſbury, Wincheſter, and Worceſter. To York appertaineth the biſhoprics of Carliſle, Cheſter, and Durham; to which may be added the biſhopric of Sodor and Man, whoſe biſhop is not a Lord of Parliament. See CANTERBURY and YORK.

The archbiſhop of Canterbury had anciently, viz. till the year 1152, juriſdiction over Ireland as well as England, and was ſtyled a *patriarch*, and ſometimes *alterius orbis papa*, and *orbis Britannici pontifex*. Matters were done and recorded in his name thus, *Anno pontificatus noſtri primo*, &c. The firſt archbiſhop of Canterbury was Auſtin, appointed by king Ethelbert, on his converſion to Chriſtianity, about the year 598. He was alſo *legatus natus*. He even enjoyed ſome ſpecial marks of royalty; as, to be patron of a biſhopric, which he was of Rocheſter; and to make knights, coin moneys, &c. He is ſtill the firſt peer of England, and the next to the royal family; having precedence of all dukes and all great officers of the crown. It is his privilege, by cuſtom, to crown the kings and queens of that kingdom. He may retain and qualify eight chaplains; whereas a duke is by ſtatute allowed only ſix. He has, by common law, the power of probate of wills and teſtaments, and granting letters of adminiſtration. He has alſo a power to grant licences and diſpenſations in all caſes formerly ſued for in the court of Rome, and not repugnant to the law of God. He accordingly iſſues ſpecial licences to marry, to hold two livings, &c. and he exerciſes the right of conferring degrees. He alſo holds ſeveral courts of judicature; as, court of arches, court of audience, prerogative court, and court of peculiars.

The archbiſhop of York has the like rights in his province as the archbiſhop of Canterbury. He has precedence of all dukes not of the royal blood; and of all officers of ſtate, except the lord high chancellor. He has alſo the rights of a count palatine over Hexamſhire. The firſt archbiſhop of York was Paulinus, appointed by Pope Gregory about the year 622. He had formerly juriſdiction over all the biſhops of Scotland; but in the year 1470, pope Sextus IV. created the biſhop of St Andrew's archbiſhop and metropolitan of all Scotland.

Scotland, whilſt epiſcopacy prevailed in that country, had two *archbiſhops*, of St Andrew's and Glaſgow; of which the former was accounted the metropolitan; and, even before it arrived at the dignity of an archbiſhopric, reſiſted with great ſpirit all the attempts of the archbiſhops of York in England to become the metropolitans of Scotland. The ſees of Argyle, Galloway, and the Iſles, were ſuffragans to Glaſgow; all the others in the kingdom, to St Andrew's.

Ireland has four archbiſhops; of Armagh, Dublin, Caſſil, and Tuam; of whom the former is primate of all Ireland.

ARCHBISHOPRIC, in eccleſiaſtical geography, a province ſubject to the juriſdiction of an archbiſhop.

ARCHBUTLER, one of the great officers of the German empire, who preſents the cup to the emperor on ſolemn occaſions. This office belongs to the king of Bohemia.

ARCHCHAMBERLAIN, an officer of the empire, much the ſame with the great chamberlain in England. The elector of Brandenburg was appointed by the golden bull archchamberlain of the empire.

ARCHCHANCELLOR, an high officer who, in ancient times, preſided over the ſecretaries of the court. Under the two firſt races of the kings of France, when their territories were divided into Germany, Italy, and Arles, there were three archchancellors: and hence the three archchancellors ſtill ſubſiſting in Germany; the archbiſhop of Mentz being archchancellor of Germany, the archbiſhop of Cologn, and the archbiſhop of Treves.

ARCHCHANTOR, the preſident of the chantors of the church.

ARCHCOUNT, a title formerly given to the earl of Flanders, on account of his great power and riches.

ARCHDEACON, an eccleſiaſtical dignitary or officer next to a biſhop, whoſe juriſdiction extends either over the whole dioceſe or only part of it. He is uſually appointed by the biſhop himſelf; and hath a kind of epiſcopal authority, originally derived from the biſhop, but now independent and diſtinct from his. He therefore viſits the clergy; and has his ſeparate court for puniſhment of offenders by ſpiritual cenſures, and for hearing all other cauſes of eccleſiaſtical cognizance. There are 60 archdeacons in England.

ARCHDEACON's Court, is the moſt inferior court in the whole eccleſiaſtical polity. It is held, in the archdeacon's abſence, before a judge appointed by himſelf, and called his *official*; and its juriſdiction is ſometimes in concurrence with, ſometimes in excluſion of, the biſhop's court of the dioceſe. From hence, however, by ſtatute 24 Hen. VIII. c. 12. there lies an apeal to that of the biſhop.

ARCHDRUID, the chief or pontiff of the ancient druids of a nation. See DRUID.

ARCHDUKE, a title peculiar to the Houſe of Auſtria; all the ſons of which are archdukes, and daughters archducheſſes. See DUKE.

ARCHELAUS, a celebrated Greek philoſopher, the diſciple of Anaxagoras, flouriſhed about 440 years before Chriſt. He read lectures at Athens, and did not depart much from the opinions of his maſter. He taught that there was a double principle of all things, namely, the *expanſion* and *condenſation* of the air, which he regarded as infinite. Heat, according to him, was in continual motion. Cold was ever at reſt. The earth, which was placed in the midſt of the univerſe, had no motion. It originally reſembled a wet marſh, but was afterwards dried up; and its figure, he ſaid, reſembled that of an egg. Animals were produced from the heat of the earth, and even men were formed in the ſame manner. All animals have a ſoul, which was born with them; but the capacities of which vary according to the ſtructure of the organs of the body in which it reſides.—Socrates, the moſt illuſtrious of his diſciples, was his ſucceſſor.

Archelaus, the ſon of Herod the Great, was declared king of Judea the ſecond year after the birth of Chriſt. He put to death 3000 perſons before he went to Rome to be confirmed by Auguſtus. However, that emperor gave him half of what had been poſſeſſed by his father; but at length, on freſh complaints exhibited againſt him by the Jews, he baniſhed him to Vienne in Gaul, A. D. 6, where he died.

Archelaus, the ſon of Apollonius, one of the greateſt ſculptors of antiquity, was a native of Ionia, and is thought to have lived in the time of the emperor Claudius. He executed, in marble, the apotheoſis of Homer. This maſterpiece in ſculpture was found in 1568, in a place named *Fratocchia*, belonging to the princes of Colonna, where, it is ſaid, the emperor Claudius had a pleaſure-houſe. Father Kircher, Cupert, Spanheim, and ſeveral other learned antiquaries, have given a deſcription and explication of the work.

ARCHERS, a kind of militia or ſoldiery armed with bows and arrows. The word is formed of *arcus* “ a bow ;” whence *arcuarius*, and even *arquis*, and *arquites*, as they are alſo denominated in the corrupt ſtate of the Latin tongue.

Archers were much employed in former times: but they are now laid aſide, excepting in Turkey and ſome of the eaſtern countries; where there are companies of archers ſtill ſubſiſting in their armies, and with which they did terrible execution at the battle of Lepanto.—As an exerciſe, the practice of archery is ſtill kept up in many places. See the article **Archery**.

In France, the officers who attend the lieutenants de police and provoſts to make captures, ſeizures, arreſts, &c. are called *archers*; though their arms be only halberds or carabines.—In this ſenſe they ſay, the *archers* of the *grand prevot de l'hotel*; of the *prevot des marchands*; the city *archers*; the *archers du guet*, or of the watch, &c.—Small parties of *archers*, called alſo *gens de marechauſſee*, are continually patrolling on the great roads, to ſecure them againſt robbers.—The carriages of Lyons, &c. are always eſcorted by a party of archers. To the diligence of theſe archers, or marſhal's-men, it is partly owing, that perſons now travel in all parts of France in the utmoſt ſecurity; there being fewer robbers on the highway in that whole kingdom in a year than about London in a week.

ARCHERY, the art or exerciſe of ſhooting with a bow and arrow.

In moſt nations the bow was anciently the principal implement of war, and by the expertneſs of the archers alone was often decided the fate of battles and of empires.—In England archery was greatly encouraged in former times, and many ſtatutes were made for the regulation thereof; whence it was that the Engliſh archers in particular became the beſt in Europe, and procured them many ſignal victories.

The *Artillery company* of London, though they have long diſuſed the weapon, are the remains of the ancient fraternity of bowmen or archers. Artillery (*artillérie*) is a French term ſignifying *archery*; as the *king's bowyer* is in that language ſtyled *artillier du roy*: And from that nation the Engliſh ſeem to have learnt at leaſt the croſs-bow archery. We therefore find that William the Conqueror had a conſiderable number of bowmen in his army at the battle of Haſtings, when no mention is made of ſuch troops on the ſide of Harold: And it is ſuppoſed that theſe Norman archers ſhot with the arbaleſt (or croſs-bow), in which formerly the arrow was placed in a groove, being termed in French a *quadrel*, and in Engliſh a *bolt*.

Archaeologia vol. vii.

Of the time when ſhooting with the long bow firſt began among the Engliſh, at which exerciſe they afterwards became ſo expert, there appear no certain accounts. Their chroniclers do not mention the uſe of archery as expreſsly applied to the croſs-bow, or the long-bow, till the death of Richard I. who was killed by an arrow at the ſiege of Limoges in Guienne, which Hemmingford mentions to have iſſued from a croſs-bow.—After this, which happened in 1196, there appear not upon record any notices of archery for nearly 150 years, when an order was iſſued by Edward III. in the 15th year of his reign, to the ſherives of moſt of the Engliſh counties for providing 500 white bows and 500 bundles of arrows, for the then intended war againſt France. Similar orders are repeated in the following years; with this difference only, that the ſheriff of Glouceſterſhire is directed to furniſh 500 painted bows as well as the ſame number of white. The famous battle of Creſſy was fought four years afterwards, in which the Engliſh chroniclers ſtate that they had 2000 archers, who were oppoſed to about the ſame number of the French, together with a circumſtance which ſeems to prove, that by this time they uſed the long-bow, whilſt the French archers ſhot with the arbaleſt. The circumſtance alluded to is as follows: Previouſly to the engagement there fell a very heavy rain, which is ſaid to have much damaged the bows of the French, or perhaps rather the ſtrings of them. Now the long-bow (when unſtrung) may be moſt conveniently covered, ſo as to prevent the rain's injuring it; nor is there ſcarcely any addition to the weight from ſuch a cauſe; whereas the arbaleſt is of a moſt inconvenient form to be ſheltered from the weather. As therefore, in the year 1342, orders iſſued to the ſherives of each county to provide 500 bows, with a proper porportion of arrows, it ſeems probable that theſe were long-bows, and not the arbaleſt.

At the above-mentioned battle, the Engliſh aſcribed their victory chiefly to the archers.—The battle of Poicters was fought A. D. 1356, and gained by the ſame means.

Sometimes the archers gained great victories without even the leaſt aſſiſtance from the men-at-arms; as, particularly, the deciſive victory over the Scots at Homildon, A. D. 1402. In that bloody battle, the men-at-arms did not ſtrike a ſtroke, but were mere ſpectators of the valour and victory of the archers. The Earl of Douglas, who commanded the Scotch army in that action, enraged to ſee his men falling thick around him by ſhowers of arrows, and truſting to the goodneſs of his armour (which had been three years in making) accompanied by about eighty lords, knights, and gentlemen, in complete armour, ruſhed forward, and attacked the Engliſh archers ſword in hand. But he ſoon had reaſon to repent his raſhneſs. The Engliſh arrows were ſo ſharp and ſtrong, and diſcharged with ſo much force, that no armour could repell them. The Earl of Douglas, after receiving five wounds, was made priſoner; and all his brave companions were either killed or taken. Philip de Comines acknowledges, what the Engliſh writers aſſert, that their archers excelled thoſe of every other nation; and Sir John Forteſcue ſays again and again,—“that the might of the realme of England ſtandyth upon archers.” The ſuperior dexterity of their archers gave the Engliſh a great advantage over their capital enemies the French and Scots. The French depended chiefly on their men-at-arms, and the Scots on their pikemen; but the ranks of both were often thinned and thrown into diſorder by flights of arrows before they could reach their enemies.

Henry's Hiſt. vol. v. p. 463.

James I. of Scotland, who had ſeen and admired the dexterity of the Engliſh archers, and who was himſelf an excellent archer, endeavoured to revive the exerciſe of archery among his own ſubjects, by whom it had been too much neglected. With this view, he ridiculed their awkward manner of handling their bows, in his humorous poem of Chriſt's Kirk on the Green; and procured the following law to be made in his firſt parliament, A. D. 1424, immediately after his return to Scotland: “That all men might buſk thame to be archares fra the be 12 years of age; and that at ilk ten punds worth of land thair be made bow markes, and ſpeciallie near paroche kirks, quhairn upon halie dayis men may cum, and at the leiſt ſchuite thryſe about, and have uſage of archarie: and whaſa uſis not archarie, the laird of the land ſall rais of him a wedder; and giff the laird raiſis not the ſaid pane, the king's ſherif or his miniſters ſall rais it to the king.” But the untimely death of that excellent prince prevented the effectual execution of this law.

There is not found any act of Parliament of Henry V. in relation to archery, and all the orders in Rymer till the battle of Agincourt relate to great guns, from which he ſeems at firſt to have expected more conſiderable advantage than from the training of bowmen. It ſhould ſeem, however, that this ſort of artillery, from its unwieldineſs, bad and narrow roads, together with other defects, was as yet but of little uſe in military operations. In the year 1417 this king therefore aſcribes his victory at Agincourt to the archers, and directs the ſherives of many counties to pluck from every gooſe ſix wing-feathers for the purpoſe of improving arrows, which are to be paid for by the king.

Archæologia

In 1421, though the French had been defeated both at Creſſy, Poicters, and Agincourt, by the Engliſh archers, yet they ſtill continued the uſe of the croſs-bow; for which reaſon, Henry V. as duke of Normandy, confirms the charters and privileges of the baliſtarii, which had been long eſtabliſhed as a fraternity in his city of Rouen.

In the fifth year of Edward IV. an act paſſed, that every Engliſhman, and Iriſhman dwelling with Engliſhmen, ſhall have an Engliſh bow of his own height, which is directed to be made of yew, wych, hazel, aſh, or awburne, or any other reaſonable tree according to their power. The next chapter alſo directs that butts ſhall be made in every townſhip, which the inhabitants are obliged to ſhoot up and down every feaſt-day, under the penalty of a halfpenny when they ſhall omit this exerciſe.

In the 14th year, however, of this ſame king, it appears by Rymer's Fœdera, that 1000 archers were to be ſent to the duke of Burgundy, whoſe pay is ſettled at ſix pence a-day, which is more than a common ſoldier receives clear in the preſent times, when proviſions are ſo much dearer, and the value of money ſo much decreaſed. This circumſtance ſeems to prove, very ſtrongly, the great eſtimation in which archers were ſtill held. In the ſame year, Edward preparing for a war with France, directs the ſherives to procure bows and arrows, “as moſt ſpecially requiſite and neceſſary.”

On the war taking place with Scotland, eight years after this, Edward provides both ordnance and archers; ſo that though the uſe of *artillery* (as we now term it) was then gaining ground, yet that of the bow and arrow was not neglected.

Richard III. by his attention to archery, was able to ſend 1000 bowmen to the duke of Bretagne, and he availed himſelf of the ſame troops at the battle of Boſworth.

During the reign of Henry VII. however, there appears no order relative to gun-powder or artillery; whilſt, on the other hand, in 1488, he directs a large levy of archers to be ſent to Britanny, and that they ſhall be reviewed before they embark. In the 19th year of his reign, this ſame king forbids the uſe of the croſs-bow, becauſe “the long-bow had been much uſed in this realm, whereby honour and victory had been gotten againſt outward enemies, the realm greatly defended, and much more the dread of all Chriſtian princes by reaſon of the ſame.”

During the reign of Henry VIII. ſeveral ſtatutes were made for the promotion of archery. The 8th Eliz. c. 10. regulates the price of bows, and the 13th Eliz. c. 14. enacts, that bow-ſtaves ſhall be brought into the realm from the Hanſe-towns and the Eaſtward; ſo that archery ſtill continued to be an object of attention in the legiſlature.

In Rymer's *Fœdera* there is neither ſtatute nor proclamation of James I. on this head; but it appears by Dr Birch's Life of his ſon (prince Henry), that at eight years of age, he learned to ſhoot both with the bow and gun, whilſt at the ſame time this prince had in his eſtabliſhment an officer who was ſtyled *bow-bearer*. The king granted a ſecond charter to the artillery company, by which the powers they had received from Henry VIII. were conſiderably extended.

Charles I. appears from the dedication of a treatiſe intitled, *The Bowman's Glory*, to have been himſelf an archer; and in the eighth year of his reign he iſſued a commiſſion to the chancellor, lord-mayor, and ſeveral of the privy council, to prevent the fields near London being ſo incloſed as "to interrupt the neceſſary and profitable exerciſe of ſhooting," as alſo to lower the mounds where they prevented the view from one mark to another.

Catharine of Portugal (queen to Charles II.) ſeems to have been much pleaſed with the ſight at leaſt of this exerciſe; for in 1676, by the contributions of Sir Edward Hungerford and others, a ſilver badge for the marſhal of the fraternity was made, weighing 25 ounces, and repreſenting an archer drawing the long-bow (in the proper manner) to his ear, with the following inſcription: *Reginæ Catherinæ Sagittarii.* The ſupporters are two bowmen, with the arms of England and Portugal. In 1682 there was a moſt magnificent cavalcade and entertainment given by the Finſbury archers, when they beſtowed the titles of "duke of Shoreditch," "marquis of Iſlington," &c. upon the moſt deſerving. Charles II. was preſent upon this occaſion; but the day being rainy, he was obliged ſoon to leave the field.

So lately as the year 1753 targets were erected in the Finſbury fields, during the Eaſter and Whitſun holidays; when the beſt ſhooter was ſtyled Captain for the enſuing year, and the ſecond Lieutenant.

Why this military weapon was ſo deciſive in the battles of former days, the following reaſons may be ſuggeſted.

Before the introduction of fire-arms, the enemy could only be ſtruck at a diſtance by ſlings, the bow uſed by the ancients, or the croſs-bow; to all which the Engliſh long-bow was infinitely ſuperior. As for ſlings, they never have been uſed in the more northern parts of Europe by armies in the field; nor does their uſe indeed ſeem to have been at all convenient or extenſively practicable, for two principal reaſons; In the firſt place, ſlingers cannot advance in a compact body, on account of the ſpace to be occupied by this weapon in its rotatory motion; in the next place, the weight of the ſtones to be carried muſt neceſſarily impede the ſlingers greatly in their movements. The bow of the ancients, again, as repreſented in all their reliefs, was a mere toy compared with that of our anceſtors; it was therefore chiefly uſed by the Parthians, whoſe attacks (like thoſe of the preſent Arabs) were deſultory. As for the croſs-bow, it is of a moſt inconvenient form for carriage, even with the modern improvements; and, in caſe of rain, could not be eaſily ſecured from the weather. After the firſt ſhot, moreover, it could not be recharged under a conſiderable time, whilſt the bolts were alſo heavy and cumberſome. The Engliſh long-bow, on the other hand, together with the quiver of arrows, was eaſily carried by the archer, as eaſily ſecured from rain, and recharged almoſt inſtantaneouſly. It is not therefore extraordinary, that troops, who ſolely uſed this moſt effectual weapon, ſhould generally obtain the victory, even when oppoſed to much more numerous armies.

It may be urged, that theſe loſſes having been experienced by our enemies, muſt have induced them to practiſe the ſame mode of warfare.——But it is thought that the long bow was not commonly uſed even in England till the time of Edward III. when the victory at Creſſy ſufficiently proclaimed the ſuperiority of that weapon. It required, however, ſo much training before the archer could be expert, that we muſt not be ſurpriſed if ſoon afterwards this military exerciſe was much neglected, as appears by the preambles of ſeveral ancient ſtatutes. Whilſt the military tenures ſubſiſted, the ſovereign could only call upon his tenants during war, who therefore attended with the weapons they had been uſed to, and which required no previous practice. On the other hand, the Engliſh archers were obliged by acts of parliament, even in time of peace, to erect butts in every pariſh, and to ſhoot on every Sunday and holiday, after repairing perhaps to theſe butts from a conſiderable diſtance, whilſt the expence of at leaſt a yew-bow is repreſented as being a charge which they were ſcarcely equal to. The king and parliaments of this country having thus compelled the inhabitants to ſuch training, the Engliſh armies had (it ſhould ſeem) the ſame advantage over their enemies as the excluſive uſe of fire-arms would give at preſent.

It appears alſo by what hath been already ſtated, that the long-bow continued to be in eſtimation for more than two centuries after gunpowder was introduced, which probably aroſe from muſkets being very cumberſome and unwieldy. It is well known that rapid movements are generally deciſive of the campaign; and for ſuch the archers were particularly adapted, becauſe, as they could not be annoyed at the ſame diſtance by the weapons of the enemy, they had ſcarcely any occaſion for armour. The flower of ancient armies likewiſe was the cavalry, againſt which the long-bow never failed to prevail, as man and horſe were too large objects to be miſſed: and hence the great number of French nobility who were priſoners at Creſſy, Poictiers, and Agincourt; for being diſmounted (if not wounded) whilſt they were alſo clad in heavy armour, they could not make their eſcape. The ſame reaſon accounts for the Engliſh obtaining theſe ſignal victories with ſo inferior numbers; for the nobility and gentry thus becoming priſoners, the other parts of the French army made little or no reſiſtance. No wonder, therefore, that in England the greateſt anxiety was ſhewn to promote the exerciſe of this moſt important weapon, and that ſo many ſtatutes were made for that purpoſe.

In Scotland, alſo, little leſs attention, though apparently not with equal ſucceſs, was ſhewn to the encouragement of the art. In both kingdoms, it was provided, that the importers of merchandiſe ſhould be obliged, along with their articles of commerce, to import a certain proportion of bows, bow-ſtaves, and ſhafts for arrows. In both, every perſon was enjoined to hold himſelf provided in bows and arrows, and was preſcribed the frequent uſe of archery. In both, a reſtraint was impoſed upon the exerciſe of other games and ſports, leſt they ſhould interfere with the uſe of the bow; for it was intended, that the people ſhould be made expert in the uſe of it as a military weapon, by habituating them to the familiar exerciſe of it as an inſtrument of amuſement. As there was no material difference between the activity and bodily ſtrength of the two people, it might be ſuppoſed that the Engliſh and Scots wielded the bow with no unequal vigour and dexterity; but from undoubted hiſtorical monuments it appears that the former had the ſuperiority; of which one inſtance has already been narrated. By the regulations preſcribed in their ſtatute-book for the practice of archery, we find that the Engliſh ſhot a very long bow, thoſe who were arrived at their full growth and maturity being prohibited from ſhooting at any mark that was not diſtant upwards of 220 yards.

In the uſe of the bow, great dexterity as well as ſtrength ſeems to have been requiſite. Though we hear of arrows at Cheviot Chaſe which were a yard long, yet it is by no means to be ſuppoſed that the whole band made uſe of ſuch, or could draw them to the head. The regulation of the Iriſh ſtatute of Edward IV. viz. that the bow ſhall not exceed the height of the man, is allowed by archers to have been well conſidered; and as the arrow ſhould be half the length of the bow, this would give an arrow of a yard in length to thoſe only who were ſix feet high. A ſtrong man of this ſize in the preſent time cannot eaſily draw above 27 inches if the bow is of a proper ſtrength to do execution at a conſiderable diſtance. At the ſame time it muſt be admitted, that as our anceſtors were obliged by ſome of the old ſtatutes to begin ſhooting with the long-bow at the age of ſeven, they might have acquired a greater ſlight in this exerciſe than their deſcendants, though the latter ſhould be allowed to be of equal ſtrength.

As the ſhooting of the long-bow was firſt introduced in England, and practiſed almoſt excluſively for nearly two centuries, ſo it hath occaſioned a peculiar method of drawing the arrow to the ear and not to the breaſt. That this is contrary to the uſage of the ancients is very clear from their reliefs, and from the tradition of the Amazons cutting off one of their paps, as it occaſioned an impediment to their ſhooting. The Finſbury archer is therefore repreſented in this attitude of drawing to the ear, both in the *Bowman's Glory*, and in the ſilver badge given by Catharine to the Artillery company. Not many years ago there was a man named Topham, who exhibited ſurpriſing feats of ſtrength, and who happened to be at a public-houſe near Iſlington, to which the Finſbury archers reſorted after their exerciſe. Topham conſidered the long bow as a play-thing, only fit for a child; upon which one of the archers laid him a bowl of punch, that he could not draw the arrow two-thirds of its length. Topham accepted this bet with the greateſt confidence of winning: but bringing the arrow to his breaſt inſtead of his ear, he was greatly mortified by paying the wager, after many fruitleſs efforts.

As to the diſtance to which an arrow can be ſhot from a long-bow with the beſt elevation of forty-five degrees, that muſt neceſſarily depend much both upon the ſtrength and ſlight of the archer; but in general the diſtance was reckoned from eleven to twelve ſcore yards. The butts for exerciſe, as above-noticed, were directed to be diſtant upwards of 220 yards. There is indeed a tradition, that an attorney of Wigan in Lancaſhire (named Leigh) ſhot a mile in three flights; but the ſame tradition ſtates, that he placed himſelf in a very particular attitude, which cannot be uſed commonly in this exerciſe. According to Neade, an archer might ſhoot ſix arrows in the time of charging and diſcharging one muſket.

The archers conſider an arrow of from 20 to 24 drop weight to be the beſt for flight or hitting a mark at a conſiderable diſtance, and that yew is the beſt material of which they can be made. As to the feathers, that of a gooſe is preferred; it is alſo wiſhed, that the bird ſhould be two or three years old, and that the feather may drop of itſelf. Two out of three feathers in an arrow are commonly white, being plucked from the gander; but the third is generally brown or grey, being taken from the gooſe; and, from this difference in point of colour, informs the archer when the arrow is properly placed. From this moſt diſtinguiſhed part therefore the whole arrow ſometimes receives its name: And this, by-the-by, affords an explanation of the grey gooſe wing in the ballad of Cheviot Chaſe. Arrows were armed anciently with flint or metal heads, latterly with heads of iron; of theſe there were various forms and denominations. By an act of parliament, made the 7th of Henry IV. it was enacted, that for the future all the heads for arrows and quarrels ſhould be well boiled or braſed, and hardened at the points with ſteel; and that every arrow-head or quarrel ſhould have the mark of the maker: workmen diſobeying this order, were to be fined and impriſoned at the king's will, and the arrow-heads or quarrels to be forfeited to the crown.

Groſe on Ancient Armour

Arrows were reckoned by ſheaves, a ſheaf conſiſting of 24 arrows. They were carried in a quiver, called alſo an *arrow-caſe*, which ſerved for the magazine; arrows for immediate uſe were worn in the girdle. In ancient times phials of quicklime, or other combuſtible matter, for burning houſes or ſhips, was fixed on the heads of arrows, and ſhot from long-bows. This has been alſo practiſed ſince the uſe of gunpowder. Neade ſays, he has known by experience, that an archer may ſhoot an ounce of fire-work upon an arrow twelve ſcore yards. Arrows with wild-fire, and arrows for fire-works, are mentioned among the ſtores at Newhaven and Berwick, in the 1ſt of Edward VI.

The force with which an arrow ſtrikes an object at a moderate diſtance, may be conceived from the account given by king Edward VI. in his journal, wherein he ſays, that 100 archers of his guard ſhot before him two arrows each, and afterwards all together; and that they ſhot at an inch board, which ſome pierced quite thro', and ſtruck into the other board; divers pierced it quite through with the heads of their arrows, the boards being well-ſeaſoned timber: their diſtance from the mark is not mentioned.

To protect our archers from the attacks of the enemy's horſe, they carried long ſtakes pointed at both ends: theſe they planted in the earth, ſloping before them. In the 1ſt of Edward VI. 350 of theſe were in the ſtores of the town of Berwick, under the article of archer's ſtakes; there were alſo at the ſame time eight bundles of archer's ſtakes in Pontefract caſtle.

To prevent the bow-ſtring from ſtriking the left arm, the arm is covered with a piece of ſmooth leather, faſtened on the outſide of the arm: this is called a *bracer*; and to guard the fingers from being cut by the bow-ſtring, archers wore ſhooting gloves. Chaucer in his prologue to the Canterbury tales, thus deſcribes an archer of his day:

> And he was clad in cote and hode of grene,
> A ſhefe of peacock arwes bright and keen,
> Under his belt he bare ful thriftily;
> Wel coude he dreſſe his takel yewmanly,
> His arwes drouped not with fetheres lowe,
> And in his hand he bare a mighty bowe,
> A not-hed hadde he, with broune viſage,
> Of wood crafte coude he wel all the uſage;
> Upon his arms he had a gai bracer,
> And by his ſide a ſwerd and a bokeler,
> And on the other ſide a gaie daggere
> Harneiſed wel, and ſharp as pointe of ſpere:
> A criſtofre on his breaſt of ſilver ſhene,
> An horn he bare, the baudrik was of grene,
> A foreſter was he ſothely as I geſſe.

Though archery continued to be encouraged by the king and legiſlature for more than two centuries after the firſt knowledge of the effects of gunpowder, yet by the latter end of the reign of Henry VIII. it ſeems to have been partly conſidered as a paſtime. Arthur, the elder brother of Henry, is ſaid to have been fond of this exerciſe, in ſo much that a good ſhooter was ſtyled Prince Arthur. We are alſo informed, that he pitched his tent at Mile End in order to be preſent at this recreation, and that Henry his brother alſo attended. When the latter afterwards became king, he gave a prize at Windſor to thoſe who ſhould excel in this exerciſe; and a capital ſhot having been made, Henry ſaid to Barlow (one of his guards), "If you ſtill win, you ſhall be duke over all archers." Barlow therefore having ſucceeded, and living in Shoreditch, was created duke thereof. Upon another occaſion, Henry and the queen were met by 200 archers on Shooter's hill, which probably took its name from their aſſembling near it to ſhoot at marks. This king likewiſe gave the firſt charter to the Artillery Company in the 29th year of his reign, by which they are permitted to wear dreſſes of any colour except purple and ſcarlet, to ſhoot not only at marks but birds, if not pheaſants or herons, and within two miles of the royal palaces. They are alſo enjoined by the ſame charter not to wear furs of a greater price than thoſe of the martin. The moſt material privilege, however, is, that of indemnification from murder, if any perſon paſſing between the ſhooter and the mark is killed, provided the archers have firſt called out *faſt*.

The following deſcription of an archer, his bow and accoutrements, is given in a MS. written in the time of Queen Elizabeth. "Captains and officers ſhould be ſkilful of that moſt noble weapon, and to ſee that their ſoldiers according to their draught and ſtrength have good bows, well nocked, well ſtrynged, everie ſtrynge whippe in their nocke, and in the myddes rubbed with wax, braſer and ſhuting glove, ſome ſpare ſtrynges trymed as aforeſaid, every man one ſhefe of arrows, with a caſe of leather defenſible againſt the rayne, and in the ſame fewer and twentie arrowes, whereof eight of them ſhould be lighter than the reſidue, to gall or aſtoyne the enemye with the hailſhot of light arrows, before they ſhall come within the danger of their harquebuſs ſhot. Let every man have a brigandine, or a little cote of plate, a ſkull or huſkyn, a mawle of leade of five foot in lengthe, and a pike, and the ſame hanging by his girdle, with hook and a dagger; being thus furniſhed, teach them by muſters to march, ſhoote, and retire, keeping their faces upon the enemy's. Sumtyme put them into great nowmbers, as to battell apperteyneth, and thus uſe them often times practiſed, till they be perfecte; ffor thoſe men in battell ne ſkirmiſh can not be ſpared. None other weapon maye compare with the ſame noble weapon."

The long-bow, as already obſerved, maintained its place in the armies long after the invention of fire-arms. Nor have there been wanting experienced ſoldiers who were advocates for its continuance, and who in many caſes even preferred it to the harquebuſs or muſket. King Charles I. twice granted ſpecial commiſſions under the great ſeal for enforcing the uſe of the long bow. The firſt was in the 4th year of his reign: but this was revoked by proclamation four years afterwards, on account of divers extortions and abuſes committed under ſanction thereof. The ſecond, anno 1633, in the 9th year of his reign, to William Neade and his ſon, alſo named William, wherein the former is ſtyled an ancient archer, who had preſented to the king a warlike invention for uniting the uſe of the pike and bow, ſeen and approved by him and his council of war: wherefore his Majeſty had granted them a commiſſion to teach and exerciſe his loving ſubjects in the ſaid invention, which he particularly recommended the chief officers of his trained bands to learn and practiſe; and the juſtices and other chief magiſtrates throughout England, are therein enjoined to uſe every means in their power to aſſiſt Neade, his ſon, and all perſons authoriſed by them in the furtherance, propagation, and practice of this uſeful invention. Both the commiſſions and proclamation are printed at large in Rymer. At the breaking out of the civil war, the Earl of Eſſex iſſued a precept, dated in November 1643, for ſtirring up all well-affected people by benevolence, towards the raiſing a company of archers for the ſervice of the king and parliament.

Archery with the long-bow continues to be uſed as a manly exerciſe by the inhabitants of Geneva, and in many parts of Flanders; nor is it totally neglected in Great Britain. There are ſeveral ſocieties of archers in England; the chief of which are, *Woodmen of Arden*, and the *Toxophilite*. But the moſt noted ſociety of this kind, now exiſting, is

The *Royal Company of Archers* in Scotland.—The ancient records of this company having been deſtroyed by fire about the beginning of the preſent century, no authentic traces of their inſtitution now remain. It is ſaid that they owe their origin to the commiſſioners appointed in the reign of James I. of Scotland for enforcing and overſeeing the exerciſe of archery in different counties. Thoſe commiſſioners, who were in general men of rank and power, picking out amongſt the better ſort of people under their cogniſance the moſt expert archers, formed them into a company, and upon perilous occaſions made a preſent of their ſervices to the king as his chief body-guards; in which ſituation they often diſtinguiſhed themſelves for their loyalty, their courage, and ſkill in archery. This rank of the king's principal body-guards the Royal Company ſtill claim within ſeven miles of the metropolis of Scotland.

Certain it is, that by an act of the privy-council of Scotland in the 1677, this Company was recogniſed under the name and title of "His Majeſty's Company of Archers:" And by the ſame act a piece of plate of the value of L. 20 Sterling was ordered to be given to be ſhot for by them at their annual parades called *Weapon-ſhawings*, and to be called *The King's Prize.*

At this period the Royal Company conſiſted, as it does at preſent, of the principal nobility and gentry of Scotland. But their unfortunate attachment to anti-revolution principles, upon that event's taking place, put almoſt a period to their exiſtence: Their public parades or marches were diſcontinued, and the royal prize was with-held.

Upon the acceſſion of Queen Anne, their former ſplendor was revived; and in the year 1703 they obtained a royal charter, confirming in general terms all their former rights and privileges, and conferring others upon them. But their partiality to the family of Stuart was at various after periods the cauſe of a temporary proſperity and decline.

Theſe unhappy differences of opinion having totally ſubſided, the Royal Company are now more numerous and flouriſhing than ever, and perhaps even more dexterous archers. His preſent Majeſty, as a mark of his royal patronage and approbation, has been pleaſed to revive the royal prize, which for the firſt time was ſhot for upon the 28th of July 1788 by a numerous and reſpectable meeting.

The Woodmen of Arden and the Toxophilite have lately been pleaſed to admit the members of the Royal Company to the freedom of their ſocieties: theſe grants have been followed by reciprocal diplomas from the Royal Company; ſo that the three chief ſocieties of archers in Britain may be ſaid to be now incorporated into one.

The prizes belonging to this Company, and which are annually ſhot for, are, 1. A ſilver arrow, given by the town of Muſſelburgh, which appears to have been ſhot for as early as the year 1603. The victor in this, as in the other prizes, except the king's prize, has the cuſtody of it for a year, then returns it with a medal appended, on which are engraved any motto and device which the gainer's fancy dictates. 2. A ſilver arrow given by the town of Peebles A. D. 1626. 3. A ſilver arrow given by the city of Edinburgh A. D. 1709. 4. A ſilver punch-bowl of about the value of L. 50, made of Scottiſh ſilver at the expence of the Company, A. D. 1720. And, 5. The king's prize above mentioned, which becomes the abſolute property of the winner. All theſe prizes are ſhot for at what is termed *rovers*, the marks being placed at the diſtance of 185 yards.

Beſides theſe, there is another prize annually contended for at butt or point-blank diſtance, called the *Gooſe*. The ancient manner of ſhooting for this prize was, a living gooſe was built in a turf-butt, having the head only expoſed to view; and the archer who firſt hit the gooſe's head was intitled to the gooſe as his reward. But this cuſtom, on account of its barbarity, has been long ago laid aſide; and in place of the gooſe-head, a mark of about an inch diameter is affixed upon each butt, and the archer who firſt hits this mark is captain of the butt-ſhooters for a year.

The affairs of the Company are managed by a preſes and ſix counſellers, who are choſen annually by the whole members. The council are veſted with the power of receiving or rejecting candidates for admiſſion, and of appointing the company's officers civil and military.

The Royal Company now conſiſts of above 1000 members, among whom are moſt of the Scottiſh nobility of the firſt diſtinction. A number of the Company meet weekly during the ſummer-ſeaſon in Edinburgh, in the Meadows, where they exerciſe themſelves in ſhooting at butts or rovers: And in the adjoining ground they have a handſome building, erected within theſe 12 years, whith ſuitable offices, whither they adjourn after their exerciſe, and where they hold their elections and other meetings relative to the buſineſs of the ſociety.

The uniform of the Royal Company of Archers is tartan, lined with white, and trimmed with green and white fringes; a white ſaſh, with green toſſels; and a blue bonnet, with a St Andrew's croſs and feathers. The Company have two ſtandards. The firſt of theſe bears on one ſide Mars and Cupid encircled in a wreath of thiſtles; with this motto, "*In peace* and war." On the other, a yew tree, with two men dreſſed and equipped as archers, encircled as the former; motto, *Dat gloria vires.* The other ſtandard diſplays, on one ſide, a lion rampant gules, on a field or, encircled with a wreath; on the top, a thiſtle and crown; motto, *Nemo me impune laceſſet.* On the other, St Andrew on the croſs on a field argent; at the top, a crown; motto, *Dulce pro patria periculum.*

ARCHES-COURT, in Engliſh eccleſiaſtical polity, is a court of appeal, belonging to the archbiſhop of each province; whereof the judge is called the *dean of the arches*, becauſe he anciently held his court in the church of St Mary *le bow* (*Sancta Maria de arcubus*), though all the principal ſpiritual courts are now holden at Doctors Commons. His proper juriſdiction is only over the 13 peculiar pariſhes belonging to the archbiſhop in London; but the office of dean of the arches having been for a long time united with that of the archbiſhop's principal office, he now, in right of the laſt-mentioned office, receives and determines appeals from the ſentences of all inferior eccleſiaſtical courts within the province. And from him there lies an appeal to the king in chancery (that is, to a court of delegates appointed under the king's great ſeal), by ſtatute 25 Hen. VIII. c. 19. as ſupreme head of the Engliſh church, in the place of the biſhop of Rome, who formerly exerciſed this juriſdiction; which circumſtance alone will furniſh the reaſon why the Popiſh clergy were ſo anxious to ſeparate the ſpiritual court from the temporal.

ARCHETYPE, the firſt model of a work, which is copied after to make another like it.—Among minters, it is uſed for the ſtandard weight by which the others

thers are adjuſted.—The archetypal world, among Platoniſts, means the world as it exiſted in the idea of God before the viſible creation.

ARCHEUS, (from αρχη, the principal, chief, or firſt mover); a ſort of primum mobile ſet up by Helmont, to ſuperintend the animal œconomy, and preſerve it. It is akin to Plato's *anima mundi*.—Hippocrates uſes the word αρχαιη φυσις, to ſignify the former healthy ſtate before the attack of the diſeaſe.

ARCHIACOLYTHUS (from αρχος, *chief*, and ακολουθος, *miniſter*), an ancient dignity in cathedral churches: the miniſters whereof were divided into four orders or degrees, viz. prieſts, deacons, ſubdeacons, and acolythi; each of which had their chiefs. The chief of the acolythi was called *archiacolythus*.

ARCHIATER, ARCHIATRUS, properly denotes chief phyſician of a prince who retains ſeveral. The word is formed of αρχη, *principium*, "chief;" and ιατρος, *medicus*, a "phyſician."

ARCHIDAPIFER, (from αρχος, and *dapifer*, "ſewer,") or chief ſewer, is a great officer of the empire. The elector of Bavaria is archidapifer. The palatine of the Rhine, at one time pretended this office was annexed to his palatinate; but he has ſince deſiſted.

ARCHIEROSYNES, in the Grecian antiquity, a high prieſt veſted with authority over the reſt of the prieſts, and appointed to execute the more ſacred and myſterious rites of religion.

ARCHIGALLUS, in antiquity, the high-prieſt of Cybele, or the chief of the eunuch-prieſts of that goddeſs, called *Galli*.

ARCHIGERONTES (from αρχος, and γερων *old*), in antiquity, the chiefs or maſters of the ſeveral companies of artificers at Alexandria. Some have miſtaken the archigerontes for the arch-prieſts appointed to take the confeſſions of thoſe who were condemned to the mines.

ARCHIGUBERNUS, ARCHIGUBERNETA, or ARCHIGUBERNITES, in antiquity, the commander of the imperial ſhip, or that which the emperor was aboard of. Some have confounded the office of archigubernus with that of *præfectus claſſis*, or admiral, but the former was under the command of the latter. Potter takes the proper office of the archiguberneta to have been, to manage the marine affairs, to provide commodious harbours, and order all things relating to the ſailing of the fleet, except what related to war.

ARCHIL, ARCHILLA, ROCELLA, ORSIELLE, is a whitiſh moſs which grows upon rocks, in the Canary and Cape Verd iſlands, and yields a rich purple tincture, fugitive indeed, but extremely beautiful. This weed is imported to us as it is gathered. Thoſe who prepare it for the uſe of the dyer, grind it betwixt ſtones, ſo as to thoroughly bruiſe, but not to reduce it into powder; and then moiſten it occaſionally with a ſtrong ſpirit of urine, or urine itſelf mixed with quicklime: in a few days it acquires a purpliſh red, and at length a blue colour. In the firſt ſtate it is called *Archil*; in the latter, *Lacmus* or *Litmaſe*.

The dyers rarely employ this drug by itſelf, on account of its dearneſs and the periſhableneſs of its beauty. The chief uſe they make of it is, for giving a bloom to other colours, as pinks, &c. This is effected by paſſing the dyed cloth or ſilk through hot water lightly impregnated with the archil. The bloom thus communicated ſoon decays upon expoſure to the air. Mr Hellet informs us, that by the addition of a little ſolution of tin, this drug gives a durable dye; that its colour is at the ſame time changed towards a ſcarlet; and that it is the more permanent in proportion as it recedes the more from its natural colour.

Prepared archil very readily gives out its colour to water, to volatile ſpirits, and to ſpirit of wine; it is the ſubſtance principally made uſe of for colouring the ſpirits of thermometers. As expoſure to the air deſtroys its colour upon cloth, the excluſion of the air produces a like effect in theſe hermetically ſealed tubes, the ſpirits of large thermometers becoming in the compaſs of a few years colourleſs. M. l'Abbe Nollet obſerves (in the French Memoirs for the year 1742), that the colourleſs ſpirit, upon breaking the tube, ſoon reſumes its colour, and this for a number of times ſucceſſively; that a watery tincture of archil, included in the tubes or thermometers, loſt its colour in three days; and that, in an open deep veſſel, it became colourleſs at the bottom, while the upper part retained its colour. See COLOUR-*Making*, n° 38.

A ſolution of archil in water, applied on cold marble, ſtains it of a beautiful violet, or purpliſh blue colour, far more durable than the colour which it communicates to other bodies. Mr du Fay ſays he has ſeen pieces of marble ſtained with it, which in two years had ſuffered no ſenſible change. It ſinks deep into the marble, ſometimes above an inch; and at the ſame time ſpreads upon the ſurface, unleſs the edges be bounded by wax or other like ſubſtances. It ſeems to make the marble ſomewhat more brittle.

Linnæus informs us, in the Swediſh Tranſactions for the year 1742, that the true archil moſs is to be found on the weſtern coaſts of England. It has been for a conſiderable time paſt prepared by Meſſrs Gordons at Leith from a ſpecies found in the Highlands of Scotland.

ARCHILOCHIAN, a term in poetry, applied to a ſort of verſes, of which Archilochus was the inventor, conſiſting of ſeven feet; the four firſt whereof are ordinarily dactyls, though ſometimes ſpondees; the three laſt trochees, as in Horace,

Solvitur acris hyems, grata vice veris & Favoni.

ARCHILOCHUS, a famous Greek poet and muſician, was, according to Herodotus, contemporary with Candaules and Gyges, kings of Lydia, who flouriſhed about the 14th Olympiad, 724 years before Chriſt. But he is placed much later by modern chronologiſts; viz, by Blair, 686, and by Prieſtley 660 years, before Chriſt.

He was born at Paros, one of the Cyclades. His father Teleſicles was of ſo high a rank, that he was choſen by his countrymen to conſult the oracle at Delphos concerning the ſending a colony to Thaſos: a proof that he was of one of the moſt diſtinguiſhed families upon the iſland. However, he is ſaid to have ſullied his birth by an ignoble marriage with a ſlave called *Enipo*, of which alliance our poet-muſician was the fruit.

Though Archilochus ſhowed an early genius and attachment to poetry and muſic, theſe arts did not prevent

vent his going into the army, like other young men of his birth; but in the firſt engagement at which he was preſent, the young poet, like Horace, and like our own Suckling, loſt his buckler, though he ſaved his life by the help of his heels. *It is much eaſier*, ſaid he, *to get a new buckler than a new exiſtence.* This pleaſantry, however, did not ſave his reputation; nor could his poetry or prayers prevail upon Lycambes, the father of his miſtreſs, to let him marry his daughter, though ſhe had been long promiſed to him. After theſe mortifications, his life ſeems to have been one continued tiſſue of diſgrace and reſentment,

> *Archilochum proprio rabies armavit iambo.*
> Hor. Art. Poet. 79.
>
> Archilochus, with fierce reſentment warm'd,
> Was with his own ſevere iambics arm'd. Francis.

The *rage of Archilochus* was proverbial in antiquity; which compared the provoking this ſatiriſt to the treading upon a ſerpent: A compariſon not very ſevere, if it be true that Lycambes, and, as ſome ſay, his three daughters, were ſo mortified by his ſatire, as to be driven to the conſolation of a halter.

In this piece, many adventures are mentioned, full of defamation, and out of the knowledge of the public. There were likewiſe many looſe paſſages in it; and it is ſaid to have been on account of this ſatire that the Lacedemonians laid a prohibition on his verſes*.

However, according to Plutarch, there is no bard of antiquity by whom the two arts of poetry and muſic have been ſo much advanced as by Archilochus. To him is attributed particularly the ſudden tranſition from one rhythm to another of a different kind, and the manner of accompanying thoſe irregular meaſures upon the lyre. Heroic poetry, in hexameter verſe, ſeems to have been ſolely in uſe among the more ancient poets and muſicians; and the tranſition from one rhythm to another, which lyric poetry required, was unknown to them; ſo that if Archilochus was the firſt author of this mixture, he might with propriety be ſtyled the *Inventor of Lyric Poetry*, which, after his time, became a ſpecies of verſification wholly diſtinct from heroic.—To him is likewiſe aſcribed the invention of *Epodes*. See Epode.

Our poet-muſician is generally ranked among the firſt victors of the Pythic games: and we learn from Pindar, that his muſe was not always a termagant; for though no mortal eſcaped her rage, yet ſhe was at times ſufficiently tranquil and pious to dictate hymns in praiſe of the gods and heroes. One in particular, written in honour of Hercules, acquired him the acclamations of all Greece; for he ſung it in full aſſembly at the Olympic games, and had the ſatisfaction of receiving from the judges the crown of victory conſecrated to real merit. This hymn, or ode, was afterwards ſung in honour of every victor at Olympia, who had no poet to celebrate his particular exploits.

Archilochus was at laſt ſlain by one Callondax Corax, of the iſland of Naxos; who, though he did it in fight, according to the laws of war, was driven out of the temple of Delphi, by command of the oracle, for having deprived of life a man conſecrated to the Muſes.

The names of Homer and Archilochus were equally revered and celebrated in Greece, as the two moſt excellent poets which the nation had ever produced. This appears from an epigram in the Anthologia; and from Cicero, who ranks him with poets of the firſt claſs, and in his Epiſtles tells us, that the grammarian Ariſtophanes, the moſt rigid and ſcrupulous critic of his time, uſed to ſay, that the longeſt poem of Archilochus always appeared to him the moſt excellent.

ARCHIMAGUS, the high-prieſt of the Perſian Magi or worſhippers of fire. He reſided in the higheſt fire-temple; which was had in the ſame veneration with them as the temple of Mecca among the Mahometans. Zoroaſtres firſt ſettled it at Balch; but after the Mahometans had over-run Perſia in the 7th century, the Archimagus was forced to remove from thence into Kerman, a province of Perſia, lying on the ſouthern ocean, where it hath continued to this day. Darius Hyſtaſpes took upon himſelf the dignity of Archimagus: for Porphyry tells us, he ordered before his death, that, among the other titles, it ſhould be engraven on his monument, that he had been *Maſter of the Magi*; which plainly implies that he had borne this office among them, for none but the Archimagus was maſter of the whole ſect. From hence it ſeems to have proceeded, that the kings of Perſia were ever after looked on to be of the ſacerdotal tribe, and were always initiated into the ſacred order of the Magi, before they took on them the crown, and were inaugurated in the the kingdom.

ARCHIMANDRITE, in eccleſiaſtical hiſtory, was a name given by the ancient Chriſtians to what we now call an *abbot*. Father Simon obſerves, that the word *mandrite* is Syriac, and ſignifies a ſolitary monk.

ARCHIMIDES, a celebrated geometrician, born at Syracuſe in the iſland of Sicily, and related to Hiero king of Syracuſe. He was remarkable for his extraordinary application to mathematical ſtudies; in which he uſed to be ſo much engaged, that his ſervants were often obliged to take him from thence by force. He had ſuch a ſurpriſing invention in mechanics, that he affirmed to Hiero, if he had another earth, whereon to plant his machines, he could move this which we inhabit. He is ſaid to have formed a glaſs ſphere, of a moſt ſurpriſing workmanſhip, wherein the motions of the heavenly bodies were repreſented. He diſcovered the exact quantity of the ſilver which a goldſmith had mixed with the gold in a crown he had made for the king; he had the hint of this diſcovery from his perceiving the water riſe up the ſides of the bath as he went into it, and was filled with ſuch joy, that he ran naked out of the bath, crying, "I have found it! I have found it!" By the invention of machines, he, for a long time, defended Syracuſe on its being beſieged by Marcellus (See Syracuse). On the city's being taken, that general commanded his ſoldiers to have a particular regard to the ſafety of this truly great man; but his care was ineffectual. "What gave Marcellus the greateſt concern (ſays Plutarch), was the unhappy Archimedes, who was at that time in his muſæum, and his mind, as well as his eyes, ſo fixed and intent upon ſome geometrical figures, that he neither heard the noiſe and hurry of the Romans, nor perceived the city was taken. In this depth of ſtudy and contemplation, a ſoldier came ſuddenly upon him, and commanded him to follow him to Marcellus; which he refuſing to do till he had finiſhed his problem, the ſoldier, in a rage, drew his ſword, and ran him through the body." Others have related the circumſtances of his death in a ſomewhat different manner. It however happened 208 years before the Chriſtian æra. Cicero, when he was quæſtor in Italy, diſcovered his tomb, on which was carved a cylinder and ſphere†. Some of the works of this great mathematician are loſt, but others are preſerved. His pieces which remain are, 1. Two books of the Sphere and Cylinder. 2. The Dimenſions of a Circle. 3. Of Centers of Gravity, or Æquiponderants. 4. Of Spheroids and Conoids. 5. Of Spiral Lines. 6. The Quadrature of a Parabola. 7. Of the Number of the Sand. 8. Of Bodies that float on Fluids. The beſt edition is theſe is that publiſhed at London, in 1675, 4to. Among the works of Archimedes which are loſt, we may reckon the deſcriptions of the following inventions, which we may gather from himſelf and other ancient authors. 1. Περι της ϛεφανης, or his account of the method which he uſed to diſcover the mixture of gold and ſilver in the crown. 2. His deſcription of the Κοχλια, or Κοχλιον, an engine to draw water out of places where it is ſtagnated. Athenæus, ſpeaking of the prodigious ſhip built by the order of Hiero, tells us, that Archimedes invented the cochlion, by means of which the hold, notwithſtanding its depth, could be drained by one man. (Δειπνοσοφιϛων, lib. b.) Diodorus Siculus informs us (lib. v.) that he contrived this machine to drain Egypt, and that by a wonderful mechaniſm it would empty the water from any depth. 3. The Ελιξ, by means of which (according to Athenæus, Δειπνοσ, lib. v.) he launched Hiero's great ſhip. 4. The Τρισπωϛεν, of the power of which Tzetzes gives a hyperbolical relation, Chil. ii. hiſt. 35. 5. The machines he uſed in the defence of Syracuſe againſt Marcellus Of theſe we have an account in Polybius, Livy, and Plutarch. 6. His burning-glaſſes, with which he is ſaid to have ſet fire to the Roman galleys. Galen, Περι κρασεων, lib. iii. 7. His pneumatic and hydraulic engines, concerning which he wrote books, according to Tzetzes, Chil. ii. hiſt. 35.

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* Val. Max. lib. 6. c. 3.

ARCHIPELAGO, in geography, a general term ſignifying a ſea interrupted with iſlands; it is however more eſpecially applied to that lying between Europe and Aſia, which contains the iſlands anciently called *Cyclades* and *Sporades*. See theſe two words.

ARCHIPHERACITÆ, miniſters in the Jewiſh ſynagogues appointed to read and interpret the Perakim, or titles and heads of the law and the prophets.

ARCHPRESBYTER, ARCH-PRIEST, a prieſt eſtabliſhed in ſome dioceſes with a ſuperiority over the reſt. He was anciently choſen out of the college of preſbyters at the pleaſure of the biſhop. Theſe archpreſbyters were much of the ſame nature with deans in the cathedral churches, as the college of preſbyters anſwers to the chapter. See PRESBYTER.

ARCHISYNAGOGUS, the chief of the ſynagogue; the title of an officer among the Jews, who preſided in their ſynagogues and aſſemblies. The number of theſe officers was not fixed, nor the ſame in all places: there being 70 in ſome, and in others only one. They are ſometimes called *princes* of the ſynagogue, and had a power of excommunicating ſuch as deſerved that puniſhment.

ARCHITECT, a perſon ſkilled in architecture, or the art of building; who forms plans and deſigns for edifices, conducts the work, and directs the ſeveral artificers employed in it. The word is derived from αρχος, *princeps*, and τεκτων, *faber*, "workman; q. d. the principal workman.

ARCHITECTURE,

IN the utmoſt latitude of the word, ſignifies the art of building in general; but the term is moſt frequently applied only to the conſtruction of ſuch buildings as are neceſſary for the purpoſes of civil life, ſuch as houſes, churches, halls, bridges, porticoes, *&c.*

Hiſtory of Architecture.

THE origin of this art, like that of moſt others, is totally unknown. We are aſſured, however, that it is as old as Cain: for Moſes tells us that he built a city; tho' what were the materials, or how the buildings were conſtructed, we are entirely ignorant. It is commonly ſaid, that the firſt materials employed in building were branches and twigs of trees, wherewith men conſtructed huts, ſuch as the *wigwams* in uſe among the American Indians at preſent. This, however, appears diſputable. The natural ſhelter afforded by hollows in the ſides of mountains or rocks, it may be ſuppoſed, would much more readily ſuggeſt the idea of uſing ſtones and earth as materials for building houſes. Indeed, conſidering that tents were not invented before the days of Jubal, Tubal-Cain's brother, it is very probable that ſuch temporary houſes as the Indian wigwams were not originally known; otherwiſe the method of covering poles with the ſkins of beaſts, inſtead of ſmall branches or twigs, muſt very ſoon have taken place. Theſe temporary houſes ſeem to have come into uſe only when men began to lead an idle wandering life, like the Tartars, and could not be at the trouble of conſtructing durable habitations in every place where they were obliged to wander with their cattle; and Jabal perhaps from them took the hint of making portable houſes or tents. Accordingly we ſee, that no nations, except thoſe who are in a perpetually unſettled ſtate, make uſe of ſuch wretched materials. Even in America, where the human race has appeared in the rudeſt form, they were no ſooner collected into great bodies under the emperors of Mexico and Peru, than ſtone-buildings began to be erected.

1 Materials firſt uſed in building.

We are not, therefore, to look for the origin of architecture in any ſingle nation; but in every nation, when the inhabitants began to leave off their ſavage way of life, and to become civilized; and if there is any nation to be found which hath been always in a civilized ſtate, we may be aſſured that architecture hath always had an exiſtence there. But whatever may be in this, the origin of regular buildings hath been deduced

† Tuſcul. Quæſt. l. iv.

duced from the conſtruction of the meaneſt huts in a very natural and plauſible manner by ſeveral authors. “ Anciently (ſays Vitruvius) men lived in woods, and inhabited caves; but in time, taking perhaps example from birds, who with great induſtry build their neſts, they made themſelves huts. At firſt they made theſe huts, very probably, of a conic figure; becauſe that is a figure of the ſimpleſt ſtructure; and, like the birds, whom they imitated, compoſed them of branches of trees, ſpreading them wide at the bottom, and joining them in a point at the top; covering the whole with reeds, leaves, and clay, to ſcreen them from tempeſts and rain.

2
Primitive huts
Plate XXXVI. fig. 1.

3
Their improvement.
Plate XXXVI. fig. 2.

“ But finding the conic figure inconvenient on account of its inclined ſides, they changed both the form and conſtruction of their huts, giving them a cubical figure, and building them in the following manner: Having marked out the ſpace to be occupied by the hut, they fixed in the ground ſeveral upright trunks of trees to form the ſides, filling the interval between them with branches cloſely interwoven and covered with clay. The ſides being thus completed, four large beams were placed on the upright trunks; which, being well joined at the angles, kept the ſides firm, and likewiſe ſerved to ſupport the covering or roof of the building, compoſed of many joiſts, on which were laid ſeveral beds of reeds, leaves, and clay.

“ Inſenſibly mankind improved in the art of building, and invented methods to make their huts laſting and handſome, as well as convenient. They took off the bark, and other unevenneſſes, from the trunks of trees that formed the ſides; raiſed them, probably, above the dirt and humidity, on ſtones; and covered each of them with a flat ſtone or ſlate, to keep off the rain. The ſpaces between the ends of the joiſts were cloſed with clay, wax, or ſome other ſubſtance; and the ends of the joiſts covered with thin boards cut in the manner of triglyphs. The poſition of the roof was likewiſe altered: for being, on account of its flatneſs, unfit to throw off the rains that fell in great abundance during the winter ſeaſon, they raiſed it in the middle; giving it the form of a gable roof, by placing rafters on the joiſts, to ſupport the earth and other materials that compoſed the covering.

Fig. 3.

“ From this ſimple conſtruction the orders of architecture took their riſe. For when buildings of wood were ſet aſide, and men began to erect ſolid and ſtately edifices of ſtone, they imitated the parts which neceſſity had introduced into the primitive huts; in ſo much that the upright trees, with the ſtones at each end of them, were the origin of columns, baſes, and capitals; and the beams, joiſts, rafters, and ſtrata of materials that formed the covering, gave birth to architraves, frizes, triglyphs, and cornices, with the corona, the mutules, the modillions, and the dentils.

“ The firſt buildings were in all likelihood rough and uncouth; as the men of thoſe times had neither experience nor tools: but when by long experience and reaſoning upon it, the artiſts had eſtabliſhed certain rules, had invented many inſtruments, and by great practice had acquired a facility in executing their ideas, they made quick advances towards perfection, and at length diſcovered certain manners of building, which ſucceeding ages have regarded with the higheſt veneration.”

4
State of architecture among the Egyptians.

Among the ancient Egyptians, Aſſyrians, and Perſians, this art was carried to an incredible length. The pyramids of Egypt are ſuch ſtructures as would exceed the power of the moſt potent monarch on earth to raiſe at this day. The largeſt of theſe, according to the account of M. Goguet, is near 500 feet high, and contains 313,590 ſolid fathoms. It is compoſed of ſtones enormouſly large; many of them being 30 feet long, four feet high, and three in breadth; and all this huge maſs of building was coated over with ſquare flags of marble.—The ſtructure called the *labyrinth*, in the ſame country, according to Herodotus, who ſaw it, excelled every thing which he could have conceived from the imagination either of himſelf or others. Within the ſame circuit of walls they had incloſed 3000 halls, 12 of which were of a ſingular form and beauty; and of theſe, half were above, and half below ground; and the whole was terminated by a pyramid 40 fathoms high. All this prodigious maſs of building was compoſed of white marble, and the walls were adorned with engravings.—The obeliſks were not leſs aſtoniſhing; the largeſt of them being entire pieces of granite, no leſs than 180 feet high.—Near Andera, in Upper Egypt, are the ruins of a palace of gray granite, the cielings of which are ſupported by columns of ſuch thickneſs, that four men can ſcarcely fathom them. The cielings themſelves are compoſed of ſtones of the ſame kind, ſix or ſeven feet in breadth and 18 feet in length. The grand hall is 112 feet long, 60 high, and 58 broad. The roof of the whole edifice is a terrace, on which the Arabs formerly built a very large village, the ruins of which are ſtill viſible.

5
Among the Babylonians and Perſians.

Among the Babylonians and Perſians, too, ſuch immenſe piles of building have been raiſed, as appear utterly inconceivable, and incredible to many modern authors where their former grandeur is not demonſtrable by ruins viſible at this day. The ruins of Perſepolis, the ancient capital of Perſia, were ſo ſtupendous in the time of Avicenna the Arab phyſician, that his countrymen could not believe ſuch ſtructures poſſible to be erected but by evil ſpirits. Of their extraordinary magnificence, indeed, we may have ſome idea from the account of the ſtair-caſes belonging to the palace. The remains, ſome time ago, conſiſted of 95 ſteps of white marble, ſo broad and flat, that 12 horſes might conveniently go up abreaſt.

6
Their buildings more remarkable for greatneſs than elegance.

In theſe vaſt ſtructures, however, the nations of whom we ſpeak ſeem to have regarded the greatneſs, rather than the elegance or uſefulneſs of their works. In the pyramids and obeliſks of Egypt this is exceedingly conſpicuous; but whether it was ſo in the labyrinth or in the palace of Thebes above mentioned, it is impoſſible to determine, unleſs the buildings were entire, and we knew for what purpoſe they had been deſigned. If the kings who built the pyramids deſigned to immortalize their memories by building, they certainly could not have fallen upon any thing more proper for this purpoſe; though even in this they have ſome how or other failed, the names of thoſe who erected them not being certainly known even in the time of Herodotus.—It is certain, however, that neither the ancient Aſſyrians nor Babylonians knew the method of conſtructing arches. The roofs of all their halls were flat, and covered with prodigiouſly large ſtones, ſome of them ſo big as to cover a whole room ſingly. Their manner of

7
Ignorant of the uſe of arches.

of building was alſo quite deſtitute of what is now called *taſte*; the columns were ill-proportioned, and their capitals executed in the pooreſt manner imaginable. This was obſerved by the Greeks, who improved upon the proportions formerly uſed, and were the inventors of three of the five orders of architecture, viz. the Doric, Ionic, and Corinthian.

8
And of proportioning columns.

“Anciently (ſays Vitruvius) they were ignorant of the art of proportioning the various parts of a building: they uſed columns; but they cut them at hazard, without rules, without principles, and without having any attention to the proportions which they ought to give them: they placed them likewiſe without any regard to the other parts of the edifice.

Origin of the Doric order.

Dorus, ſon of Helen and grandſon of Deucalion, having cauſed a temple to be built at Argos in honour of Juno, that edifice was found by chance to be conſtructed according to the taſte and proportions of the order which afterwards they called *Doric*. The form of this building having appeared agreeable, they conformed to it for the conſtruction of edifices which they afterwards had to build.

“About the ſame time, the Athenians ſent into Aſia a colony under the conduct of Ion, nephew of Dorus: this undertaking had very good ſucceſs. Ion ſeized on Caria, and there founded many cities: theſe new inhabitants thought to build temples. They propoſed for a model that of Juno at Argos; but, ignorant of the proportion which they ought to give to the columns, and in general to the whole edifice, they ſought for rules capable of regulating their operation. Theſe people wanted, in making their columns ſufficiently ſtrong to ſupport the whole edifice, to render them at the ſame time agreeable to the ſight. For this purpoſe, they thought to have given it the ſame proportion that they found between the foot of a man and the reſt of his body. According to their ideas, the foot made a ſixth part of the human height: in conſequence, they gave at firſt to a Doric column, taking in its chapiter, ſix of its diameters; that is to ſay, they made it ſix times as high as it was thick: afterwards they added to it a ſeventh diameter.

10
Of the Ionic

“This new order of architecture was not long in giving birth to a ſecond: they would immediately go beyond their firſt invention. The Ionians tried to throw ſtill more delicacy and elegance into their edifices. They employed the ſame method which they had before put in practice for the compoſition of the Doric order: but inſtead of taking for a model the body of a man, the Ionians were regulated by that of a woman. With a view to make the columns of this new order more agreeable and more pleaſing, they gave them eight times as much height as they had diameter. They alſo made channelings all along the trunk to imitate the folds of the robes of women: the volutes of the chapiter repreſented that part of the hair which hung in curls on each ſide of the face. The Ionians added, laſtly, to theſe colums a baſe, which was not in uſe in the Doric order.” According to Vitruvius, theſe baſes were made in the manner of twiſted cords, as a kind of caſe for the columns. This order of architecture was called *Ionic*, from the name of the people who had invented it.

Such is the account given by Vitruvius of the origin of improvements in the proportion of columns. Had theſe improvements, however, exiſted in ſuch early times, Homer, who was greatly poſterior to them, would certainly have made mention of ſomething of that kind; but in all his writings he gives us no account of any thing like columns of ſtone, but uſes a word which would rather incline us to think that his columns were nothing more than bare poſts.

11
Hints of improvement probably taken from Solomon's temple.

It is remarkable, that improvements in architecture did not take place in any nation till after, or about, the time that Jeruſalem was taken by Nebuchadnezzar. The grandeſt buildings erected among the Aſſyrians ſeem to have owed their exiſtence to this monarch; and it can ſcarce be imagined that he would not endeavour to imitate the architecture of Solomon's temple, to which, by his conqueſt of Jeruſalem, he had full acceſs.—It is alſo remarkable, that the dimenſions of the two pillars, Jachin and Boaz, ſet up by Solomon, very nearly correſpond with thoſe of the Doric order, firſt invented by the Greeks, and which originally came from their colonies ſettled in Aſia Minor. The height of Solomon's pillars, without the chapiter, was 18 cubits; that of the chapiter itſelf was five cubits; the circumference was 12 cubits; from whence, according to the ſcripture language, we may reckon the diameter to have been exactly four cubits. Had they been a ſingle cubit higher, they would have been preciſely of the ſame height with columns of the original Doric order. We do not indeed mean to aſſert, that this famous temple gave a model of architecture to the whole world; although it is ſcarce conceivable but imitations of it, as far as could be known, muſt have taken place among many nations.

12
Egyptian banqueting room deſcribed.

Notwithſtanding all their defects, however, the Egyptian buildings undoubtedly have an air of vaſt grandeur and magnificence, if we may credit the deſcription given of one of their banqueting-rooms by Vitruvius. The uſual ſize of one of theſe rooms was from 100 to 150 feet in length, and its breadth ſomewhat more than half its length. At the upper end, and along the two ſides, they placed rows of pillars tolerably well proportioned to one another, though not of any regular order; and at the lower part they made a magnificent and ſpacious entrance; this, with its ornaments, ſeems to have taken up one end of the building entire. We are not told that there were any pillars there; tho' perhaps they placed two or more towards the angles on each ſide, for uniformity, the central ſpace being enough for an enrance in the grandeſt and moſt auguſt manner. Theſe rows of columns were ſet at a diſtance from the wall, forming a noble portico along the two ſides and upper end of the building. Upon the pillars was laid an architrave; and from this was carried up a continued wall with three quarter columns, anſwering directly to thoſe below, and in proportion one-fourth ſmaller in all their parts. Between theſe three quarter columns were placed the windows for enlightening the building. From the tops of the lower pillars to the wall was laid a floor: this covered the portico overhead within, and made on the outſide a platform, which was ſurrounded by a corrider with rails and balluſters. This was terraced, and ſerved as a plain for people to walk on; and from this they could look through the windows down into the room. To this terrace there was no covering required, as the Egyptians were in no fear of rain. The Egyptians decorated this ſort of building with ſtatues; and no kind of ornament could anſwer it ſo well, as the light cannot fall upon ſtatues to ſuch advantage in any direction, as when it comes from above; in ſuch a regular, proportioned, and uninterrupted manner.

13
Ancient architecture ſuperior in grandeur to the modern

We have already taken notice, that among the ancient Egyptians, Perſians, and Babylonians, the vaſt ſtrength and extent of their buildings ſeems to have been what they chiefly valued; and in this they certainly as much excelled the Greeks and modern nations, as the latter excel them in the beautiful proportion and elegance of their ſtructures. There are not wanting, however, ſome modern authors, who endeavour to deprive the ancients of what is juſtly their due, and will have every thing to be exaggerated which ſeems beyond the power of modern princes to accompliſh. In this way M. Goguet remarkably diſtinguiſhes himſelf; and that without giving any reaſon at all, but merely that he takes it into his head. Speaking of the wonders of ancient Babylon, "All theſe works (ſays he), ſo marvellous in the judgment of antiquity, appear to me to have been extremely exaggerated by the authors who have ſpoken of them. How can we conceive, in effect, that the walls of Babylon could have been 318 feet high and 81 in thickneſs, in a compaſs of near ten leagues?" To this we may eaſily reply, that the pyramids of Egypt, and the immenſe wall which divides China from Tartary, ſhow us, that even ſuch a work as the wall of ancient Babylon is ſaid to have been is not altogether incredible. The loweſt computation of the dimenſion of the Chineſe wall is, that it extends in length 1200 miles, is eighteen feet high at a medium, and as many thick; according to which computation, it muſt contain 9,504,000 ſolid fathoms; and yet, if we may credit the Chineſe hiſtorians, this immenſe maſs of building was finiſhed in five years. If therefore we can ſuppoſe Nebuchadnezzar, or whoever fortified the city of Babylon, to have been capable of employing as many men for 10 years as were employed in raiſing the Chineſe wall, we may ſuppoſe him able to have fortified the city of Babylon as ſtrongly as it is ſaid to have been; for the maſs of building is not quite double that of the Chineſe wall, though nearly ſo, amounting to 18,189,600 ſolid fathoms. When our author afterwards gaſconades about the works of the French king, it is difficult to avoid laughter at hearing him declare, that "infinitely more money has been expended, and much more genius required, as well as more power, taſte, and time, to finiſh Verſailles, with all its defects, than to conſtruct a pyramid, or erect an obeliſk." The genius, taſte, and time, we ſhall not diſpute; but as the ſame author confeſſes that 100,000 men were employed for 30 years together in the conſtruction of the largeſt pyramid, we think the power may juſtly be doubted. This doubt will appear ſtill the more reaſonable, when we conſider what time the abovementioned number of men would have taken to accompliſh ſome of the works of which M. Goguet boaſts ſo much. The canal of Languedoc, he tells us, extends in length upwards of 70 leagues, and required the removal of two millions of cubic fathoms of earth. This was no doubt a great work; but had 100,000 men been employed upon it at once, they muſt have removed this quantity of earth in three weeks, ſuppoſing each to have removed only a ſingle fathom a day. Nor can we imagine, that any modern work will at all ſtand in competition with the works of the ancients as to greatneſs, whatever they may do in other reſpects.

14
Architecture improved by the Greeks.

As to the improvements in architecture, the Greeks were undoubtedly the firſt European nation who began to diſtinguiſh themſelves in this way. Whence they took the firſt hint of improvement, we have no means of knowing: though, as we have already hinted, it is ſcarce credible but that Solomon's temple muſt have ſomewhat contributed thereto; eſpecially as we learn from Scripture, that the capitals of the columns there were ornamented in the richeſt manner. The origin of the Doric and Ionic orders we have already given an account of from Vitruvius; to which we may add, that the volutes, which are the peculiar ornament of the Ionic capital, are by ſome ſaid to repreſent the natural curling down of a piece of bark from the top of a beam, which is ſuppoſed to have been the firſt kind of column.—The Corinthian order was not invented till long after the others, and is ſaid to have taken its riſe from the following accident: A baſket had been ſet upon the ground, and covered with a ſquare tile; there grew near it a plant of acanthus or bears-breech; the leaves ſhot up and covered the outer ſurface of the baſket; and as the ſtalks roſe up among them, they ſoon reached the tile which overhung the edges of the baſket at the top; this ſtopping their courſe upwards, they curled and twiſted themſelves into a kind of volutes. In this ſituation a ſculptor, Callimachus, ſaw it; the twiſted part of the ſtalk repreſented to him the volutes of the Ionic capital, which, as they were here ſmaller, and more numerous, appeared in a new form: he ſaw the beauty of raiſing them among leaves, and was ſtruck with the repreſentation of a noble and lofty capital; which being afterwards put into execution, has been univerſally admired.

15
Origin of the Corinthian order.

16
Private houſes of the Greeks.

In their private houſes the Greeks had greater convenience, but much leſs magnificence, than the Romans, as the former reſerved the uſe of their grandeſt architecture for their temples and public buildings. The entrance to their private houſes, however large they were, was always ſmall, narrow, and plain. The whole edifice uſually conſiſted of two courts, and ſeveral ranges of building. The porter's lodge, if ſuch a phraſe may be allowed, was uſually on the right hand of this narrow entrance, and oppoſite to this were the ſtables. From this entrance one came into the firſt or ſmaller court. This had piazzas on three ſides; and on the fourth, which was uſually the ſouth ſide, there were butments of pilaſters, which ſupported the more inward parts of the ceiling.—A ſpace being thus left between the one and the other, they had places for the lodgings of men and maid ſervants, and ſuch as had the principal care of the houſe. Upon the ſame floor with theſe butments they had ſeveral regular apartments, conſiſting of an antichamber, a chamber, and cloſets; and about the piazzas, rooms for eating, and other common purpoſes.—Oppoſite to the entrance was a lobby or veſtibule, through which lay the paſſage into the ſeveral rooms; and through this, in front, one entered a large paſſage, which led into the larger or principal ſquare. Round this they had four piazzas, which, in the common way of building, were all of one height; but, in more magnificent houſes, they made that which faced the great entrance loftier, and every way nobler, than the other three. A nobleman of Rhodes added this to the common method of building; and it was thence called the *Rhodian* manner. In this more noble part of the building were the apartments of the family. Theſe were adorned with lofty galleries, and here were the beſt rooms: they were called the *mens apartments;* for, in rude times, the Greeks lodged their wives and female relations in the beſt rooms of the firſt court, where they had alſo their ſeparate and detached place. The two ſides of this larger court were kept for the reception of viſitors; and ſervants were appointed to wait upon them. The maſter of the houſe entertained his gueſts the firſt day in his own apartments; but after this, how long ſoever they ſtaid, they lived without reſtraint in one of thoſe ſeparate piazzas, and joined the family only when they choſe it. Thus was the upper end and two ſides of the great court diſpoſed of; and its lower end, being the ſame range of building that was the upper end of the firſt court, held the lady of the houſe and her female friends.

17
Of the Romans.

The Romans borrowed their architecture from the Greeks, but did not imitate them in the modeſty of their private dwellings. They placed the principal front of their houſe towards the ſouth, and on this they beſtowed all the decoration of expenſive ornament. They had here lofty galleries and ſpacious rooms, and every thing carried an air of greatneſs and ſhow. In their country houſes they preſerved the ſame ſituation and the ſame front, but the inner diſtribution was different. At the entrance they placed the meaner and more offenſive offices, after the manner of the Greeks. The firſt gallery, which received the ſtranger at his entrance, had on one ſide a paſſage to the kitchen, and on the other to the ſtalls where they kept cattle, that their noiſe or ſmell might not be offenſive within, while yet they were in readineſs for all ſervices. Theſe ſtalls were placed to the left, as in the Greek houſes; on the right was the kitchen, which had its light from above, and its chimney in the middle. Farther within the building were placed on one ſide bathing-rooms, and on the other family-conveniences, in the manner of our butteries and ſtore-rooms: the bathing-rooms were on the left, and the others on the right. Backwards, and full to the north, they placed their cellars, for fear of the ſun, and over theſe were other ſtore-rooms. From this part of the ſtructure one came into the court; for in theſe there generally was only one court: this was taken up by ſervants, and thoſe who had the care of the cattle; and on each ſide there were ſtalls for the cattle. In front from the entrance, but very far from all theſe annoyances, ſtood the nobler apartments for the maſter of the family.

18
Decline of the art among the Romans.

How magnificent the Romans were in their temples and public buildings, is yet to be ſeen in what remains of them, and which are not only models for all modern architects, but have never been ſurpaſſed or even equalled to this day. But though the art of architecture continued almoſt at its higheſt pitch among the Romans for two centuries, it declined exceedingly as the empire began to fail. Tacitus relates, that after the battle of Actium no men of genius appeared; and after the reign of Alexander Severus, a manner of building altogether confuſed and irregular was introduced, wherein nothing of the true graces and majeſty of the former was preſerved.

19
Gothic manner of building.

When the empire was entirely over-run by the Goths, the conquerors naturally introduced their own method of building. Like the ancient Egyptians, the Goths ſeem to have been more ſtudious to amaze people with the greatneſs of their buildings than to pleaſe the eye with the regularity of their ſtructure, or the propriety of their ornaments. They corrected themſelves, however, a little by the models of the Roman edifices which they ſaw before them: but theſe models themſelves were faulty; and the Goths being totally deſtitute of genius, neither architecture nor any other art could be improved by them.

Moſt writers who mention the ancient buildings in Britain, particularly the religious ones, notwithſtanding the ſtriking difference in the ſtyles of their conſtruction, claſs them all under the common denomination of *Gothic;* a general appellation by them applied to buildings not exactly conformable to ſome one of the five orders of architecture. Our modern antiquaries, more accurately, divide them into Saxon.—Norman,—and Saracenic, or that ſpecies vulgarly tho' improperly called *modern Gothic.*

20
Of the Saxon and Norman ſtyles

It has been maintained by ſome, that the Saxon churches, after they began to be built with ſtone, conſiſted only of upright walls, without pillars or arches, the conſtruction of which it is alleged they were entirely ignorant of. But this opinion is not only contradicted by the teſtimony of ſeveral contemporary or very ancient writers, who expreſsly mention them both, but alſo by the remains of ſome edifices univerſally allowed to be of Saxon workmanſhip, one of them the ancient conventual church at Ely. Indeed, it is highly improbable that the Saxons could be ignorant of ſo uſeful a contrivance as the arch. Many of them, built by the Romans, they muſt have had before their eyes; ſome of which have reached our days: two particularly are now remaining in Canterbury only; one in the caſtle-yard, the other at Riding-gate. And it is not to be believed, that once knowing them and their convenience, they would neglect to make uſe of them; or having uſed, would relinquiſh them. Beſides, as it appears from undoubted authorities they procured workmen from the Continent to conſtruct their capital buildings, "according to the Roman manner," this alone would be ſufficient to confute that ill-grounded opinion; and at the ſame time proves, that what we commonly call *Saxon,* is in reality Roman architecture.

This was the ſtyle of building practiſed all over Europe; and it continued to be uſed by the Normans, after their arrival here, till the introduction of what is called the *modern Gothic,* which was not till about the end of the reign of Henry II. ſo that there ſeems to be little or no grounds for a diſtinction between the Saxon and Norman architecture. Indeed it is ſaid, the buildings of the latter were of larger dimenſions both in height and area; and they were conſtructed with a ſtone brought from Caen in Normandy, of which their workmen were peculiarly fond: but this was ſimply an alteration in the ſcale and materials, and not in the manner of the building. The ancient parts of moſt of our cathedrals are of this early Norman work.—The characteriſtic marks of this ſtyle are theſe: The walls are very thick, generally without buttreſſes; the arches, both within and without, as well as thoſe over the doors and windows, ſemicircular, and ſupported by very ſolid, or rather clumſy, columns, with a kind of regular baſe and capital: in ſhort, plainneſs and ſolidity conſtitute the ſtriking features of this method of building. Nevertheleſs, the architects of thoſe days ſometimes deviated from this rule: their capitals were adorned with carvings of foliage, and even animals; and their maſſive columns decorated with ſmall half columns united to them, and their ſurfaces ornamented with ſpirals, ſquares, lozenge net-work, and other figures, either engraved or in relievo. Various inſtances of theſe may be ſeen in the cathedral of Canterbury, particularly the under-croft, the monaſtery at Lindisfarn or Holy iſland, the cathedral at Durham, and the ruined Choir at Orford in Suffolk. The columns 1, 1, 1, 1, (Plate XXXV.), are at the monaſtery of Lindisfarn or Holy iſland. Thoſe 2, 2, 2, belong to the ruined chancel at Orford in Suffolk. N° 3 is at Chriſt-church, Canterbury. N° 4, a column with two remarkable projections like claws, in the ſouth aiſle of Romſey-church, Hampſhire.

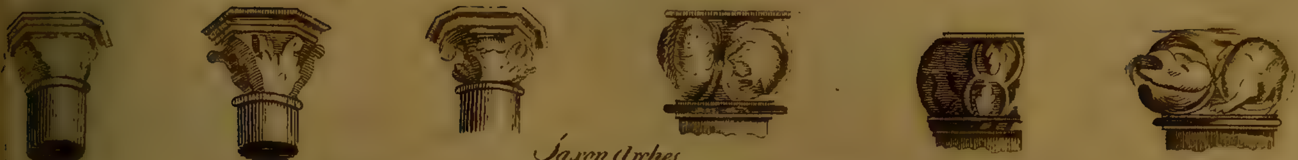
21 Of the modern Gothic or Saracenic ſtyle.

To what country or people the *modern Gothic*, or the ſtyle of building with pointed arches ſo called, owes its origin, ſeems by no means ſatisfactorily determined. Some have imagined it may poſſibly have taken its riſe from thoſe arcades we ſee in the early Norman or Saxon buildings or walls, where the wide ſemicircular arches croſs and interſect each other, and form at their interſection a narrow and ſharp-pointed arch: But it is more generally conjectured to be of Arabian extraction, and to have been introduced into Europe by ſome perſons returning from the Cruſades in the Holy Land. Sir Chriſtopher Wren was of that opinion, and it has been ſubſcribed to by moſt writers who have treated on this ſubject.

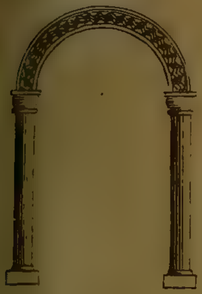
"Modern Gothic, as it is called (Says Rious), is diſtinguiſhed by the lightneſs of its work, by the exceſſive boldneſs of its elevations and of its ſections; by the delicacy, profuſion, and extravagant fancy of its ornaments. The pillars of this kind are as ſlender as thoſe of the ancient Gothic are maſſive; ſuch productions, ſo airy, cannot admit the heavy Goths for their author. How can be attributed to them a ſtyle of architecture, which was only introduced in the tenth century of our æra, ſeveral years after the deſtruction of all thoſe kingdoms, which the Goths had raiſed upon the ruins of the Roman empire, and at a time when the very name of Goth was entirely forgotten? From all the marks of the new architecture, it can only be attributed to the Moors; or, what is the ſame thing, to the Arabians or Saracens, who have expreſſed, in their architecture, the ſame taſte as in their poetry; both the one and the other falſely delicate, crowded with ſuperfluous ornaments, and often very unnatural: the imagination is highly worked up in both; but it is an extravagant imagination; and this has rendered the edifices of the Arabians (we may include the other orientals) as extraordinary as their thoughts. If any one doubts of this aſſertion, let us appeal to any one who has ſeen the moſques and palaces of Fez, or ſome of the cathedrals in Spain built by the Moors: one model of this ſort is the church at Burgos; and even in Britain there are not wanting ſeveral examples of the ſame; ſuch buildings have been vulgarly called modern Gothic, but their true appellation is Arabic, Saracenic, or Moreſque.—This manner was introduced into Europe through Spain. Learning flouriſhed among the Arabians all the time that their dominion was in full power; they ſtudied philoſophy, mathematics, phyſic, and poetry. The love of learning was at once excited; in all places that were not at too great a diſtance from Spain, theſe authors were read; and ſuch of the Greek authors as they had tranſlated into Arabic, were from thence turned into Latin. The phyſic and philoſophy of the Arabians ſpread themſelves in Europe, and with theſe their architecture: many churches were built after the Saracenic mode; and others with a mixture of heavy and light proportions, the alteration that the difference of the climate might require, was little, if at all conſidered. In moſt ſouthern parts of Europe, and in Africa, the windows (before the uſe of glaſs), made with narrow apertures, and placed very high in the walls of the building, occaſioned a ſhade and darkneſs within ſide, and were all contrived to guard againſt the fierce rays of the ſun; yet were ill ſuited to latitudes, where that glorious luminary ſhades its feebler influences, and is rarely ſeen but through a watery cloud."

Mr Groſe, however, thinks the above opinion is not ſufficiently favoured by the obſervations of ſeveral learned travellers who have accurately ſurveyed the ancient mode of building in thoſe parts of the world. Thus Cornelius le Brun, an indefatigable and inquiſitive traveller, has publiſhed many views of eaſtern buildings, particularly about the Holy Land: in all theſe, only one Gothic ruin, the church near Acre, and a few pointed arches, occur; and thoſe built by the Chriſtians when in poſſeſſion of the country. Near Iſpahan, in Perſia, he gives ſeveral buildings with pointed arches: but theſe are bridges and caravanſeras, whoſe age cannot be aſcertained; conſequently are as likely to have been built after as before the introduction of this ſtyle into Europe. At Iſaphan itſelf, the mey doen, or grand market-place, is ſurrounded by divers magnificent Gothic buildings; particularly the royal moſque, and the Talaer Ali-kapie, or theatre. The magnificent bridge of Alla-werdie-chan, over the river Zenderoet, 540 paces long and 17 broad, having 33 pointed arches, is alſo a Gothic ſtructure; but no mention is made when or by whom theſe are built. The Chiaer Baeg, a royal garden, is decorated with Gothic buildings; but theſe were, it is ſaid, built only in the reign of Scha Abbas, who died anno 1629. One building indeed, Mr Groſe admits, ſeems at firſt as if it would corroborate this aſſertion, and that the time when it was erected might be in ſome degree fixed; it is the tomb of Abdalla, one of the apoſtles of Mahomet, probably him ſurnamed Abu Becr. "If this tomb (ſays he) is ſuppoſed to have been built ſoon after his death, eſtimating that even to have happened according to the common courſe of nature, it will place its erection about the middle of the ſeventh century: but this is by far too conjectural to be much depended on. It alſo ſeems as if this was not the common ſtyle of building at that time, from the temple of Mecca; where, if any credit is to be given to the print of it in Sale's Koran, the arches are ſemicircular. The tomb here mentioned has one evidence to prove its antiquity; that of being damaged by the injuries of time and weather. Its general appearance much reſembles the eaſt end of the chapel belonging

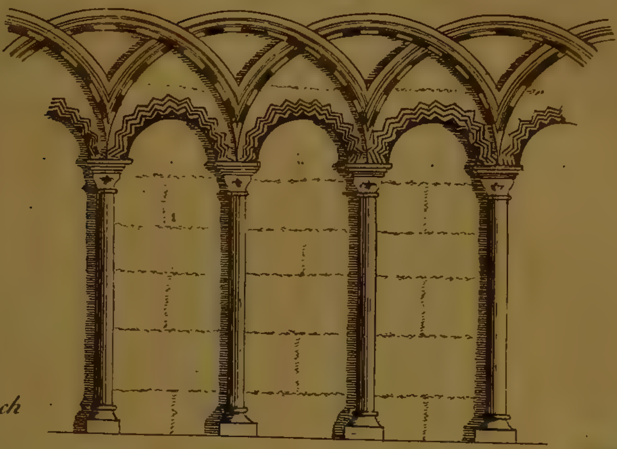
Saxon Capitals



Saxon Arch



Saxon Arches



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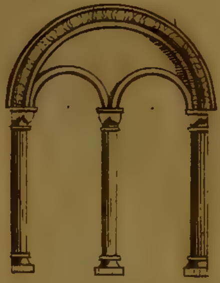

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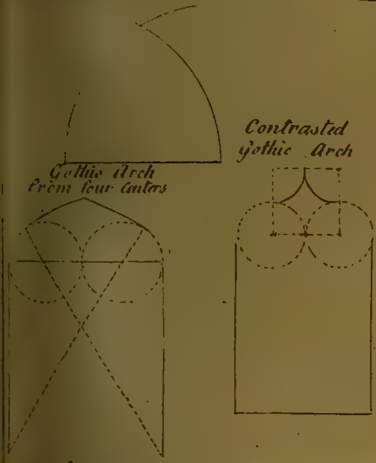
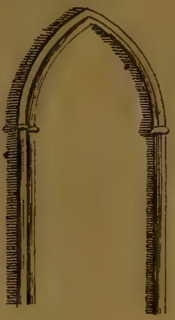


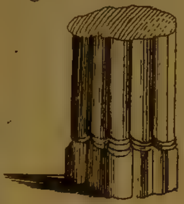
Gothic Arch from four Centers

Contrasted Gothic Arch

Common Gothic Arch



Gothic Column



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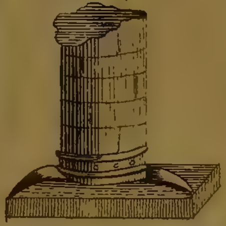

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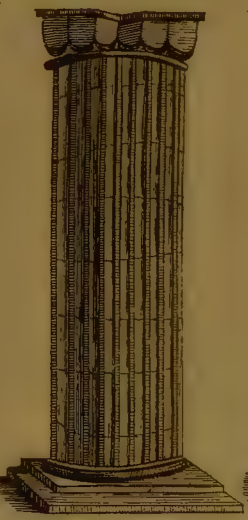

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to Ely Houſe, London, except that which is filled up there by the great window: in the tomb is an open pointed arch, where alſo the columns or pinnacles on each ſide are higher in proportion."

As to the ſuppoſition that this kind of architecture was brought into Spain by the Moors (who poſſeſſed themſelves of a great part of that country the beginning of the eighth century, which they held till the latter end of the fifteenth), and that from thence, by way of France, it was introduced into Britain this at firſt ſeems plauſible: though, accoding to Mr Groſe, the only inſtance which ſeems to corroborate this hypotheſis, or at leaſt the only one proved by authentic drawings, is the moſque at Cordua in Spain; where, if we may judge from the views publiſhed by Mr Swinburn, although moſt of the arches are circular or horſeſhoe faſhion, there are ſome pointed arches formed by the interſection of two ſegments of a circle. This moſque was, as it is there ſaid, begun by Abdoulrahman I. who laid the foundation two years before his death, and was finiſhed by his ſon Hiſſem or Iſcan about the year 800. If theſe arches were part of the original ſtructure, it would be much in favour of the ſuppoſition; but as it is alſo ſaid that edifice has been more than once altered and enlarged by the Mahometans, before any well-grounded concluſion can be drawn, it is neceſſary to aſcertain the date of the preſent building.

There are alſo ſeveral pointed arches in the Mooriſh palace at Grenada, called the Alhambra; but as that was not built till the year 1273, long after the introduction of pointed arches into Europe, they are as likely to be borrowed by the Moors from the Chriſtians, as by the Chriſtians from the Moors. The greateſt peculiarity in the Mooriſh architecture is the horſeſhoe arch, which containing more than a ſemicircle, contracts towards its baſe, by which it is rendered unfit to bear any conſiderable weight, being ſolely calculated for ornament. In Romſey church, Hampſhire, there are ſeveral arches ſomewhat of that form.

The drawings of the Mooriſh buildings given in *Les Delices de l'Eſpagne*, ſaid to be faithful repreſentations, there are no traces of the ſtyle called Gothic architecture: there, as well as in the Mooriſh caſtle at Gibraltar, the arches are all repreſented circular. Perhaps a more general knowledge of theſe buildings would throw ſome light on the ſubject: poſſibly the Moors may, like us, at different periods have uſed different manners of building.

The marks which conſtitute the character of Gothic, or Saracenical architecture, are its numerous and prominent buttreſſes, its lofty ſpires and pinnacles, its large and ramified windows, its ornamental niches or canopies, its ſculptured ſaints, the delicate lace-work of its fretted roofs, and the profuſion of ornaments laviſhed indiſcriminately over the whole building: but its peculiar diſtinguiſhing characteriſtics are, the ſmall cluſtered pillars and pointed arches formed by the ſegments of two interſecting circles; which arches, though laſt brought into uſe, are evidently of more ſimple and obvious conſtruction that the ſemicircular ones; two flat ſtones, with their tops inclined to each other, and touching, form its rudiments; a number of boughs ſtuck into the ground oppoſite each other, and tied together at the top, in order to form a bower, exactly deſcribe it: whereas a ſemicircular arch appears the reſult of deeper contrivance, as conſiſting of more parts; and it ſeems leſs probable chance, from whence all theſe inventions were firſt derived, ſhould throw ſeveral wedge-like ſtones between two ſet perpendicular, ſo as exactly to fit and fill up the interval.

Biſhop Warburton, in his notes on Pope's Epiſtles, in the octavo edition, has the following ingenious obſervations on this ſubject:—"Our Gothic anceſtors had juſter and manlier notions of magnificence, on Greek and Roman ideas, than theſe mimics of taſte, who profeſs to ſtudy only claſſic elegance; and becauſe the thing does honour to the genius of thoſe barbarians, I ſhall endeavour to explain it. All our ancient churches are called without diſtinction Gothic, but erroneouſly. They are of two ſorts; the one built in the Saxon times, the other in the Norman. Several cathedral and collegiate churches of the firſt ſort are yet remaining, either in whole or in part; of which this was the original: When the Saxon kings became Chriſtians, their piety (which was the piety of the times) conſiſted chiefly in building churches at home, and performing pilgrimages abroad, eſpecially to the Holy Land; and theſe ſpiritual exerciſes aſſiſted and ſupported one another; for the moſt venerable as well as moſt elegant models of religious edifices were then in Paleſtine. From theſe the Saxon builders took the whole of their ideas, as may be ſeen by comparing the drawings which travellers have given us of the churches yet ſtanding in that country, with the Saxon remains of what we find at home; and particularly in that ſameneſs of ſtyle in the latter religious edifices of the knights temporals (profeſſedly built upon the model of the church of the Holy Sepulchre at Jeruſalem), with the earlier remains of our Saxon edifices. Now the architecture of the Holy Land was Grecian, but greatly fallen from its ancient elegance. Our Saxon performance was indeed a bad copy of it, and as much inferior to the works of St Helene and Juſtinian, as theirs were to the Grecian models they had followed: yet ſtill the footſteps of ancient art appeared in the circular arches, the entire columns, the diviſion of the entablature into a ſort of architrave, frize, and corniche, and a ſolidity equally diffuſed over the whole maſs. This by way of diſtinction, I would call the Saxon architecture. But our Norman works had a very different original. When the Goths had conquered Spain, and the genial warmth of the climate and the religion of the old inhabitants had ripened their wits and inflamed their miſtaken piety, both kept in exerciſe by the neighbourhood of the Saracens, through emulation of their ſervice, and averſion to their ſuperſtition, they ſtruck out a new ſpecies of architecture, unknown to Greece and Rome, upon original principles, and ideas much nobler than what had given birth even to claſſical magnificence. For this northern people having been accuſtomed, during the gloom of paganiſm, to worſhip the deity in groves (a practice common to all nations); when their new religion required covered edifices, they ingeniouſly projected to make them reſemble groves, as nearly as the diſtance of architecture would permit; at once indulging their old prejudices, and providing for their preſent convenience, niences, by a cool receptacle in a ſultry climate: and with what ſkill and ſucceſs they executed the project by the aſſiſtance of Saracen architects, whoſe exotic ſtyle of building very luckily ſuited their purpoſe, appears from hence, that no attentive obſerver ever viewed a regular avenue of well grown trees intermixing their branches overhead, but it preſently put him in mind of the long viſto through the Gothic cathedral; or even entered one of the larger and more elegant edifices of this kind, but it preſented to his imagination an avenue of trees; and this alone is what can be truly called the Gothic ſtyle of building. Under this idea of ſo extraordinary a ſpecies of architecture, all the irregular tranſgreſſions againſt art, all the monſtrous offences againſt nature, diſappear; every thing has its reaſon, every thing is in order, and an harmonious whole ariſes from the ſtudious application of means proper and proportionate to the end. For could the arches be otherwiſe than pointed, when the workmen were to imitate that curve which branches of two oppoſite trees make by their inſertion with one another? or could the columns be otherwiſe than ſplit into diſtinct ſhafts, when they were to repreſent the ſtems of a clump of trees growing cloſe together? On the ſame principles they formed the ſpreading ramification of the ſtone-work in the windows, and the ſtained glaſs in the interſtices; the one to repreſent the branches, and the other the leaves of an opening grove, and both concurred to preſerve that gloomy light which inſpires religious reverence and dread. Laſtly, we ſee the reaſon of their ſtudied averſion to apparent ſolidity in theſe ſtupendous maſſes, deemed ſo abſurd by men accuſtomed to the apparent as well as real ſtrength of Grecian architecture. Had it been only a wanton exerciſe of the artiſt's ſkill, to ſhow he could give real ſtrength without the appearance of any, we might indeed admire his ſuperior ſcience, but we muſt needs condemn his ill judgment. But when one conſiders, that this ſurpriſing lightneſs was neceſſary to complete the execution of his idea of a ſylvan place of worſhip, one cannot ſufficiently admire the ingenuity of the contrivance. This too will account for the contrary qualities in what I call the Saxon architecture. Theſe artiſts copied, as has been ſaid, from the churches in the Holy Land, which were built on the models of the Grecian architecture, but corrupted by prevailing barbariſm; and ſtill farther depraved by a religious idea. The firſt places of Chriſtian worſhip were ſepulchres and ſubterraneous caverns, low and heavy from neceſſity. When Chriſtianity became the religion of the ſtate, and ſumptuous temples began to be erected, they yet, in regard to the firſt pious ages, preſerved the maſſive ſtyle, made ſtill more venerable by the church of the Holy Sepulchre; where this ſtyle was, on a double account, followed and aggravated."

22
Riſe and progreſs of architecture in Britain.

In Britain, before the Roman invaſion, the natives appear to have had no better lodgings than thickets, dens, and caves. Some of theſe caves, which were their winter-habitations, and places of retreat in time of war, were formed and rendered ſecure and warm by art, like thoſe of the ancient Germans, which are thus deſcribed by Tacitus: "They are uſed to dig deep caves in the ground and cover them with earth, where they lay up their proviſions, and dwell in winter for the ſake of warmth. Into thoſe they retire alſo from their enemies, who plunder the open country, but cannot diſcover theſe ſubterranean receſſes." Some of the ſubterraneous, or *earth-houſes*, as they are called, are ſtill remaining in the weſtern iſles of Scotland and in Cornwal. The ſummer habitations of the moſt ancient Britons were very ſlight; and, like thoſe of the Finnians, conſiſted only of a few ſtakes driven into the ground, interwoven with wattles, and covered over with the boughs of trees.

When Julius Cæſar invaded Britain, the inhabitants of Cantium (Kent), and of ſome other parts in the ſouth, had learned to build houſes a little more ſubſtantial and convenient. "The country (ſays Cæſar) abounds in houſes, which very much reſemble thoſe of Gaul." The firſt ſtep towards this improvement ſeems to have been that of daubing the wattled walls of their houſes with clay, to fill up the chinks and make them warmer. "The Germans uſed for this purpoſe a kind of pure reſplendent earth of different colours, which had an appearance of painting at a diſtance;" but the Gauls and Britains choſe rather to whitewaſh the clay after it was dry with chalk. Inſtead of the boughs of trees, they thatched theſe houſes with ſtraw, as a much better ſecurity againſt the weather. They next proceeded to form the walls of large beams of wood, inſtead of ſtakes and wattles. This ſeems to have been the mode of building in Britain, when it was firſt invaded by the Romans. "The Britons (ſays Diodorus Siculus, who was cotemporary with Cæſar) dwell in wretched cottages, which are conſtructed of wood, covered with ſtraw." Theſe wooden houſes of the ancient Gauls and Britons were not ſquare but circular, with high tapering roofs, at the top or centre of which was an aperture for the admiſſion of light and emiſſion of ſmoke. Thoſe of Gaul are thus deſcribed by Strabo: "They build their houſes of wood, in the form of a circle, with lofty tapering roofs." The foundations of ſome of the moſt magnificent of theſe circular houſes were of ſtone, of which there are ſome veſtiges ſtill remaining in Angleſey and other places. It was probably in imitation of theſe wooden houſes, that the moſt ancient ſtone edifices, of which there are ſtill ſome remains in the weſtern iſlands of Scotland, were built circular, and have a large aperture at the top.

When the Britons were invaded by the Romans, they had nothing among them anſwering to our ideas of a city or town, conſiſting of a great number of contiguous houſes, diſpoſed into regular ſtreets, lanes, and courts. Their dwellings, like thoſe of the ancient Germans, were ſcattered about the country, and generally ſituated on the brink of ſome rivulet for the ſake of water, and on the ſkirt of ſome wood or foreſt for the conveniency of hunting and paſture for their cattle. As theſe inviting circumſtances were more conſpicuous in ſome part of the country than others, the princes and chiefs made choice of theſe places for their reſidence; and a number of their friends and followers, for various reaſons, built their houſes as near to them as they could with conveniency. This naturally produced an ancient Britiſh town, which is deſcribed by Cæſar and Strabo in the following manner: "From the Caſſi he learnt that the town of Caſſivelaun was at no great diſtance; a place defended by woods and marſhes, in which very great numbers of men and cattle were collected. For what the Britons call a town, is a tract of a woody country, ſurrounded by a mound and ditch, for the ſecurity of themſelves and their cattle againſt the incurſions of their enemies." "The foreſts of the Britons are their cities: for when they have incloſed a very large circuit with felled trees, they build within it houſes for themſelves, and hovels for their cattle. Theſe buildings are very ſlight, and not deſigned for long duration." The palaces of the Britiſh princes were probably built of the ſame materials, and on the ſame plan, with the houſes of their ſubjects, and differed from them only in ſolidity and magnitude.

Though the communication between Britain and the continent was more free and open after the firſt Roman invaſion than it had been before, and ſome of the Britiſh princes and chieftans even viſited Rome, then in its greateſt glory; it doth not appear that the people of Britain made any conſiderable improvements in their manner of building for at leaſt a hundred years after that invaſion. For when the renowned Caractacus was carried priſoner to Rome, A. D. 52, and obſerved the beauty and magnificence of the buildings in that proud metropolis of the world, he is ſaid to have expreſſed great ſurpriſe, "That the Romans, who had ſuch magnificent palaces of their own, ſhould envy the wretched cabbins of the Britons."

It muſt appear very ſurpriſing that the ancient Britons, when they were ſo ignorant of architecture, were capable of erecting (if indeed it was erected by them) ſo ſtupendous a fabric as that of Stonehenge on Saliſbury plain: A fabric which hath been the admiration of all ſucceeding ages, and hath outlaſted all the ſolid and noble ſtructures which were erected by the Romans in that iſland. See the article STONEHENGE.

Of another very extraordinary ſpecies of building ſeveral remains are found in the Highlands of Scotland. They conſiſt of ruins; the walls of which, inſtead of being cemented with lime or ſome other ſimilar ſubſtance, or of being raiſed with dry ſtones, as was the method before cement came into uſe, are deſcribed as having been vitrefied, or the ſtones run and compacted together by the force of fire. Concerning the origin, uſe, &c. of theſe buildings, different opinions have been formed; and even the reality of them as works of contrivance has been called in queſtion: of all which particulars the reader will find an account under the article *Forts (Vitrefied)*.

But for whatever purpoſes, or by whatever means, the above and other ſimilar ſtructures of a peculiar nature were erected, we have ſufficient evidence that the people of Britain, before they were ſubdued and inſtructed by the Romans, had but a rude knowledge of architecture, and were very meanly lodged. As ſoon, however, as the Romans began to form ſettlements and plant colonies in that iſland, a ſudden and ſurpriſing change enſued in the ſtate of architecture. For that wonderful people were as induſtrious as they were brave, and made haſte to adorn every country that they conquered. The firſt Roman colony was planted at Camelodunum, A. D. 50; and when it was deſtroyed by the Britons in their great revolt under Boadicia, only eleven years after, it appears to have been a large and well built town, adorned with ſtatutes, temples, theatres, and other public edifices.

The Romans not only built a prodigious number of ſolid, convenient, and magnificent ſtructures for their own accommodation, but they exhorted, encouraged, and inſtructed the Britons to imitate their example. This was one of the arts which Agricola, the moſt excellent of the Roman governors, employed to civilize the Britons, and reconcile them to the Roman government. "The following winter (ſays Tacitus) was ſpent by Agricola in very ſalutary meaſures. That the Britons, who led a roaming and unſettled life, and were eaſily inſtigated to war, might contract a love to peace and tranquillity, by being accuſtomed to a more pleaſant way of living, he exhorted and aſſiſted them to build houſes, temples, courts, and market-places. By praiſing the diligent and reproaching the indolent, he excited ſo great an emulation among the Britons, that after they had erected all thoſe neceſſary edifices in their towns, they proceeded to build others merely for ornament and pleaſure, as porticoes, galleries, baths, banqueting-houſes, &c." From this time, which was A. D. 80, to the middle of the fourth century, architecture and all the arts immediately connected with it greatly flouriſhed in that iſland; and the ſame taſte for erecting ſolid, convenient, and beautiful buildings, which had long prevailed in Italy, was introduced into Britain. Every Roman colony and free city (of which there was a great number in that country) was a little Rome, encompaſſed with ſtrong walls, adorned with temples, palaces, courts, halls, baſiliſks, baths, markets, aqueducts, and many other fine buildings, both for uſe and ornament. The country every where abounded with well-built villages, towns, forts, and ſtations; and the whole was defended by that high and ſtrong wall, with its many towers and caſtles, which reached from the mouth of the river Tine on the eaſt to the Solway Firth on the weſt. This ſpirit of building, which was introduced and encouraged by the Romans, ſo much improved the taſte and increaſed the number of the Britiſh builders, that in the third century that iſland was famous for the great number and excellence of its architects and artificers. When the Emperor Conſtantius, father of Conſtantine the Great, rebuilt the city of Autun, in Gaul, A. D. 296, he was chiefly furniſhed with workmen from Britain, "which (ſays Eumenius) very much abounded with the beſt artificers."

Not very long after this period, architecture and all the arts connected with it began to decline very ſenſibly in Britain, and in all the provinces of the weſtern empire. This was partly owing to the building of Conſtantinople, which drew many of the moſt famous architects and other artificers into the eaſt, and partly to the irruptions and depredations of the barbarous nations.

The final departure of the Romans was followed by the almoſt total deſtruction of architecture in that iſland. For the unhappy and unwarlike people whom they left behind, having neither ſkill nor courage to defend the numerous towns, forts, and cities which they poſſeſſed, they were ſeized by their ferocious invaders, who firſt plundered and then deſtroyed them. By this means, the many noble ſtructures with which Provincial Britain had been adorned by the art and induſtry of the Romans, were ruined or defaced in a very little time; and the unfortunate Britons were quite incapable of repairing them, or of building others in their room. That long ſucceſſion of miſeries in which they were involved by the Scots, Picts, and Saxons, deprived them of the many uſeful arts which they had learned from their former maſters, and lodged them once more in foreſts, dens, and caves, like their ſavage anceſtors.

The moſt wanton and extenſive devaſtations were thoſe committed by the Anglo-Saxons; among whom it ſeems to have been a maxim to deſtroy all the towns and caſtles which they took from their enemies, inſtead of preſerving them from their own uſe.

It cannot be ſuppoſed, that a people who wantonly demoliſhed ſo many beautiful and uſeful ſtructures had any taſte for the arts by which they had been erected. The truth is, that the Anglo-Saxons at their arrival in this iſland were almoſt totally ignorant of theſe arts; and, like all the other nations of Germany, had been accuſtomed to live in wretched hovels, built of wood or earth, and covered with ſtraw or the branches of trees: nor did they much improve in the knowledge of architecture for 200 years after their arrival. During that period, maſonry was quite unknown and unpractiſed in this iſland: and the walls even of cathedral churches were built of wood. “There was a time (ſays Venerable Bede) when there was not a ſtone church in all the land; but the cuſtom was to build them all of wood. Finan, the ſecond biſhop of Lindisfarne, or Holy iſland, built a church in that iſland, A. D. 652, for a cathedral, which yet was not of ſtone, but of wood, and covered with reeds; and ſo it continued till Eadbert, the ſucceſſor of St Cuthbert, and ſeventh biſhop of Lindisfarne, took away the reeds, and covered it all over, both roof and walls, with ſheets of lead.” The firſt cathedral of York was built of the ſame materials; and a church of ſtone was eſteemed a kind of prodigy in thoſe times that merited a place in hiſtory. “Paulinus, the firſt biſhop of York, built a church of ſtone in the city of Lincoln, whoſe walls (ſays Bede) are ſtill ſtanding, though the roof is fallen down; and ſome healing miracles are wrought in it every year, for the benefit of thoſe who have the faith to ſeek them.”

There does not ſeem to have been ſo much as one church of ſtone, nor any artiſts who could build one, in all Scotland, at the beginning of the eighth century. For Naitan king of the Picts, in his famous letter to Ceolfred abbot of Weremouth, A. D. 710, earneſtly intreats him to ſend him ſome maſons to build a church of ſtone in his kingdom, in imitation of the Romans; which he promiſes to dedicate to the honour of the apoſtle Peter, to whom the abbey of Weremouth was dedicated: and we are told by Bede, who was then living in that abbey, that the reverend abbot Ceolfred granted this pious requeſt, and ſent maſons according to his deſire.

Maſonry was reſtored, and ſome other arts connected with it introduced into England, towards the end of the ſeventh century, by two clergymen, who were great travellers, and had often viſited Rome, where they had acquired ſome taſte for theſe arts. Theſe were, the famous Wilfrid biſhop of York, and afterwards of Hexham, and Benedict Biſcop, founder of the Abbey of Weremouth. Wilfrid, who was one of the moſt ingenious, active, and magnificent prelates of the ſeventh century, was a great builder, and erected ſeveral ſtructures at York, Rippon, and Hexham, which were the admiration of the age in which he flouriſhed. The cathedral of Hexham, which was one of theſe ſtructures, is thus deſcribed by his biographer: “Having obtained a piece of ground at Hexham from Qeen Etheldreda, he there founded a moſt magnificent church, which he dedicated to the bleſſed apoſtle St Andrew. As the plan of this ſacred ſtructure ſeems to have been inſpired by the Spirit of God, it would require a genius much ſuperior to mine to deſcribe it properly. How large and ſtrong were the ſubterraneous buildings conſtructed of the fineſt poliſhed ſtones! How magnificent the ſuperſtructure, with its lofty roof, ſupported by many pillars, its long and high walls, its ſublime towers, and winding ſtairs! In one word, there is no church on this ſide of the Alps ſo great and beautiful.” This admired edifice, of which ſome veſtiges are ſtill remaining, was built by maſons and other artificers brought from Rome by the munificence of its generous founder. Benedict Biſcop was the cotemporary and companion of Wilfrid in ſome of his journeys, and had the ſame taſte for the arts. He made no fewer than ſix journeys to Rome, chiefly with a view of collecting books, pictures, ſtatues, and other curioſities, and of perſuading artificers of various kinds to come from Italy and France and ſettle in England. Having obtained a grant of a conſiderable eſtate from Egfrid king of Northumberland, near the mouth of the river Were, he there founded a monaſtery, A. D. 647. “About a year after the foundations of this monaſtery were laid, Benedict croſſed the ſea into France, where he collected a number of maſons, and brought them over with him, in order to build the church of his monaſtery of ſtone after the Roman manner, of which he was a great admirer. His love to the apoſtle Peter, to whom he deſigned to dedicate his church, made him urge theſe workmen to labour ſo hard, that maſs was celebrated in it about a year after it was founded. When the work was far advanced, he ſent agents into France to procure if poſſible ſome glaſs-makers, a kind of artificers quite unknown in England, and to bring them over to glaze the windows of his church and monaſtery. Theſe agents were ſucceſsful, and brought ſeveral glaſs-makers with them; who not only performed the work required by Benedict, but inſtructed the Engliſh in the art of making glaſs for windows, lamps, drinking-veſſels, and other uſes.”

Eddii Vitæ Wilfridi, c. 22.

Bedæ Hiſt. Abbat.

But though theſe arts of building edifices of ſtone, with windows of glaſs and other ornaments, were thus introduced by theſe two prelates in the latter part of the ſeventh century, they do not ſeem to have flouriſhed much for ſeveral centuries. It appears from many incidental hints in our ancient hiſtorians, that ſtone-buildings were ſtill very rare in the eighth and ninth ages; and that when any ſuch buildings were erected, they were the objects of much admiration. When Alfred the Great, towards the end of the ninth century, formed the deſign of rebuilding his ruined cities, churches, and monaſteries, and of adorning his dominions with more magnificent ſtructures, he was obliged to bring many of his artificers from foreign countries. “Of theſe (as we are told by his friend and companion Aſſerius) he had an almoſt innumerable multitude, collected from different nations; many of them the moſt excellent in their ſeveral arts.”

In the other parts of the iſland architecture was, as might naturally be imagined, in a ſtill leſs flouriſhing ſtate. It appears indeed to have been almoſt entirely loſt among the poſterity of the ancient Britons after they retired to the mountains of Wales. The chief palace of the kings of Wales, where the nobility and wiſe men aſſembled for making laws, was called the *white palace*, becauſe the walls of it were woven with white wands which had the bark peeled off. By the laws of Wales, whoever burnt or deſtroyed the king's hall or palace was obliged to pay one pound and eighty pence, beſides one hundred and twenty pence for each of the adjacent buildings, which were eight in number; viz. the dormitory, the kitchen, the chapel, the granary, the bake-houſe, the ſtore-houſe, the ſtable, and the dog-houſe. From hence it appears, that a royal reſidence in Wales, with all its offices, when theſe laws were made, was valued at five pounds and eighty pence of the money of that age, equal in quantity of ſilver to ſixteen pounds Sterling, and in efficacy to one hundred and ſixty. This is certainly a ſufficient proof of the meanneſs of thoſe buildings which were only of wood. Even the caſtles in Wales, in this period, that were built for the ſecurity of the country, appear to have been conſtructed of the ſame materials; for the laws required the king's vaſſals to come to the building of theſe caſtles with no other tools but an axe.

The arts of building do not ſeem to have been much better underſtood by the Scots and Picts than by the ancient Britons in the former part of this period. When Finan, the ſecond biſhop of Lindisfarne, built a church of wood in that iſland, A. D. 652, he is ſaid to have done it *more Scotorum*, after the manner of his countrymen the Scots; and it hath been already obſerved, that Naitan king of the Picts was obliged to bring maſons from Northumberland when he reſolved to build a church of ſtone in his dominions, A. D. 710. After this laſt period, it is probable that the Picts, and perhaps the Scots, began to learn and practiſe the art of maſonry; becauſe there are ſtill ſome ſtone buildings of a very ſingular conſtruction, and great antiquity, to be ſeen in Scotland. Theſe buildings are all circular; though of two kinds ſo different from each other, that they ſeem to be the works of different ages and of different nations. The largeſt of theſe ſtructures are in a very extraordinary taſte of architecture; and are thus deſcribed by a modern antiquary, who viewed them with no little attention: "Having arrived at the barrack of Glenelg, I was conducted to the remains of thoſe ſtupendous fabrics, ſeated about two miles from thence, in a valley called *Glenbeg*, in which four of them anciently ſtood. Two of theſe are now almoſt quite demoliſhed, the third is half fallen down, the fourth is almoſt entire. The firſt I met with lies towards the north ſide of the valley, and is called *Caſtle Chalamine*, or *Malcom's Caſtle*. It ſtands upon a conſiderable eminence, and affords us a fine proſpect of the iſland of Sky, and a good part of the ſea-coaſt. The foundation of this only appears; as alſo of that other, on the eaſt end of the valley, called *Caſtle Chonnel*. About a quarter of a mile further, upon the bank of a rivulet which paſſes through the middle of the glen, ſtands the third fabric, called *Caſtle Tellve*. I found it compoſed of ſtones without cement; not laid in regular courſes, after the manner of elegant buildings, but rudely and without order. Thoſe toward the baſe were pretty large, but aſcending higher they were thin and flat, ſome of them ſcarce exceeding the thickneſs of an ordinary brick. I was ſurpriſed to find no windows on the outſide, nor any manner of entrance into the fabric, except a hole towards the weſt, at the baſe, ſo very low and narrow, that I was forced to creep in upon hands and knees, and found that it carried me down four or five ſteps below the ſurface of the ground. When I was got within, I was environed betwixt two walls, having a cavity or void ſpace which led me round the whole building. Oppoſite to the little entry on the outſide was a pretty large door in the ſecond or inner wall, which let me into the area or inner court. When I was there, I perceived that one half of the building was fallen down, and thereby had the opportunity of ſeeing a complete ſection thereof. The two walls join together at the top, round about, and have formed a large void ſpace or area in the middle. But to give a more complete idea of theſe buildings, I ſhall deſcribe the fourth, called *Caſtle Troddan*, which is by far the moſt entire of any in that country, and from whence I had a very clear notion how theſe fabrics were originally contrived. On the outſide were no windows, nor were the materials of this caſtle any wiſe different from thoſe of the other already deſcribed, only the entry on the outſide was ſomewhat larger; but this might be occaſioned by the falling of the ſtones from above. The area of this makes a complete circle; and there are four doors in the inner wall, which face the four cardinal points of the compaſs. Theſe doors are each eight feet and a half high, and five feet wide, and lead from the area into the cavity between the two walls, which runs round the whole building. The perpendicular height of this fabric is exactly 33 feet; the thickneſs of both walls, including the cavity between, no more than 12 feet; and the cavity itſelf is hardly wide enough for two men to walk abreaſt: the external circumference is 178 feet. The whole height of the fabric is divided into four parts or ſtories, ſeparated from each other by thin floorings of flat ſtones, which knit the two walls together, and run quite round the building; and there have been winding ſtairs of the ſame flat ſtones aſcending betwixt wall and wall up to the top. The undermoſt partition is ſomewhat below the ſurface of the ground, and is the wideſt; the others grow narrower by degrees till the wall cloſes at the top. Over each door are nine ſquare windows, in a direct line above each other, for the admiſſion of light; and between every row of windows are three others in the uppermoſt ſtory, riſing above a cornice which projects out from the inner wall and runs round the fabric." From this deſcription of theſe ſingular edifices, it plainly appears, that they were deſigned both for lodging and defence; and conſidering the ſtate of the times in which they were built, they were certainly very well contrived for anſwering both theſe purpoſes.

Gordon's Itinerarium Septentrionale, p. 166.

The ſtone edifices of the other kind which were probably erected in this period, and of which ſome few are ſtill to be ſeen in Scotland, are not ſo large as the former, but more artificial. They are ſlender, lofty, circular towers, of cut ſtone, laid in regular rows, between 40 and 50 feet in external circumference, and from 70 to 100 feet high, with one door ſome feet from the ground. They are exactly ſimilar to the round tower of Ardmore, and ſeveral others in Ireland; and therefore were probably built about the ſame time, which was in the tenth century, and for the ſame purpoſes; which are believed by ſome to have been for the confinement of penitents while they were performing penance. On this account theſe towers are always found in the neighbourhood of churches both in Scotland and Ireland; and are ſaid to have been uſed in this manner: "The penitents were placed in the uppermoſt ſtory of the tower (which commonly conſiſted of five or ſix ſtories); where having made probation, or done penance, ſuch a limited time, according to the heinouſneſs of their crimes, they then were permitted to deſcend to the next floor, and ſo on by degrees, until they came to the door, which always faced the entrance of the church, where they ſtood to receive abſolution from the clergy, and the bleſſings of the people." A tedious proceſs, to which few penitents in the preſent age would willingly ſubmit. Other writers are of opinion, that the deſign of theſe circular towers (of which one is ſtill remaining at Abernethy, and another at Brechin) was to be places from whence the people were called to public worſhip by the ſound of a horn or trumpet, before the introduction of bells.

Archæologia vol. i. p. 307.

This art received very great improvements in the 12th century; which indeed may be called *the age of architecture*; when the rage for building was more violent in England than at any other time. The great and general improvements that were made in the fabrics of houſes and churches in the firſt years of this century, are thus deſcribed by a cotemporary writer. "The new cathedrals and innumerable churches that were built in all parts, together with the many magnificent cloiſters and monaſteries, and other apartments of monks, that were then erected, afford a ſufficient proof of the great felicity of England in the reign of Henry I. The religious of every order, enjoying peace and proſperity, diſplayed the moſt aſtoniſhing ardour in every thing that might increaſe the ſplendor of divine worſhip. The fervent zeal of the faithful prompted them to pull down houſes and churches every where, and rebuild them in a better manner. By this means the ancient edifices that had been raiſed in the days of Edgar, Edward, and other Chriſtian kings, were demoliſhed, and others of greater magnitude and magnificence, and of more elegant workmanſhip, were erected in their room, to the glory of God."

Orderic. Vital. Hiſt. Eccleſ. p. 788.

As the prodigious power of religious zeal, whatever turn it happens to take, when it is thoroughly heated, is well known, it may not be improper to give one example of the arts employed by the clergy and monks of this period, to inflame the pious ardour of the kings, nobles, and people, for building and adorning churches. When Joffred Abbot of Croyland reſolved to rebuild the church of his monaſtery in a moſt magnificent manner, A. D. 1106, he obtained from the Archbiſhops of Canterbury and York, a bull diſpenſing with the third part of all penances for ſin to thoſe who contributed any thing towards the building of that church. This bull was directed not only to the king and people of England, but to the kings of France and Scotland, and to all other kings, earls, barons, archbiſhops, biſhops, abbots, priors, rectors, preſbyters, and clerks, and to all true believers in Chriſt, rich and poor, in all Chriſtian kingdoms. To make the beſt uſe of this bull, he ſent two of his moſt eloquent monks to proclaim it over all France and Flanders, two other monks into Scotland, two into Denmark and Norway, two into Wales, Cornwall, and Ireland, and others into different parts of England. "By this means (ſays the hiſtorian) the wonderful benefits granted to all the contributors to the building of this church were publiſhed to the very ends of the earth; and great heaps of treaſure and maſſes of yellow metal flowed in from all countries upon the venerable Abbot Joffred, and encouraged him to lay the foundations of his church." Having ſpent about four years in collecting mountains of different kinds of marble from quarries both at home and abroad, together with great quantities of lime, iron, braſs, and other materials for building, he fixed a day for the great ceremony of laying the foundation, which he contrived to make a very effectual mean of raiſing the ſuperſtructure: For on the long-expected day, the feaſt of the Holy Virgins Felicitas and Perpetua, an immenſe multitude of earls, barons, and knights, with their ladies and families, of abbots, priors, monks, nuns, clerks, and perſons of all ranks, arrived at Croyland, to aſſiſt at this ceremony. The pious Abbot Joffred began by ſaying certain prayers, and ſhedding a flood of tears on the foundation. Then each of the earls, barons, knights, with their ladies, ſons, and daughters, the abbots, clerks, and others, laid a ſtone, and upon it depoſited a ſum of money, a grant of lands, tithes, or patronages, or a promiſe of ſtone, lime, wood, labour, or carriages for building the church. After this the abbot entertained the whole company, amounting to 5000 perſons, at dinner. To this entertainment they were all intitled; for the money, and grants of different kinds, which they had depoſited on the foundation-ſtones, were alone ſufficient to have raiſed a very noble fabric. By ſuch arts as theſe the clergy inſpired kings, nobles, and people of all ranks, with ſo ardent a ſpirit for theſe pious works, that in the courſe of this period almoſt all the ſacred edifices in England were rebuilt, and many hundreds of new ones raiſed from the foundation. Nor was this ſpirit confined to England, but prevailed as much in Scotland in proportion to its extent and riches. King David I. alone, beſides ſeveral cathedrals and other churches, built no fewer than thirteen abbeys and priories, ſome of which were very magnificent ſtructures.

The ſacred architecture of the Anglo-Normans in the beginning of this period did not differ much in its ſtyle and manner from that of the Anglo-Saxons; their churches being in general plain, low, ſtrong, and dark; the arches both of the doors and windows ſemicircular, with few or no ornaments. By degrees, through much practice, our architects, who were all monks or clergymen, improved in their taſte and ſkill, and ventured to form plans of more noble, light, and elevated ſtructures, with a great variety of ornaments; which led to that bold magnificent ſtyle of building, commonly, though perhaps not very properly, called *the later Gothic*. It is not improbable that our monkiſh architects were aſſiſted in attaining this ſtyle of building by models from foreign countries, or by inſtructions from ſuch of their own number as had viſited Italy, France, Spain, or the Eaſt. But the origin of this ſtyle of architecture has been already conſidered, and the characters by which it is diſtinguiſhed from the ancient Gothic have alſo been deſcribed: (See nº 21. *ſupra.*) Its firſt appearance in England was towards the latter end of the reign of King Henry II. But it was not at once thoroughly adopted; ſome ſhort ſolid columns and ſemicircular arches being retained and mixed with the pointed ones; as for example, in the weſt end of the Old Temple Church; and at York, where under the choir there remains much of the ancient work, the arches of which are but juſt pointed and riſe on ſhort round pillars. In the reign of Henry III. however, this manner of building ſeems to have gained a complete footing; the circular giving place to the pointed arch, and the maſſive column yielding to the ſlender pillar. Indeed, like all novelties, when once admitted, the rage of faſhion made it become ſo prevalent, that many of the ancient and ſolid buildings, erected in former ages, were taken down in order to be re-edified in the new taſte, or had additions patched to them, of this mode of architecture. The preſent cathedral church of Saliſbury was begun early in this reign, and finiſhed in the year 1258. It is entirely in the Saracenic ſtyle; and, according to Sir Chriſtopher Wren, may be juſtly accounted one of the beſt paterns of architecture of the age in which it was built. Its excellency is undoubtedly in a great meaſure owing to its being conſtructed on one plan; whence ariſes that ſymmetry and agreement of parts, not to be met with in many of our other cathedral churches; which have moſtly been built at different times, and in a variety of ſtyles. From this time till the reign of Henry VIII. the faſhionable pillars in churches were of Purbic marble, very ſlender and round, encompaſſed with marble ſhafts a little detached, having each a capital adorned with foliage, which joining, formed one elegant capital for the whole pillar. The windows were long and narrow, with pointed arches and painted glaſs, which was introduced about that time, or at leaſt became more common. In this century alſo they began to delight in lofty ſteeples, with ſpires and pinnacles. In the fourteenth century, the pillars conſiſted of an aſſemblage of ſhafts not detached, but united, forming one ſolid and elegant column; the windows, eſpecially thoſe in the eaſt and weſt ends, were greatly enlarged, divided into ſeveral lights by ſtone mullions running into ramifications above, and forming numerous compartments in various fanciful ſhapes. Thoſe windows, filled with ſtained glaſs of the moſt lively colours, repreſenting kings, ſaints, and martyrs, and their hiſtories, made a moſt ſolemn and glorious appearance. There were ſeveral other variations, eſpecially in the taſte of the carvings and other ornaments, which are too minute for general hiſtory.

As to the ſtate of civil architecture during the ſame period: The houſes of the common people in the country, and of the lower burgeſſes in towns and cities, were very little improved in their ſtructure, that moſt numerous and uſeful order of men being much depreſſed in the times we are now delineating. Even in the capital city of London, all the houſes of mechanics and common burgeſſes were built of wood, and covered with ſtraw or reeds, towards the end of the twelfth century. But the palaces, or rather caſtles, of the Anglo-Norman kings, barons, and prelates, were very different from the reſidences of perſons of the ſame rank in the Anglo-Saxon times. For this we have the teſtimony of a perſon of undoubted credit, who was well acquainted with them both. "The Anglo-Saxon nobles (ſays William of Malmſbury) ſquandered away their ample revenues in low and mean houſes; but the French and Norman barons are very different from them, living at leſs expence, but in great and magnificent palaces." The truth is, that the rage of building fortified caſtles, was no leſs violent among the Norman princes, prelates, and barons, than that of building churches. To this they were prompted, not only by the cuſtom of their native country, but alſo by their dangerous ſituation in that iſland. Surrounded by multitudes, whom they had depreſſed and plundered, and by whom they were abhorred, they could not think themſelves ſafe without the protection of deep ditches and ſtrong walls. The conqueror himſelf was ſenſible, that the want of fortified places in England had greatly facilitated his conqueſt, and might facilitate his expulſion; and therefore he made all poſſible haſte to remedy this defect, by building very magnificent and ſtrong caſtles in all the towns within the royal demeſnes. "William (ſays Matthew Paris) excelled all his predeceſſors in building caſtles, and greatly haraſſed his ſubjects and vaſſals with theſe works." All his earls, barons, and even prelates, imitated his example; and it was the firſt care of every one who received the grant of an eſtate from the crown, to build a caſtle upon it for his defence and reſidence. The diſputes about the ſucceſſion in the following reigns, kept up this ſpirit for building great and ſtrong caſtles. William Rufus was ſtill a greater builder than his father. "This William (ſays Henry Knyghton) was much addicted to building royal caſtles and palaces, as the caſtles of Dover, Windſor, Norwich, Exeter, the palace of Weſtminſter, and many others, teſtify; nor was there any king of England before him that erected ſo many and ſuch noble edifices." Henry I. was alſo a great builder both of caſtles and monaſteries. But this rage for building never prevailed ſo much in any period of the Engliſh hiſtory as in the turbulent reign of king Stephen, from A. D. 1135 to A. D. 1154. "In this reign (as we are told by the author of the Saxon Chronicle) every one who was able built a caſtle; ſo that the poor people were worn out with the toil of theſe buildings, and the whole kingdom was covered with caſtles." This laſt expreſſion will hardly appear too ſtrong, when we are informed, that beſides all the caſtles before that time in England, no fewer than 1115 were raiſed from the foundation in the ſhort ſpace of 19 years. See the article CASTLE.

The caſtles, monaſteries, and greater churches of this period, were generally covered with lead, the windows glazed; and when the walls were not of Aſhler, they were neatly plaſtered, and whitewaſhed on both ſides. The doors, floors, and roof, were commonly made of oak planks and beams, exactly ſmoothed and jointed, and frequently carved. It is hardly neceſſary to obſerve, that the building one of theſe great and magnificent caſtles, monaſteries, or churches, of which there were many in England, muſt have been a work of prodigious expence and labour; and that the architects and artificers, by whom that work was planned and executed, muſt have attained conſiderable dexterity in their reſpective arts. Several of theſe architects have obtained a place in hiſtory, and are highly celebrated for their ſuperior ſkill. William of Sens, architect to Archbiſhop Lanfranc in building his cathedral, is ſaid, by Gervaſe of Canterbury, to have been a moſt exquiſite artiſt both in ſtone and wood. He made not only a model of the whole cathedral, but of every particular piece of ſculpture and carving, for the direction of the workmen; and invented many curious machines for loading and unloading ſhips, and conveying heavy weights by land, becauſe all the ſtones were brought from Normandy. Matthew Paris ſpeaks even in a higher ſtrain of Walter of Coventry, who flouriſhed towards the end of this period, when he ſays, that "ſo excellent an architect had never yet appeared, and probably never would appear, in the world." This encomium was undoubtedly too high; but it is impoſſible to view the remains of many magnificent fabrics, both ſacred and civil, that were erected in this period, without admiring the genius of the architects by whom they were planned, and the dexterity of the workmen by whom they were executed.

In the beginning of the reign of Henry VIII. or rather towards the latter end of that of Henry VII. when brick building became common, a new kind of low pointed arch grew much in uſe: it was deſcribed from four centres, was very round at the haunches, and the angle at the top was very obtuſe. This ſort of arch is to be found in every one of Cardinal Wolſey's buildings; alſo at Weſt Sheen; an ancient brick gate at Mile End, called *King John's Gate*; and in the great gate of the palace of Lambeth. From this time Gothic architecture began to decline; and was ſoon after ſupplanted by a mixed ſtyle, if one may venture to call it one; wherein the Grecian and Gothic, however diſcordant and irreconcileable, are jumbled together. Concerning this mode of building, Mr Warton, in his obſervations on Spencer's Fairy Queen, has the following anecdotes and remarks.

"Although the Roman or Grecian architecture did not begin to prevail in England till the time of Inigo Jones, yet our communication with the Italians, and our imitation of their manners, produced ſome ſpecimens of that ſtyle much earlier. Perhaps the earlieſt was Somerſet Houſe in the Strand, built about the year 1549, by the Duke of Somerſet, uncle to Edward VI. The monument of Biſhop Gardiner, in Wincheſter cathedral, made in the reign of Mary, about 1555, is decorated with Ionic pillars. Theſe verſes of Spencer,

> ———————Did riſe
> On ſtately pillars, fram'd after the Doric guiſe.

bear an alluſion to ſome of the faſhionable improvements in building, which at this time were growing more and more into eſteem. Thus alſo Biſhop Hall, who wrote about the ſame time, viz 1598:

> There findeſt thou ſome ſtately Doricke frame,
> Or neat Ionicke work.———

But theſe ornaments were often abſurdly introduced into the old Gothic ſtyle: as in the magnificent portico of the ſchools at Oxford, erected about the year 1613; where the builder, in a Gothic edifice, has affectedly diſplayed his univerſal ſkill in the modern architecture, by giving us all the five orders together. However, moſt of the great buildings of Queen Elizabeth's reign have a ſtyle peculiar to themſelves both in form and finiſhing; where, though much of the old Gothic is retained, and great part of the new taſte is adopted, yet neither predominates; while both, thus diſtinctly blended, compoſe a fantaſtic ſpecies, hardly reducible to any claſs or name. One of its Characteriſtics is the affectation of large and lofty windows; where, ſays Bacon, "you ſhall have ſometimes fair houſes ſo full of glaſs, that one cannot tell where to come to be out of the ſun."

To return now to our general hiſtory, and to conclude: In the 15th and 16th centuries, when learning of all kinds began to revive, the chaſte architecture of the Greeks and Romans ſeemed as it were to be recalled into life. The firſt improvements in it began in Italy, and owed their exiſtence to the many ruins of the ancient Roman ſtructures that were to be found in that country, from whence an improved method of building was gradually brought into the other countries of Europe: and though the Italians for a long time retained the ſuperiority as architects over the other European nations; yet, as men of genius travelled from all quarters into Italy, where they had an opportunity of ſeeing the originals from whence the Italians copied, architects have riſen in other nations equal, if not ſuperior, to any that ever appeared in Italy. Of this we have a recent inſtance in Mr Mylne, who lately gained the prize in architecture at Rome, where it would no doubt be diſputed by ſuch natives of Italy as were beſt ſkilled in that art.

PART. I. PRINCIPLES OF ARCHITECTURE.

MANY ages muſt have elapſed before architecture came to be conſidered as a fine art. Utility was its original deſtination, and ſtill continues to be its principal end. Experience, however, has taught us, that architecture is capable of exciting a variety of agreeable feelings. Of theſe, utility, grandeur, regularity, order, and proportion, are the chief.

23 Diſtinction of buildings.

Architecture being an uſeful as well as a fine art, leads us to diſtinguiſh buildings, and parts of buildings, into three kinds, viz. what are intended for uſe ſolely, what for ornament ſolely, and what for both. Buildings intended for utility ſolely, ought in every part to correſpond preciſely to that intention: the leaſt deviation from uſe, though contributing to ornament, will be diſagreeable; for every work of uſe being conſidered as a mean to an end, its perfection as a mean is the capital circumſtance, and every other beauty in oppoſition is neglected as improper. On the other hand, in ſuch things as are intended ſolely for ornament, as columns, obeliſks, triumphal arches, &c. beauty alone ought to be regarded. The principal difficulty in architecture lies in combining uſe and ornament. In order to accompliſh theſe ends, different and even oppoſite means muſt be employed; which is the reaſon why they are ſo ſeldom united in perfection; and hence, in buildings of this kind, the only practicable method is, to prefer utility to ornament according to the character of the building: in palaces, and ſuch buildings as admit of a variety of uſeful contrivance, regularity ought to be preferred; but in dwelling-houſes that are too ſmall for a variety of contrivance, utility ought to prevail, neglecting regularity as far as it ſtands in oppoſition to convenience.

24
Intrinſic and relative beauty.

In conſidering attentively the beauty of viſible objects, we diſcover two kinds. The firſt may be termed *intrinſic* beauty, becauſe it is diſcovered in a ſingle object, without relation to any other. The ſecond may be termed *relative* beauty, being founded on a combination of relative objects. Architecture admits of both kinds. We ſhall firſt give a few examples of *relative* beauty.

The proportions of a door are determined by the uſe to which it is deſtined. The door of a dwelling-houſe, which ought to correſpond to the human ſize, is confined to ſeven or eight feet in height and three or four in breadth. The proportions proper for a ſtable or coach-houſe are different. The door of a church ought to be wide, in order to afford an eaſy paſſage for a multitude; and its height muſt be regulated by its wideneſs, that the proportion may pleaſe the eye. The ſize of the windows ought always to be proportioned to that of the room they are deſtined to illuminate; for if the apertures be not large enough to convey light to every corner, the room muſt be unequally lighted, which is a great deformity. Steps of ſtairs ſhould likewiſe be accommodated to the human figure, without regarding any other proportion; they are accordingly the ſame in large and in ſmall buildings, becauſe both are inhabited by men of the ſame ſize.

We ſhall next conſider *intrinſic* beauty, blended with that which is *relative*. A cube itſelf is more agreeable than a parallelopipedon; this conſtantly holds in ſmall figures: but a large building in the form of a cube is lumpiſh and heavy; while a parallelopipedon, ſet on its ſmaller baſe, is more agreeable on account of its elevation: Hence the beauty of Gothic towers. But if this figure were to be uſed in a dwelling-houſe, to make way for relative beauty, we would immediately perceive that utility ought chiefly to be regarded; and this figure, inconvenient by its height, ought to be ſet on its larger baſe: the loftineſs in this caſe would be loſt; but that loſs will be more than ſufficiently compenſated by the additional convenience. Hence the form of buildings ſpread more upon the ground than raiſed in height, is always preferred for a dwelling houſe.

25
Internal diviſions of houſes.

With regard to the internal diviſions, utility requires that the rooms be rectangular, to avoid uſeleſs ſpaces. An hexagonal figure leaves no void ſpaces; but it determines the rooms to be all of one ſize, which is both inconvenient and diſagreeable for want of variety. Though a cube be the moſt agreeable figure, and may anſwer for a room of a moderate ſize; yet, in a very large room, utility requires a different figure. Unconfined motion is the chief convenience of a great room; to obtain this the greateſt length that can be had is neceſſary. But a ſquare room of large ſize is inconvenient. It removes chairs, tables, &c. at too great a diſtance from the hand, which, when unemployed, muſt be ranged along the ſides of the room. Utility, therefore, requires a large room to be a parallelogram. This figure is likewiſe beſt calculated for the admiſſion of light; becauſe, to avoid croſs-lights, all the windows ought to be in one wall; and if the oppoſite wall be at ſuch a diſtance as not to be fully lighted, the room muſt be obſcure. The height of a room exceeding nine or ten feet has little relation to utility; therefore proportion is the only rule for determining the height when above that number of feet.

26
Utility and beauty often incompatible.

Artiſts who deal in the beautiful, love to entertain the eye; palaces and ſumptuous buildings, in which intrinſic beauty may be fully diſplayed, give them an opportunity of exerting their taſte. But ſuch a propenſity is peculiarly unhappy with regard to private dwelling-houſes; becauſe, in theſe, relative beauty cannot be diſplayed to perfection without hurting intrinſic beauty. There is no opportunity for great variety of form in a ſmall houſe; and in edifices of this kind, internal convenience has not hitherto been happily adjuſted to external regularity. Perhaps an accurate coincidence in this reſpect is beyond the reach of art. Architects, however, conſtantly ſplit upon this rock; for they never can be perſuaded to give over attempting to reconcile theſe two incompatibles: how otherwiſe ſhould it happen, that of the endleſs variety of private dwelling-houſes, there ſhould not be one found that is generally agreed upon as a good pattern? the unwearied propenſity to make a houſe regular as well as convenient obliges the architect, in ſome articles, to ſacrifice convenience to regularity; and, in others, regularity to convenience; and accordingly the houſe which turns out neither regular nor convenient, never fails to diſpleaſe.

Nothing can be more evident, than that the form of a dwelling-houſe ought to be ſuited to the climate; yet no error is more common than to copy in Britain the form of Italian houſes, not forgetting even thoſe parts that are purpoſely contrived for collecting air, and for excluding the ſun: witneſs our colonnades and logios, deſigned by the Italians to gather cool air, and exclude the beams of the ſun, conveniences which the climate of Britain does not require.

27
Architecture conſidered as a fine art.

We ſhall next view architecture as one of the fine arts; which will lead us to the examination of ſuch buildings, and parts of buildings, as are calculated ſolely to pleaſe the eye. Variety prevails in the works of nature; but art requires to be guided by rule and compaſs. Hence it is, that in ſuch works of art as imitate nature, the great art is, to hide every appearance of art; which is done by avoiding regularity and indulging variety. But in works of art that are original and not imitative, ſuch as architecture, ſtrict regularity and uniformity ought to be ſtudied, ſo far as conſiſtent with utility.

28
Difference between proportions of number and quantity.

Proportion is not leſs agreeable than regularity and uniformity; and therefore, in buildings intended to pleaſe the eye, they are all equally eſſential. It is taken for granted by many writers, that in all the parts of a building there are certain ſtrict proportions which pleaſe the eye, in the ſame manner as in ſound there are certain ſtrict proportions which pleaſe the ear; and that, in both, the ſlighteſt deviations is equally diſagreeable. Others ſeem to reliſh more a compariſon between proportion in numbers and proportion in quantity; and maintain, that the ſame proportions are agreeable in both. The proportions, for example, of the numbers

bers 16, 24, and 36, are agreeable; and ſo, ſay they, are the proportions of a room, whoſe height is 16 feet, the breadth 24, and the length 36. But it ought to be conſidered, that there is no reſemblance or relation between the objects of different ſenſes. What pleaſes the ear in harmony, is not the proportion of the ſtrings of the inſtrument, but of the ſound which theſe ſtrings produce. In architecture, on the contrary, it is the proportion of different quantities that pleaſes the eye, without the leaſt relation to ſound. The ſame thing may be ſaid of numbers. Quantity is a real quality of every body; number is not a real quality, but merely an idea that ariſes upon viewing a plurality of things in ſucceſſion. An arithmetical proportion is agreeable in numbers: but have we from this any reaſon to conclude, that it muſt alſo be agreeable in quantity? At this rate, a geometrical proportion, and many others, ought alſo to be agreeable in both. A certain proportion may coincide in quantity and number; and amongſt an endleſs variety of proportions, it would be wonderful if there never ſhould be a conicidence. One example is given of this coincidence in the numbers 16, 24, and 36; but, to be convinced that it is merely accidental, we need but reflect, that the ſame proportions are not applicable to the external figure of a houſe, and far leſs to a column.

It is ludicrous to obſerve writers acknowledging the neceſſity of accurate proportions, and yet differing widely about them. Laying aſide reaſoning and philoſophy, one fact univerſally agreed on ought to have undeceived them, that the ſame proportions which pleaſe in a model are not agreeable in a large building: a room 48 feet in length, and 24 in breadth and height, is well proportioned: but a room 12 feet wide and high, and 24 long, approaches to a gallery.

29
Beauty ariſing from proportion.

Perrault, in his compariſon of the ancients and moderns, goes to the oppoſite extreme; maintaining, that the different proportions aſſigned to each order of columns are arbitrary, and that the beauty of theſe proportions is entirely the effect of cuſtom. But he ſhould have conſidered, that if theſe proportions had not originally been agreeable, they could never have been eſtabliſhed by cuſtom.

For illuſtrating this point, we ſhall add a few examples of the agreeableneſs of different proportions. In a ſumptuous edifice, the capital rooms ought to be large, otherwiſe they will not be proportioned to the ſize of the building; for the ſame reaſon, a very large room is improper in a ſmall houſe. But in things thus related, the mind requires not a preciſe or ſingle proportion, rejecting all others; on the contrary, many different proportions are equally agreeable. It is only when a proportion becomes looſe and diſtant, that the agreeableneſs abates, and at laſt vaniſhes. Accordingly, in building, rooms of different proportions are found to be equally agreeable, even where the proportion is not influenced by utility. With regard to the proportion the height of a room ſhould bear to the length and breadth, it muſt be extremely arbitrary, conſidering the uncertainty of the eye as to the height of a room when it exceeds 16 or 17 feet. In columns, again, every architect muſt confeſs that the proportion of height and thickneſs varies betwixt 8 diameters and 10, and that every proportion between theſe two extremes is agreeable. Beſides, there muſt certainly be a further variation of proportion, depending on the ſize of the column. A row of columns 10 feet high, and a row twice that height, require different proportions: The intercolumniations muſt alſo differ in proportion according to the height of the row.

Proportion of parts is not only itſelf a beauty, but is inſeparably connected with a beauty of the higheſt reliſh, that of concord and harmony: which will be plain from what follows: A room, the parts of which are all finely adjuſted to each other, ſtrikes us not only with the beauty of proportion, but with a pleaſure far ſuperior. The length, the breadth, the height, the windows, raiſe each of them a ſeparate emotion: Theſe emotions are ſimilar; and, though faint when ſeparately felt, they produce in conjunction the emotion of concord or harmony, which is very pleaſant. On the other hand, where the length of a room far exceeds the breadth, the mind, comparing together parts ſo intimately connected, immediately perceives a diſagreement or diſproportion which diſguſts. Hence a long gallery, however convenient for exerciſe, is not an agreeable figure of a room.

In buildings deſtined chiefly or ſolely to pleaſe the eye, regularity and proportion are eſſentially neceſſary, becauſe they are the means of producing intrinſic beauty.

30
Form of ſtructures to be ſuited to the purpoſes for which they are intended.

But a ſkilful artiſt will not confine his view to regularity and proportion; he will alſo ſtudy congruity, which is perceived when the form and ornaments of a ſtructure are ſuited to the purpoſe for which it is appointed. Hence every building ought to have an expreſſion ſuited to its deſtination. A palace ought to be ſumptuous and grand; a private dwelling, neat and modeſt; a play-houſe, gay and ſplendid; and a monument, gloomy and melancholy. A heathen temple has a double deſtination: It is conſidered as a houſe dedicated to ſome divinity; therefore it ought to be grand, elevated, and magnificent: It is alſo conſidered as a place of worſhip; and therefore ought to be ſomewhat dark and gloomy, becauſe dimneſs or obſcurity produces that tone of mind which is favourable to humility and devotion. Columns, beſides their chief deſtination of being ſupports, contribute to that peculiar expreſſion which the deſtination of a building requires. Columns of different proportions ſerve to expreſs loftineſs, lightneſs, &c. as well as ſtrength. Situation may alſo contribute to expreſſion: Conveniency regulates the ſituation of a private dwelling-houſe; and the ſituation of a palace ought to be lofty. This leads to a queſtion. Whether the ſituation, where there happens to be no choice, ought, in any meaſure, to regulate the form of the edifice? The connection between a great houſe and a neighbouring field, though not extremely intimate, demands however ſome congruity. It would, for example, diſpleaſe us to find an elegant building thrown away upon a wild uncultivated country: congruity requires a poliſhed field for ſuch a building. The old Gothic form of building was well ſuited to the rough uncultivated regions where it was invented; but was very ill adapted to the fine plains of France and Italy.

31
Internal diviſion of houſes.

The external ſtructure of a houſe leads naturally to its internal ſtructure. A large and ſpacious room, which is the firſt that commonly receives us, is a bad contrivance in ſeveral reſpects. In the firſt place, when immediately from the open air we ſtep into ſuch a room, its ſize in appearance is diminiſhed by contraſt; it looks little, compared with the great canopy of the ſky. In the next place, when it recovers its grandeur, as it ſoon doth, it gives a diminutive appearance to the reſt of the houſe; paſſing from it, every apartment looks little. In the third place, by its ſituation it ſerves only for a waiting-room, and a paſſage to the principal apartments. Rejecting therefore this form, a hint may be taken from the climax in writing for another that appears more ſuitable: A handſome portico, proportioned to the ſize and faſhion of the front, leads into a waiting-room of a larger ſize, and this to the great room, all by a progreſſion of ſmall to great.

Grandeur is the principal emotion that architecture is capable of raiſing in the mind: it might therefore be the chief ſtudy of the artiſt, in great buildings deſtined to pleaſe the eye. But as grandeur depends partly on ſize, it is unlucky for architecture that it is governed by regularity and proportion, which never deceive the eye by making objects appear larger than they are in reality. But though regularity and proportion contribute nothing to grandeur, ſo far as that emotion depends on ſize; yet they contribute greatly to it by confining the ſize within ſuch bounds that it can be taken in and examined at one view; for when objects are ſo large as not to be comprehended but in parts, they tend rather to diſtract than ſatisfy the mind.

We ſhall next paſs to ſuch ornaments as contribute to give buildings a peculiar expreſſion. It has been doubted, whether a building can regularly admit any ornament but what is uſeful, or at leaſt has that appearance. But, conſidering the double aim of architecture as a fine, as well as an uſeful art, there is no reaſon why ornaments may not be added to pleaſe the eye, without any relation to utility. A private dwelling-houſe, it is true, and other edifices, where uſe is the chief aim, admit not regularly any ornament but what has at leaſt the appearance of uſe; but temples, triumphal arches, and other buildings intended chiefly or ſolely for ſhow, may be highly ornamented.

32
Different kinds of ornaments.

This ſuggeſts a diviſion of ornaments into three kinds, *viz.* 1. Ornaments that are beautiful without relation to uſe; ſuch as ſtatues, vaſes, baſſo or alto relievo: 2. Things in themſelves not beautiful, but poſſeſſing the beauty of utility, by impoſing on the ſpectator, and appearing to be uſeful; ſuch as blind windows: 3. Where things are beautiful in themſelves, and at the ſame time take on the appearance of uſe; ſuch as pilaſters.

With regard to the *firſt*, we naturally require that a ſtatue be ſo placed, as to be ſeen in every direction, and examined at different diſtances. Statues, therefore, are properly introduced to adorn the great ſtair that leads to the principal door of a palace, or to leſſen the void between pillars. But a niche in the external front is an improper place for a ſtatue. There is an additional reaſon againſt placing them upon the roof or top of the walls: their tickliſh ſituation gives pain, as they have the appearance of being in danger of tumbling down; beſides, we are inclined to feel from their being too much expoſed to the inclemencies of the weather. To adorn the top of the wall with a row of vaſes, is an unhappy conceit, by placing a thing, whoſe natural deſtination is utility, where it cannot have even the appearance of uſe. As to carvings upon the external ſurface of a building, termed *baſſo relievo* when flat, and *alto relievo* when prominent, all contradictory expreſſions ought be be avoided. Now, firmneſs and ſolidity being the proper expreſſions of a pedeſtal, and, on the contrary, lightneſs and delicacy of carved work, the pedeſtal, whether of a column or of a ſtatue, ought to be ſparingly ornamented. The ancients never ventured any bolder ornament than the baſſo relievo.

With reſpect to ornaments of the *ſecond* kind, it is a great blunder to contrive them ſo as to make them appear uſeleſs. A blind window, therefore, when neceſſary for regularity, ought to be ſo diſguiſed as to appear a real window: when it appears without diſguiſe, it is diſguſtful, as a vain attempt to ſupply the want of invention; it ſhows the irregularity in a ſtronger light, by ſignifying that a window ought to be there in point of regularity, but that the architect had not ſkill ſufficient to connect external regularity with internal convenience.

As to the *third*, it is an error to ſink pilaſters ſo far into the wall, as to remove totally, or moſtly, the appearance of uſe. They ſhould always project ſo much from the wall, as to have the appearance of ſupporting the entablature over them.

33
Columns.

From ornaments in general, we deſcend to a pillar, the chief ornament in great buildings. The deſtination of a pillar is to ſupport, really, or in appearance, another part termed the *entablature*. With regard to the form of a pillar, it muſt be obſerved, that a circle is a more agreeable figure than a ſquare, a globe than a cube, and a cylinder than parallelopipedon. This laſt, in the language of architecture, is ſaying, that a column is a more agreeable figure than a pilaſter; and for that reaſon it ought be preferred, when all other circumſtances are equal. Another reaſon concurs, that a column annexed to a wall, which is a plain ſurface, makes a greater variety than a pilaſter. Beſides, pilaſters at a diſtance are apt to be miſtaken for pillars; and the ſpectator is diſappointed, when, on a nearer approach, he diſcovers them to be only pilaſters.

As to the parts of a column, a bare uniform cylinder, without a capital, appears naked; and without a baſe, appears too tickliſhly placed to ſtand firm; it ought therefore to have ſome finiſhing at the top and bottom: Hence the three chief parts of a column, the ſhaft, the baſe, and the capital. Nature undoubtedly requires proportion among theſe parts, but it admits of variety of proportion. Vitruvius and ſome of the elder writers ſeem to think, that the proportions of columns were derived from the human figure, the capital repreſenting the head, the baſe the feet, and the ſhaft the body. The Tuſcan has been accordingly denominated the *Gigantic*; the Doric, the *Herculean*; the Ionic, the *Matronal*; and the Corinthian, the *Virginal*;—The Compoſite is a mixture of the Corinthian and Ionic. As to the baſe, the principle of utility interpoſes to vary it from the human figure, and to proportion it ſo to the whole, as to give the column the appearance of ſtability.

34
Whether new orders can be invented.

Among the Greeks, we find only three orders of columns, the Doric, the Ionic, and the Corinthian, diſtinguiſhed from each other by their deſtination as well as by their ornaments. It has been diſputed, whether any new order can be added to theſe: ſome hold the affirmative, and give for inſtances the Tuſcan and Compoſite; others maintain, that theſe properly are not diſtinct orders, but only the original orders with ſome ſlight variation. The only circumſtances that can ſerve to diſtinguiſh one order from another, are the form of the column, and its deſtination. To make the firſt a diſtinguiſhing mark, without regard to the other, would multiply orders without end. Deſtination is more limited, and it leads us to diſtinguiſh three kinds of orders; one plain and ſtrong, for the purpoſe of ſupporting plain and maſſy buildings; one delicate and graceful, for ſupporting buildings of that character; and between theſe, a third, for ſupporting buildings of a mixed nature. So that, if deſtination alone is to be regarded, the Tuſcan is of the ſame order with the Doric, and the Compoſite with the Corinthian.

The ornaments of theſe three orders ought to be ſuited to the purpoſes for which they are intended. Plain and ruſtic ornaments would not be a little diſcordant with the elegance of the Corinthian order, and ſweet and delicate ornaments not leſs with the ſtrength of the Doric.

35 Rules regarding building in general.

With reſpect to buildings of every kind, one rule, dictated by utility, is, that they be firm and ſtable. Another, dictated by beauty, is, that they alſo appear ſo to the eye: for every thing that appears tottering, and in hazard of tumbling down, produceth in the ſpectator the painful emotion of fear, inſtead of the pleaſing emotion of beauty; and accordingly it ſhould be the great care of the artiſt, that every part of his edifice appear to be well ſupported. Some have introduced a kind of conceit in architecture, by giving parts of buildings the appearance of falling; of this kind is the church of St Sophia in Conſtantinople; the round towers in the uppermoſt ſtories of Gothic buildings is in the ſame falſe taſte.

The moſt conſiderable ornaments uſed in architecture are the five orders of columns, pediments, arches, balluſters, *&c.* of which in the following chapters.

Chap. I. *Of the Orders of Architecture.*

An **Order** conſiſts of two principal members, the **Column** and the **Entablature**; each of which is compoſed of three principal parts. Thoſe of the Column are, the *Baſe*, the *Shaft*, and the *Capital*; and thoſe of the Entablature are, the *Architrave*, the *Frize*, and the *Cornice*. All theſe are ſubdivided into many leſſer parts, whoſe number, form, and dimenſions, characteriſe each order, and expreſs the degree of ſtrength, delicacy, richneſs, or ſimplicity peculiar to it.

36 Parts of an order divided into two claſſes.

The parts that compoſe an order may be diſtributed into two different claſſes. In the *firſt* may be ranged all that have any analogy to the primitive huts, and repreſent ſome part that was neceſſary in their conſtruction. Such are the ſhaft of the column, with the plinth of its baſe, and the abacus of its capital; likewiſe the architrave and triglyphs, the mutules, modilions, or dentils, which all of them repreſent the rafters, or ſome other pieces of timber uſed to ſupport the covering; and the corona, repreſenting the beds of materials that compoſed the covering. All theſe may properly be diſtinguiſhed by the name of *eſſential members*. The ſubſervient parts, contrived for the uſe or ornaments of the former, and commonly called *mouldings*, may conſtitute the *ſecond* claſs.

There are eight regular mouldings in ornamenting columns: the fillet, liſtel, or ſquare; the aſtragal, or bead; the torus, or tore; the ſcotia, mouth, or caſement; the echinus, ovolo, or quarter-round; the inverted cyma, talon, or ogee; the cyma, cyma recta, or cymation; the cavetto, or hollow. The names of theſe allude to their forms, and their forms are adapted to the purpoſes for which they are intended. See Plate XL.

The ovolo and talon, as they are ſtrong at the extremities, are fit for ſupporters; the cyma and cavetto, though improper for ſupports, ſerve for coverings to ſhelter other members; the torus and aſtragal, being ſhaped like ropes, are intended to bind and fortify the parts with which they are connected: But the uſe of the ſcotia and fillet is only to ſeparate and diſtinguiſh the other mouldings, to give a graceful turn to the profile, and to prevent the confuſion which would ariſe from joining ſeveral curved members together.

There are various methods of deſcribing the contours of mouldings; but the ſimpleſt and beſt is to form them of quadrants of circles.

37 Profile, what.

An aſſemblage of what are called eſſential parts and mouldings is termed a *profile*. The moſt perfect profiles are ſuch as are compoſed of few mouldings, varied in form and ſize; and ſo diſpoſed, that the ſtraight and curved ones ſucceed each other alternately. When ornaments are employed in mouldings, ſome of them ſhould be left plain, in order to give a proper repoſe: For when all are ornamented, the figure of the profile is loſt.

38 Diminution of columns.

Columns, in imitation of trees, from which they drew their origin, are tapered in their ſhafts. In the antiques the diminution is variouſly performed; beginning ſometimes from the foot of the ſhaft, and at others from one-quarter, or one-third of its height; the lower part being perfectly cylindrical. The former of theſe was moſt in uſe amongſt the ancients, and, being the moſt natural and graceful, ought to have the preference, though the latter hath been more univerſally practiſed by modern artiſts.

The firſt architects, ſays Mr Auzoult, probably made their columns in ſtraight lines, in imitation of trees; ſo that their ſhaft was a fruſtum of a cone: but finding this form abrupt and diſagreeable, they made uſe of ſome curve, which, ſpringing from the extremities of the ſuperior and inferior diameters of the column, ſwelled beyond the ſides of the cone, and by that means gave a more pleaſing figure to the contour.

Vitruvius, in the ſecond chapter of his third book, mentions this practice, but in ſo obſcure and curſory a manner, that his meaning hath not been underſtood; and ſeveral of the modern architects, intending to conform themſelves to the doctrine have made the diameters of their columns greater in the middle than at the foot of the ſhaft. Leon Baptiſta, Alberti, and others of the Florentine and Roman architects, have carried this to a very great exceſs; for which they have

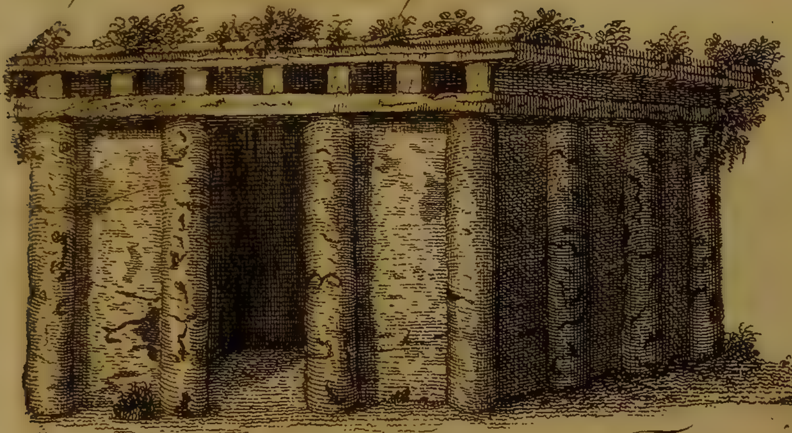


Fig. 2. The second sort of Huts

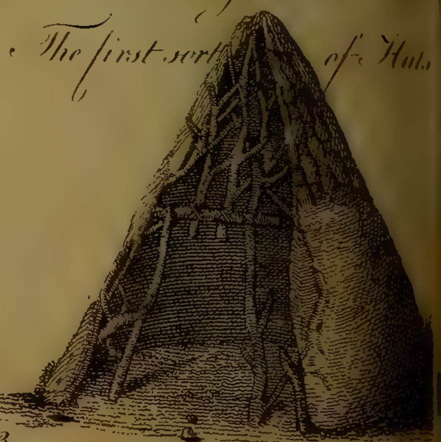


Fig. 1. The first sort of Huts

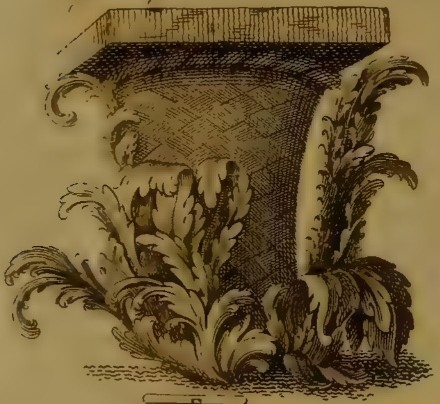


Fig. 4. Origin of the Corinthian Order

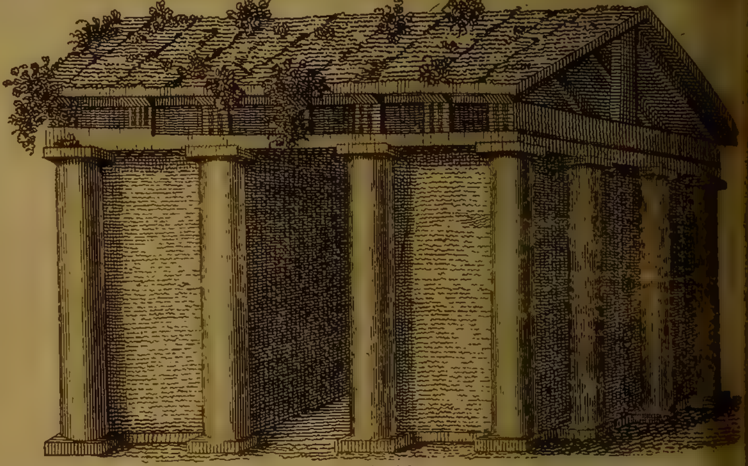


Fig. 3. The third sort of huts which gave rise to the Doric Or

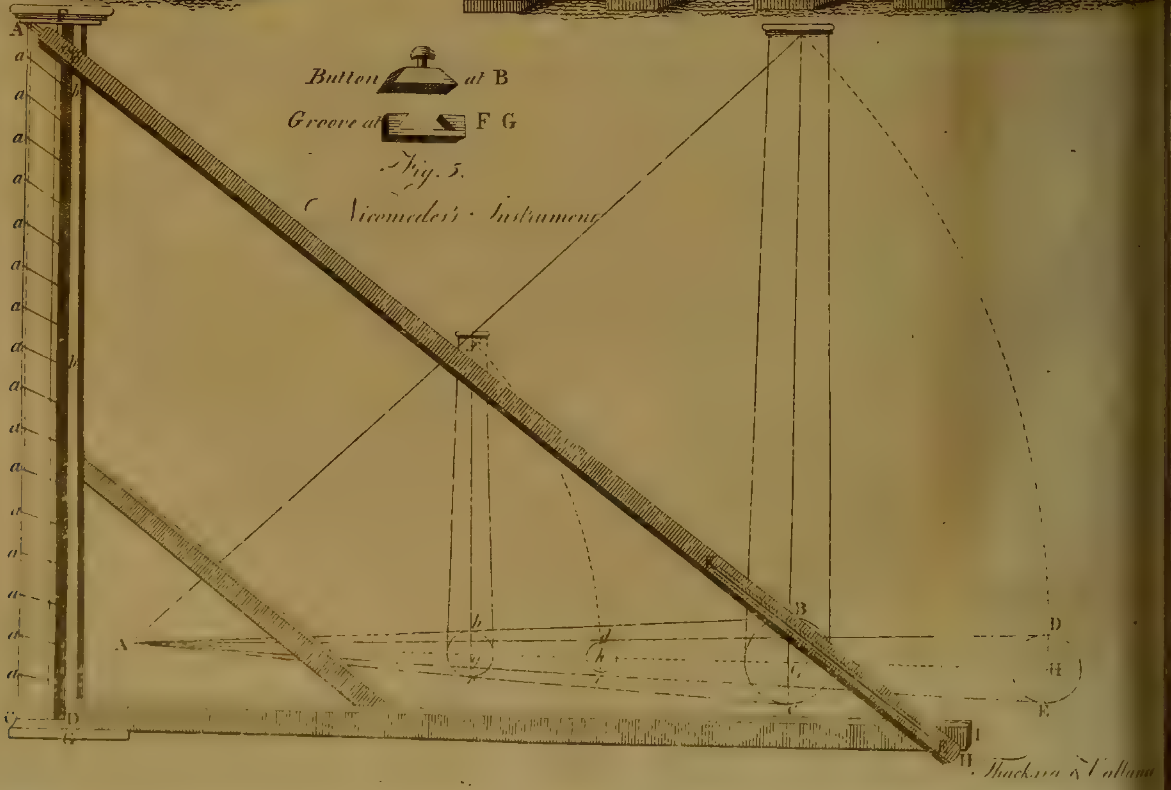
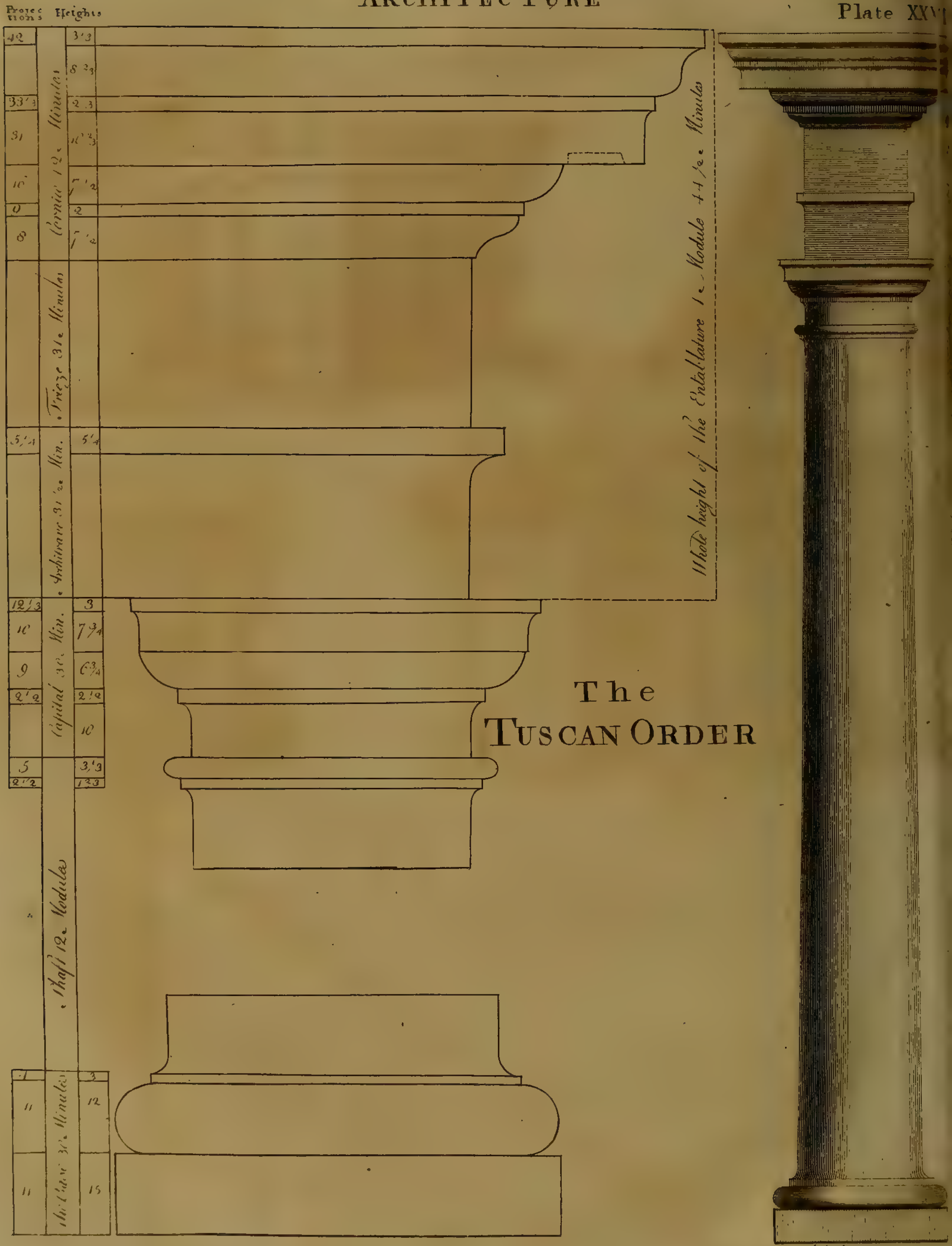


Fig. 5. Nicomedes's Instrument

Thackara & Vallanc



The TUSCAN ORDER

Scot Philad.ª

have been juſtly blamed, as it is neither natural, reaſonable, nor beautiful.

Monſieur Auzoult obſerves, that a column, ſuppoſing its ſhafts to be the fruſtum of a cone, may have an additional thickneſs in the middle, without being ſwelled there beyond the bulk of its inferior parts; and ſuppoſes the addition mentioned by Vitruvius to ſignify nothing but the increaſe towards the middle of the column, occaſioned by changing the ſtraight line, which at firſt was in uſe, for a curve.

This ſuppoſition is extremely juſt, and founded on what is obſerved in the works of antiquity; where there is no inſtance of columns thicker in the middle than at the bottom, though all have the ſwelling hinted at by Vitruvius, all of them being terminated by curves; ſome granite columns excepted, which are bounded by ſtraight lines; a proof, perhaps, of their antiquity, or of their having been wrought in the quarries of Egypt by bungling and unſkilful workmen.

Monſieur Blondel, in his book, entitled, *Reſolution des quatre principaux problemes d'Architecture*, teaches various manners of diminiſhing columns; the beſt and ſimpleſt of which is by means of the inſtrument which Nicomedes invented to deſcribe the the firſt conchoid: for this, being applied at the bottom of the ſhaft, performs at one ſweep both the ſwelling and the diminution; giving ſuch a graceful form to the column, that it is univerſally allowed to be the moſt perfect practice hitherto diſcovered. The columns in the Pantheon, accounted the moſt beautiful among the antiques, are made in this manner; as appears by the exact meaſures of one of them to be found in Deſgodet's antiquities of Rome.

36
Vignola's method.

To give an accurate idea of the operation, it will be neceſſary firſt to deſcribe Vignola's method of diminution, on which it is grounded. "As to this ſecond method, ſays Vignola, it is a diſcovery of my own; and although it be leſs known than the former, it will be eaſily comprehended by the figure. Having therefore determined the meaſures of your column, (that is to ſay, the height of the ſhaft, and its inferior and ſuperior diameters), draw a line indefinitely from C through D, perpendicular to the axis of the column: this done, ſet off the diſtance C D, which is the inferior ſemi-diameter, from A, the extreme point of the ſuperior ſemi-diameter, to B, a point in the axis; then from A, through B, draw the line A B E, which will cut the indefinite line C D in E; and, from this point of interſection E, draw thro' the axis of the column any number of rays as E b a, on each of which, from the axis towards the circumference, ſetting off the interval C D, you may find any number of points, a, a, a, through which if a curve be drawn, it will deſcribe the ſwelling and diminution of the column."

Pl. XXXVI

40
Nicomedes's inſtrument.

Though this method be ſufficiently accurate for practice, eſpecially if a conſiderable number of points be found, yet, ſtrictly ſpeaking, it is defective; as the curve muſt either be drawn by hand, or by applying a flexible ruler to all the points; both of which are liable to variations. Blondel therefore, to obviate this objection, (after having proved the curve paſſing from A to C through the points a a, to be of the ſame nature with the firſt conchoid of the ancients), employed the inſtrument of Nicomedes to deſcribe it; the conſtruction of which is as follows:

Having determined, as above, the length of the ſhaft, with the inferior and ſuperior diameters of the column, and having likewiſe found the length of the line C D E, take three rulers, either of wood or metal, as F G, I D, and A H; of which let F G and I D be faſtened together at right angles in G. Cut a dove-tail groove in the middle of F G, from top to bottom; and at the point E on the ruler I D (whoſe diſtance, from the middle of the groove in F G, is the ſame as that of the point of interſection from the axis of the column) fix a pin; then on the ruler A H ſet off the diſtance A B, equal to C D the inferior ſemi-diameter of the column, and at the point B fix a button, whoſe head muſt be exactly fitted to the groove made in F G, in which it is to ſlide; and, at the other extremity of the ruler A H, cut a ſlit or canal from H to K, whoſe length muſt not be leſs than the difference of length between E B and E D, and whoſe breadth muſt be ſufficient to admit the pin fixed at E, which muſt paſs through the ſlit, that the ruler may ſlide thereon.

The inſtrument being thus completed, if the middle of the groove, in the ruler F G, be placed exactly over the axis of the column, it is evident that the ruler A H, in moving along the groove, will with the extremity A deſcribe the curve A a a C; which curve is the ſame as that produced by Vignola's method of diminution, ſuppoſing it done with the utmoſt accuracy; for the interval A B, a b, is always the ſame; and the point E is the origin of an infinity of lines, of which the parts B A, ba, ba, extending from the axis to the circumference, are equal to each other and to D C. And if the rulers be of an indefinite ſize, and the pins at E and B be made to move along their reſpective rulers, ſo that the intervals A B and D E may be augmented or diminiſhed at pleaſure, it is likewiſe evident that the ſame inſtrument may be thus applied to columns of any ſize.

41
Quantity of diminution

In the remains of antiquity the quantity of the diminution is various; but ſeldom leſs than one-eighth of the inferior diameter of the column, nor more than one-ſixth of it. The laſt of theſe is by Vitruvius eſteemed the moſt perfect.

Of the TUSCAN Order.

42
Plate XXXVII.

This is the moſt ſolid and ſimple of all the orders. It is compoſed of few parts, devoid of ornaments, and ſo maſſy, that it ſeems capable of ſupporting the heavieſt burden. There are no remains of a regular Tuſcan order among the antiques: the doctrine of Vitruvius concerning it is obſcure; and the profiles of Palladio, Scamozzi, Serlio, de l'Orme, and Vignola, are all imperfect.

The height of the Tuſcan column is 14 modules, or ſemi-diameters, each conſiſting of 30 minutes; and that of the whole entablature 3½ modules; which being divided into 10 equal parts, three of them are for the height of the architrave, three for the frize, and the remaining four for the cornice; The capital is one module; the baſe, including the lower cincture of the ſhaft, is likewiſe one module; and the ſhaft, with its upper cincture and aſtragal, 12 modules.

Theſe are the general dimenſions of the order; the particular dimenſions may be learned by inſpection of the plates.

In the remains of antiquity, the quantity of diminution at the top of the Tuſcan column is various; but ſeldom leſs than one-eighth, nor more than one-ſixth, of the inferior diameter of the column. The laſt of theſe is generally preferred; and Chalmers and others make the ſame diminution in all columns, without regard to their order.

Of the DORIC Order.

43 Plate XXXVIII. This order is next in ſtrength to the Tuſcan; and, being of a grave, robuſt, and maſculine aſpect, is by Scamozzi called the *Herculean*. As it is the moſt ancient of all the orders, it retains more of the ſtructure of the primitive huts than any of the reſt; the triglyphs in its frize repreſenting the ends of the joiſts, and the mutules in its cornice repreſenting the rafters.

The height of the Doric column, including its capital and baſe, is 16 modules, and the height of the entablature four; the latter of which being divided into eight parts, two of them are for the architrave, three for the frize, and three for the cornice.

In moſt of the antiques, the Doric column is executed without a baſe. Vitruvius likewiſe makes it without one; the baſe, according to him, having been firſt employed in the Ionic order, in imitation of the ſandal of a woman's foot. Scamozzi blames this practice, and moſt of the modern architects are of his opinion.

44 Ornaments of the frize. In the profile of the theatre of Marcellus, the frize is enriched with huſks and roſes; the architrave conſiſts only of one faſcia and a fillet; the drops are conical; the metope is enriched with a bull's ſkull, adorned with a garland of beads, in imitation of thoſe on the temple of Jupiter Tonans, at the foot of the Capitol. In ſome antique fragments, and in a great many modern buildings, the metopes are alternately adorned with ox-ſkulls and pateras. But they may be filled with any other ornaments, according to the deſtination of the building.

The IONIC Order

45 Plate XXXIX. Is of a more ſlender make than the Doric or Tuſcan; its appearance is ſimple, yet graceful and majeſtic; its ornaments are few; ſo that it has been compared to a ſedate matron, in decent, rather than magnificent, attire.

Among the ancients, the form of the Ionic profile appears to have been more poſitively determined than that of any other order; for, in all the antiques at Rome (the temple of Concord excepted), it is exactly the ſame.

The modern artiſts have likewiſe been unanimous in their opinions; all of them, excepting Palladio and his imitators, having employed the dentil, cornice, and the other parts of the profile, nearly as they are found in the Colliſeum, the temple of Fortune, and the theatre of Marcellus.

The height of the Ionic column is 18 modules, and that of the entablature $4\frac{1}{2}$, or one quarter of the height of the column, as in the other orders, which is a trifle leſs than in any of the antique Ionics. In all the antiques, the baſe is Attic; and the ſhaft of the column may either be plain, or fluted with 24 flutings, or 20 only, as in the temple of Fortune. The plan of the flutings may be a trifle more than a ſemicircle, as in the forum of Nerva, becauſe they then appear more diſtinct. The fillets, or intervals between them, muſt not be broader than one-third of the breadth of the fluting, nor narrower than one-fourth. The ornaments of the capital muſt correſpond with the flutings of the ſhaft; and there muſt be an ove above the middle of each fluting. The volutes ought to be traced according to Mr Goldman's method, which is as follows:

46 Method of drawing volutes. Plate XL. fig. 9. Draw the cathetus F C, whoſe length muſt be 15 minutes, or one-fourth of a module; and, from the point C, deſcribe the eye of the volute A E B D, of which the diameter is to be $6\frac{2}{3}$ minutes; divide it into four equal ſectors by the diameters A B, D E. Biſect the radii C A, C B, in 1 and 4; and on the line 1, 4, conſtruct a ſquare 1, 2, 3, 4. From the centre C, to the angles 2, 3, draw the diagonals C 2, C 3, and divide the ſide of the ſquare 1, 4, into 6 equal parts, at 5, 9, C, 12, 8. Then through the points 5, 9, 12, 8, draw the lines 5, 6, 9, 10, 12, 11, 8, 7, parallel to the diameter E D, which will cut the diagonals in 6, 7, 10, 11; and the points 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, will be the centres of the volute. From the firſt centre 1, with the diſtance 1 F, deſcribe the quadrant F G; from the ſecond centre 2, with the diſtance 2 G, deſcribe the quadrant G H; and, continuing the ſame operation from all the 12 centres, the contour of the volute will be completed.

Fig. 10. The centres for deſcribing the fillet are found in this manner. Conſtruct a triangle, of which the ſide A F is equal to the part of the cathetus contained between A F and the ſide F V, equal to C 1; place the diſtance F S from F towards A, equal to F S the breadth of the fillet, and through the point S draw the line S T, which will be to C 1 in the ſame proportion as A S is to A F; place this line on the diameter of the eye A B; divide it into three equal parts; and, through the points of diviſion, draw lines parallel to the diameter E D, which will cut the diagonals C 2, C 3, and you will have twelve new centres, from whence the interior contour of the fillet may be deſcribed, in the ſame manner as the exterior one was from the firſt centres.

Of the CORINTHIAN Order.

47 Plate XLI. The proportions of this order are extremely delicate. It is divided into a great variety of members, and enriched with a profuſion of ornaments. Scamozzi calls it the *virginal order*; and indeed it has all the delicacy in its make, and all the delicacy in its dreſs, peculiar to young girls.

The moſt perfect model of the Corinthian order is generally allowed to be in the three columns in the Campo Vaccino at Rome, the remains, as it is thought, of the temple of Jupiter Stator.

The Corinthian column ſhould be 20 modules high, and the entablature 5; which proportions are a medium between thoſe of the Pantheon and the three columns. The baſe of the column may be either Attic or Corinthian: They are both beautiful. If the entablature be enriched, the ſhaft may be fluted. The fluting may be filled, to one-third of their height, with cabblings, as in the inſide of the Pantheon; which will ſtrengthen the lower part of the column, and make it leſs liable to injury.

In moſt of the antiques at Rome, the capital of this order is enriched with olive-trees; the acanthus being ſeldom employed but in the Compoſite. De Cordemoy, however, prefers the acanthus.

The diviſions of the entablature bear the ſame proportions to each other, as the Tuſcan, Ionic, and Compoſite orders.

The Composite

48 Pl. XLII. Is, ſtrictly ſpeaking, only a ſpecies of the Corinthian; and therefore retains, in a great meaſure, the ſame character.

49 Different kinds of ornaments. It does not appear, that the ancients affected any particular form of entablature to this order. Sometimes the cornice is entirely plain, as in the temple of Bacchus; at others, as in the arch of Septimius Severus, it is enriched with dentils differing very little from the Ionic; and in the arch of Titus, there are both dentils and modilions; the whole form of the profile being the ſame with the Corinthian, as executed in the antiques at Rome.

The modern architects have varied more in this than in any other order, each following the bent of his own fancy.

The height of the Compoſite column, and parts of the entablature, is the ſame with that of the Corinthian. The foot of the leaves of the capital ought not to project beyond the upper part of the ſhaft. The different bunches of leaves ſhould be ſtrongly marked; the ſprigs which ariſe between the upper ones ſhould be kept flat upon the vaſe; and the ornaments of the volutes muſt not project beyond the fillets that incloſe them.

50 Chap. II. *Of Pilaſters.*

These differ from columns only in their plan; which is a ſquare, as that of columns is round. Their baſes, capitals, and entablatures, have the ſame parts, with the ſame heights and projections, as thoſe of columns: they are alſo diſtinguiſhed in the ſame manner, by the names of Tuſcan, Doric, Ionic, Corinthian, and Compoſite.

The column is undoubtedly more perfect than the the pilaſtre. However, they may be employed with great propriety on many occaſions. Some authors declaim againſt pilaſters, becauſe, according to them, they do not admit of diminution. But this is a miſtake; there are many inſtances, in the remains of antiquity, of their being diminiſhed. Scamozzi always gave his pilaſters the ſame diminution as his columns: Palladio and Inigo Jones have likewiſe diminiſhed them in many of their buildings.

51 Pilaſters where uſeful. Pilaſters are employed in churches, galleries, halls, and other interior decorations, to ſave room; for, as they ſeldom project beyond the ſolid wall above one quarter of their diameter, they do not occupy near ſo much ſpace as columns. They are likewiſe uſed in exterior decorations; ſometimes alone, inſtead of columns on account of their being leſs expenſive; and ſometimes they accompany columns, being placed behind them to ſupport the architraves, where they enter the building, as in the Pantheon at Rome; or, in the ſame line with them, to fortify the angles, as in the portico of Septimius.

When pilaſters are uſed alone, they ſhould project one-quarter of their diameter beyond the walls. When placed behind columns, eſpecially if they be very near them, they need not project above one-eighth of their diameter. But, when placed on a line with columns, their projection muſt be regulated by that of the columns; and, conſequently it can never be leſs than a ſemidiameter, even when the columns are engaged as much as poſſible.

52 How ornamented. The ſhafts of pilaſters are frequently adorned with flutings, in the ſame manner as thoſe of columns; the plan of which may be a trifle more than a ſemicircle: their number muſt be ſeven on each face, which make them nearly of the ſame ſize with thoſe of columns. The intervals, or fillets, muſt either be one-third or one-fourth of the fluting in breadth.

Pl. XLIII. The capitals of pilaſters are profiled nearly in the ſame manner as thoſe of columns.

Chap. III. *Of Attics.* 53

These very properly follow the pilaſters; being nothing more than ſquare pillars with their cornices. They had their origin in Athens, where it was for many ages a rule in building to conceal the roof. For this purpoſe, nothing ſerved ſo well as a kind of low or little order ranged in a continued line, ſingly, or with the interruption of balluſters; which riſing above the reſt of the work and before the roof, hid it perfectly, and placed ſomething agreeable in view. The place of Attics, therefore, is at the uppermoſt extremity of a building, to which they ſerve as a crown, or very properly make a finiſhing for the other orders when they have been uſed in the ſtructure. They muſt never ſtand under any thing except ſuch ornaments as are placed at the very top. Theſe Attics ſhould never exceed in height one-third of the height of the order on which they are placed, nor be leſs than one-quarter of it. The baſe, dye, and cornice, of which they are compoſed, may bear the ſame proportions to each other as thoſe of pedeſtals do; and the baſe and cornice may be compoſed of the ſame mouldings as thoſe pedeſtals. Sometimes the Attic is continued throughout; at others, it projects, and forms a pilaſter over each column of the order. The breadth of this pilaſter is ſeldom made narrower than the upper diameter of the column below it, and never broader. Its projection may be equal to one-quarter of its breadth.

Chap. IV. *Of Perſians, Caryatides, and Termini.* 54

Besides columns and pilaſters, it is ſometimes cuſtomary to employ repreſentations of the human figure, to ſupport entablatures in buildings. The male figures are called *Perſians*; and the female, *Carians*, or *Caryatides*.

The

55 Origin of Perſians. The *Perſians* are ſo called from a victory gained over the Perſians by Pauſanias, who having brought home ſpoils and trophies to the Athenians, they fixed upon Perſian figures for thoſe which ſhould ſupport entablatures, and thus kept in mind that there were once Perſian ſlaves in Athens. To repreſent theſe conquered people in the loweſt ſtate poſſible, they loaded them with the heavieſt entablature, *viz.* that of the Doric order. In proceſs of time, however, other figures beſides that of Perſians were introduced, and other entablatures put over them; but the name was ſtill retained.

56 Of Caryatides. The proper Caryatides are women dreſſed in long robes, after the Aſiatic manner; and the origin of the device was as follows.—The Carians had been long at war with the Athenians; but being at length totally vanquiſhed, their wives were led away captives; and, to perpetuate the memory of this event, trophies were erected, in which figures of women dreſſed in the Caryatic manner, were uſed to ſupport entablatures like the Perſians; and though other female figures were afterwards uſed in the ſame manner, the name of *Caryatides* was always retained.

The ancients made frequent uſe of Perſians and Caryatides, and delighted in diverſifying them a thouſand ways. The modern artiſts have followed their example; and there is a great variety of compoſitions of this kind to be met with in different parts of Europe.

Indecent attitudes, diſtorted features, and all monſtrous productions, ought to be avoided, of which there are many examples in Gothic buildings. On the contrary, the attitudes ſhould be ſimple and graceful, the countenance always pleaſing, though varied and ſtrongly marked agreeable to the nature of the object repreſented.

57 Their proportions, &c. The Caryatides, or female figures, ſhould never much exceed the human ſize. But the Perſians, or male figures, may be of any ſize; and the larger the better, as they will ſtrike the beholder with the greater awe and aſtoniſhment. Perſians may be uſed with propriety in arſenals, galleries of armour, &c. under the figures of captives, heroic virtues, &c. Their entablature ought to be Doric, and bear the ſame proportion to them as to columns of the ſame height. The entablature for Caryatides ought to be either Ionic or Corinthian, according as the character of the figures is more or leſs delicate.

58 Termini. Termini are ſometimes employed, inſtead of Perſians or Caryatides, to ſupport the entablatures of monuments, chimney-pieces, and ſuch like compoſitions. Theſe figures owe their origin to the ſtones uſed by the ancients to mark the limits of particular poſſeſſions. Numa Pompilius, to render theſe inviolable, conſecrated the terminus into a deity, and inſtituted feſtivals and ſacrifices to his honour. In a ſhort time, what was formerly only large upright ſtones, were repreſented in human ſhape; and afterwards introduced as ornaments to temples and other buildings. The termini are now principally uſed as ornaments for gardens and fields.

59 CHAP. V. *Of Pedeſtals.*

MOST writers conſider the *Pedeſtal* as a neceſſary part of the order, without which it is not complete. It is indeed a matter of little importance whether it be conſidered in that light, or as a diſtinct compoſition; we ſhall therefore treat of a pedeſtal as a diſtinct body, having no more connection with the order than an attic, a baſement, or any other part with which it may on ſome occaſions be aſſociated.

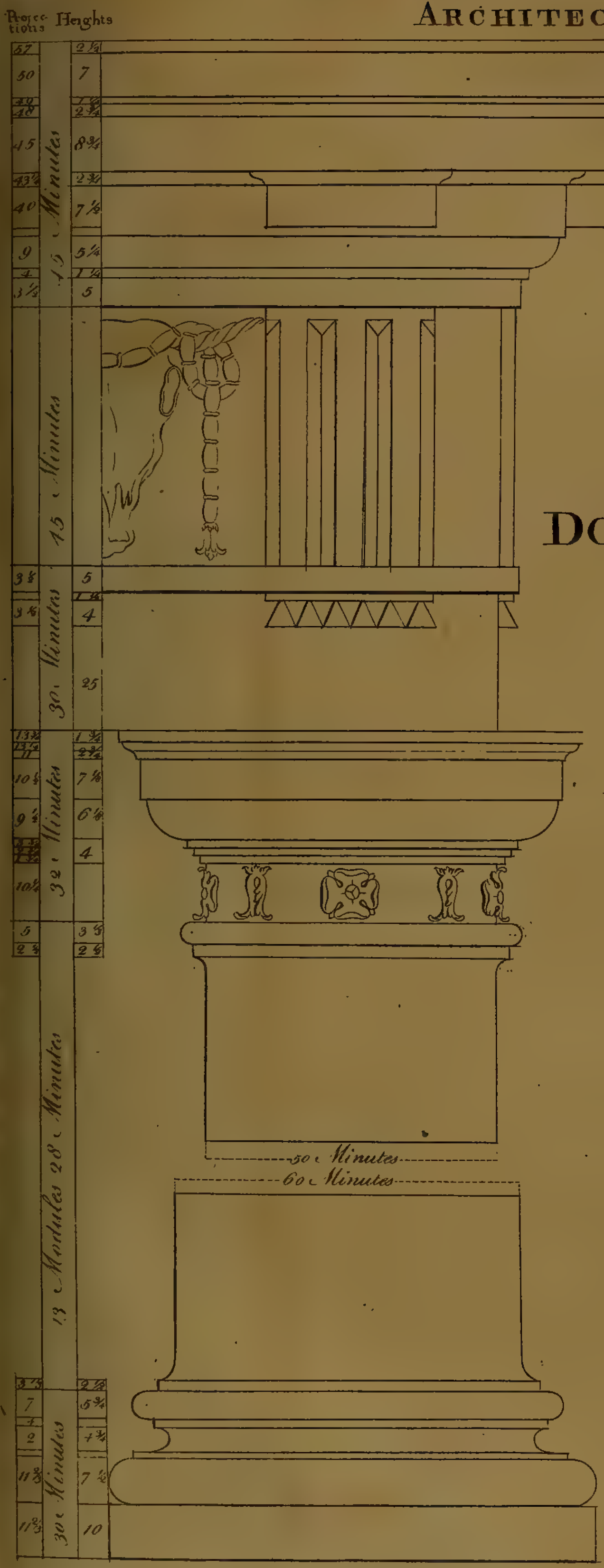
A pedeſtal conſiſts of three principal parts; the baſe, the dye, and the cornice. The dye is always nearly of the ſame figure; being conſtantly either a cube or a parallelopipedon: but the baſe and cornice are varied and adorned with more or fewer mouldings, according to the ſimplicity or richneſs of the compoſition in which the pedeſtal is employed. Hence pedeſtals are, like columns, diſtinguiſhed by the names of *Tuſcan*, *Doric*, *Ionic*, *Corinthian*, and *Compoſite*.

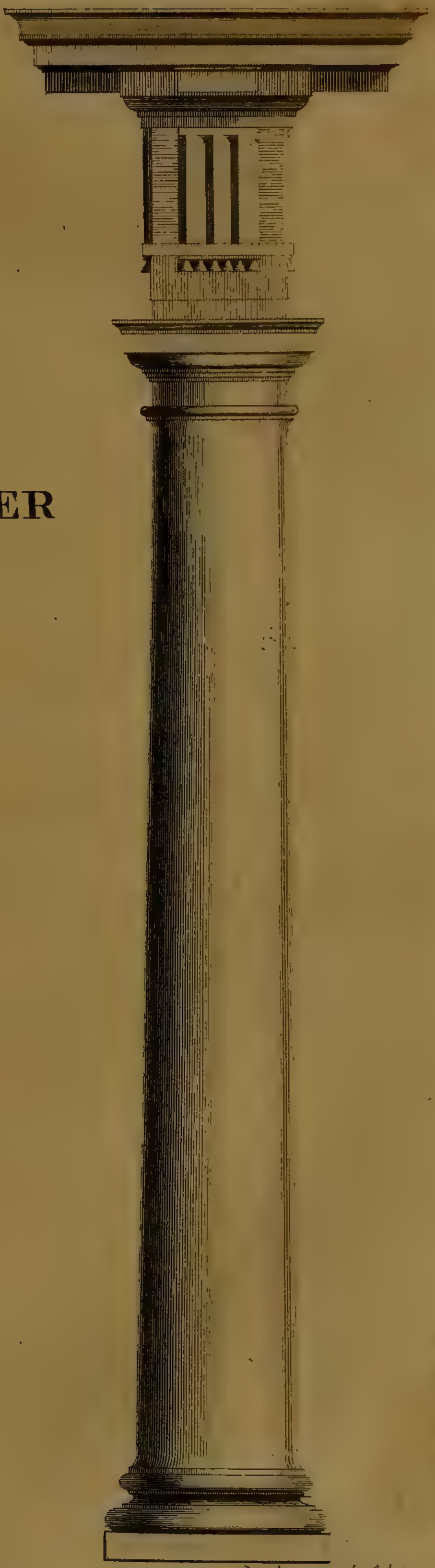
60 Pedeſtals where proper. Some authors are averſe to pedeſtals, and compare a column raiſed on a pedeſtal to a man mounted on ſtilts; imagining that they were introduced merely from neceſſity, and for want of columns of a ſufficient length. It is indeed true, that the ancients often made uſe of artifices to lengthen their columns; as appears by ſome that are in the Baptiſtery of Conſtantine at Rome; the ſhafts of which, being too ſhort for the building, were lengthened and joined to their baſes by an undulated ſweep, adorned with acanthus leaves. Nevertheleſs, there are many occaſions where pedeſtals are evidently neceſſary; and ſome in which the order, were it not ſo raiſed, would loſe much of its beautiful appearance. Thus, in the inſide of churches, if the columns that ſupport the vault were immediately placed on the ground, the ſeats would hide their baſes and a good part of their ſhafts; and in the theatres of the ancients, if the columns of the ſcene had been placed immediately on the ſtage, the actors would have hid a part of them from the audience. In anterior decorations, a pedeſtal diminiſhes the parts of the order, which otherwiſe might perhaps appear too clumſy, and hath the advantage of placing the column in a more favourable view, by raiſing its baſe near the level of the ſpectator's eye. In a ſecond order of arcades, there is no avoiding pedeſtals; as without them it is impoſſible to give the arches any tolerable proportion.

61 Their proportions. With regard to the proportion that pedeſtals ought to bear to that of the columns they ſupport, it is by no means fixed. Both the ancients and moderns vary greatly on this head. Vignola's proportions are generally reckoned the beſt. He makes his pedeſtals in all the orders of the ſame height, *viz.* one-third of the column; and as their breadth of courſe increaſes or diminiſhes in the ſame degree as the diameters of their reſpective columns do, the character of the order is always preſerved, which, according to any other method, is impoſſible.

As to the diviſions of the pedeſtals; if the whole height be divided into nine parts, one of them may be given to the height of the cornice, two to the baſe, and the ſix remaining to the dye. The breadth of the dye is always made equal to that of the plinth of the column. The projection of the cornice may be made equal to its height; and the baſe being divided into three parts, two of them will be for the height of the plinth, and one for the mouldings, whoſe projection muſt be leſs than that of the cornice. Theſe

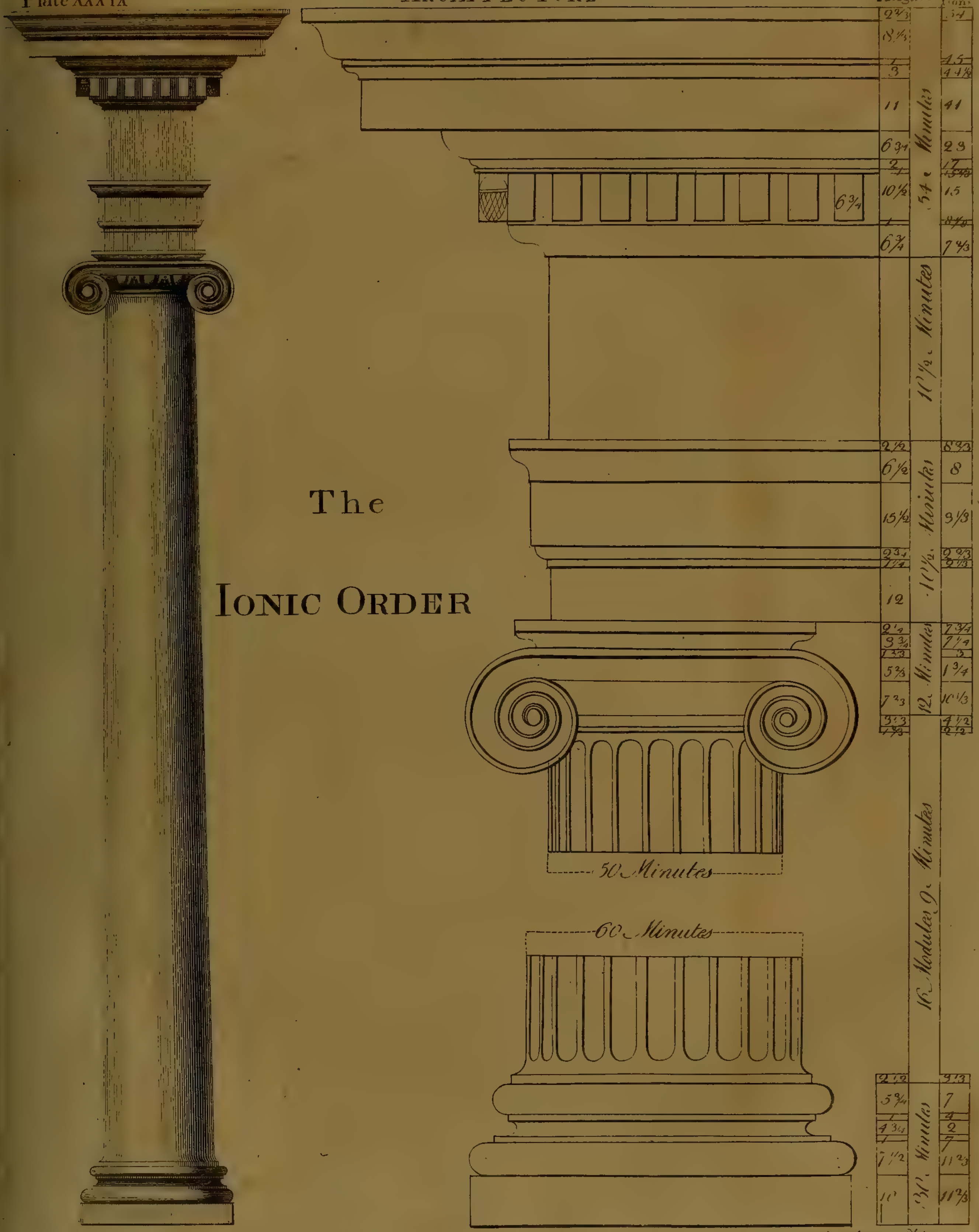
The
DORIC ORDER





R. Scot Sculp. Philada.

The IONIC ORDER



[illegible] Sculp. Philada

ARCHITECTURE

Plate XL.

Fig. 1 Fillet List

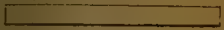


Fig. 2 Astragal

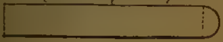


Fig. 3 Torus

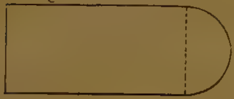


Fig. 4 Scotia Mouth

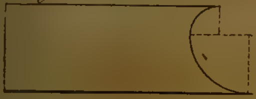


Fig. 5 Ovolo

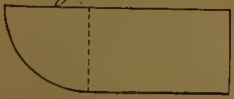


Fig. 7 Cyma Recta

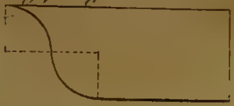


Fig. 6 Ogee

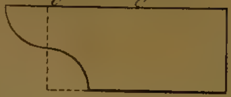


Fig. 8 Cavetto

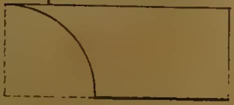


Fig. 9

VOLUTE

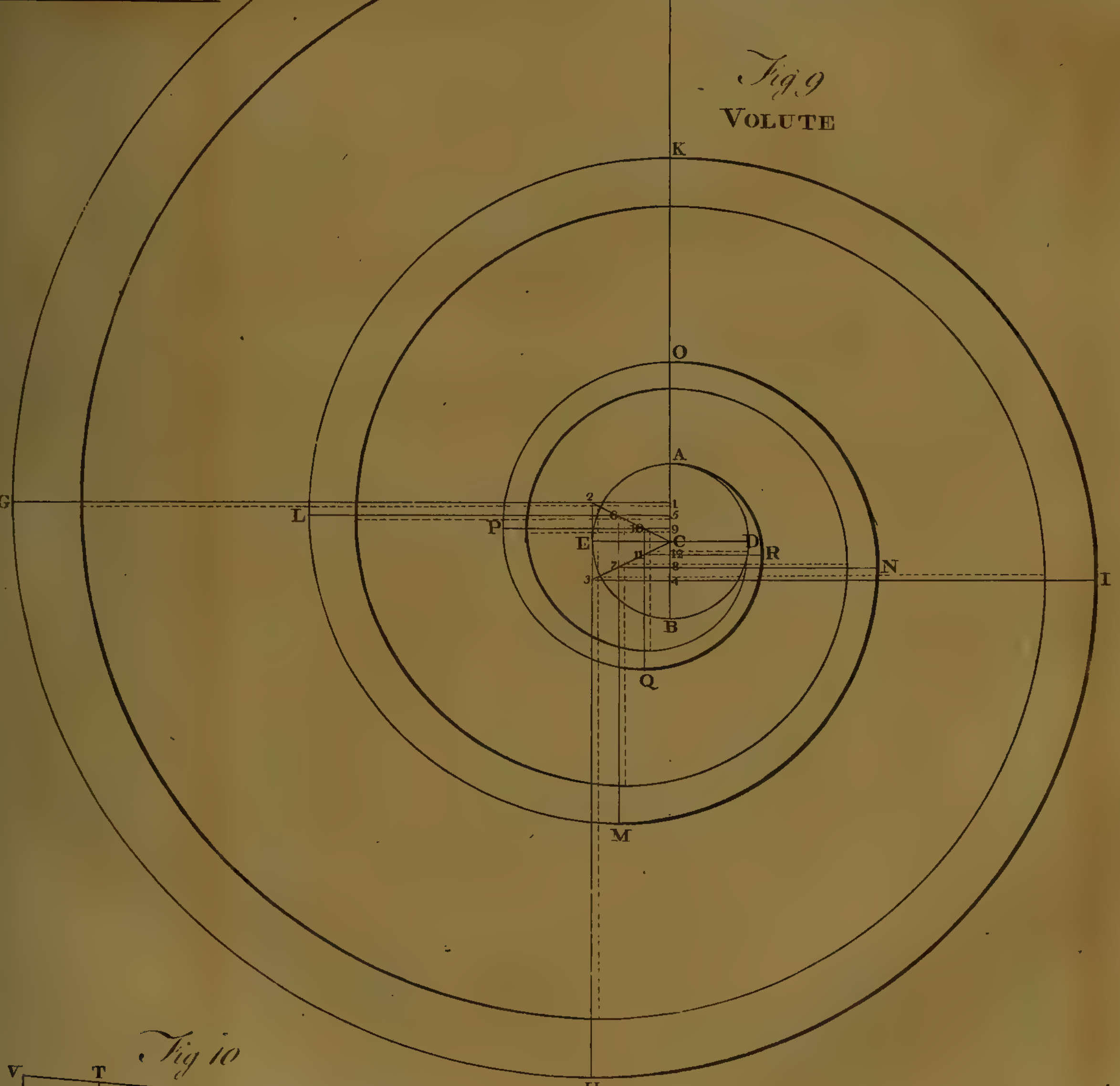
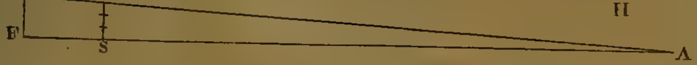
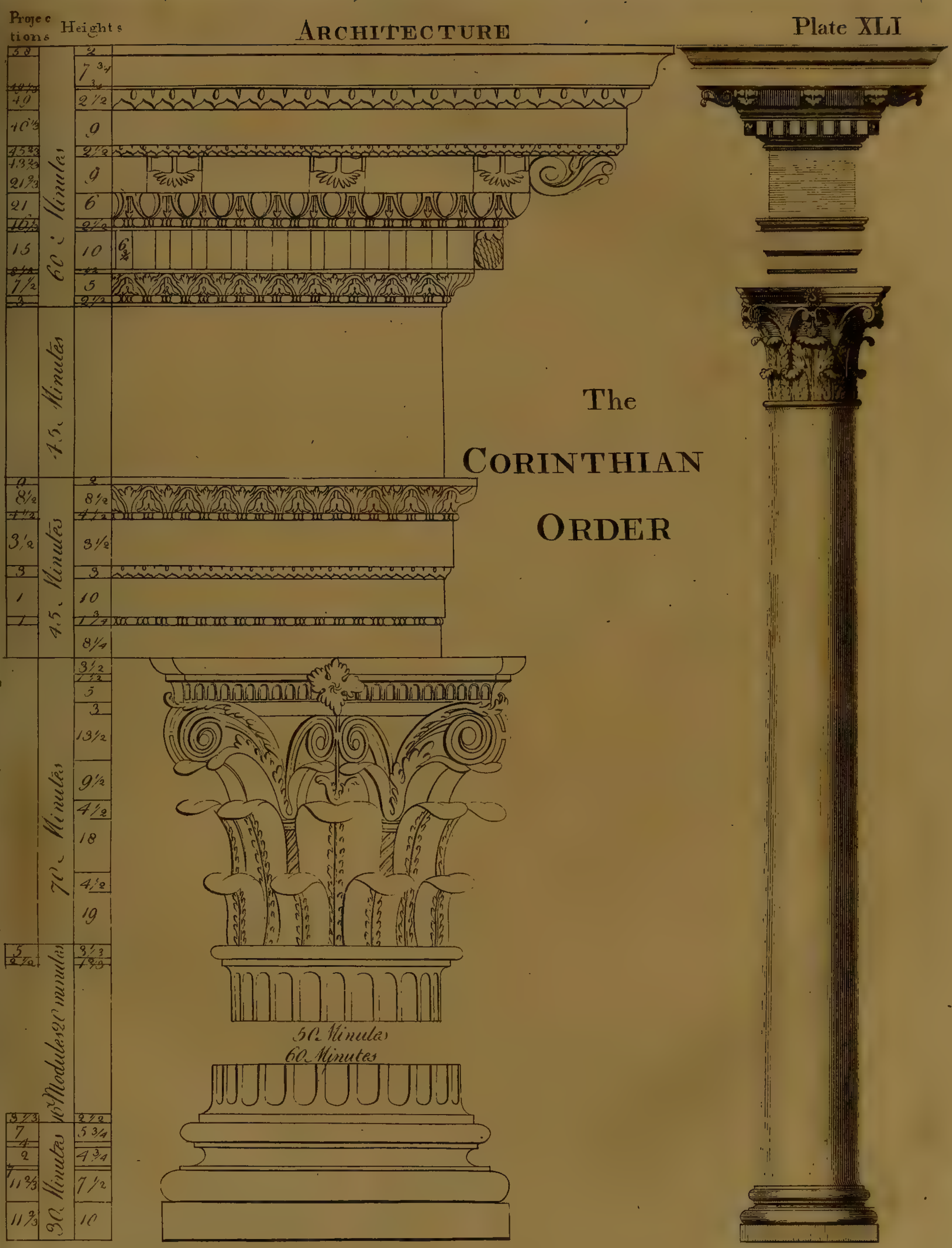


Fig. 10



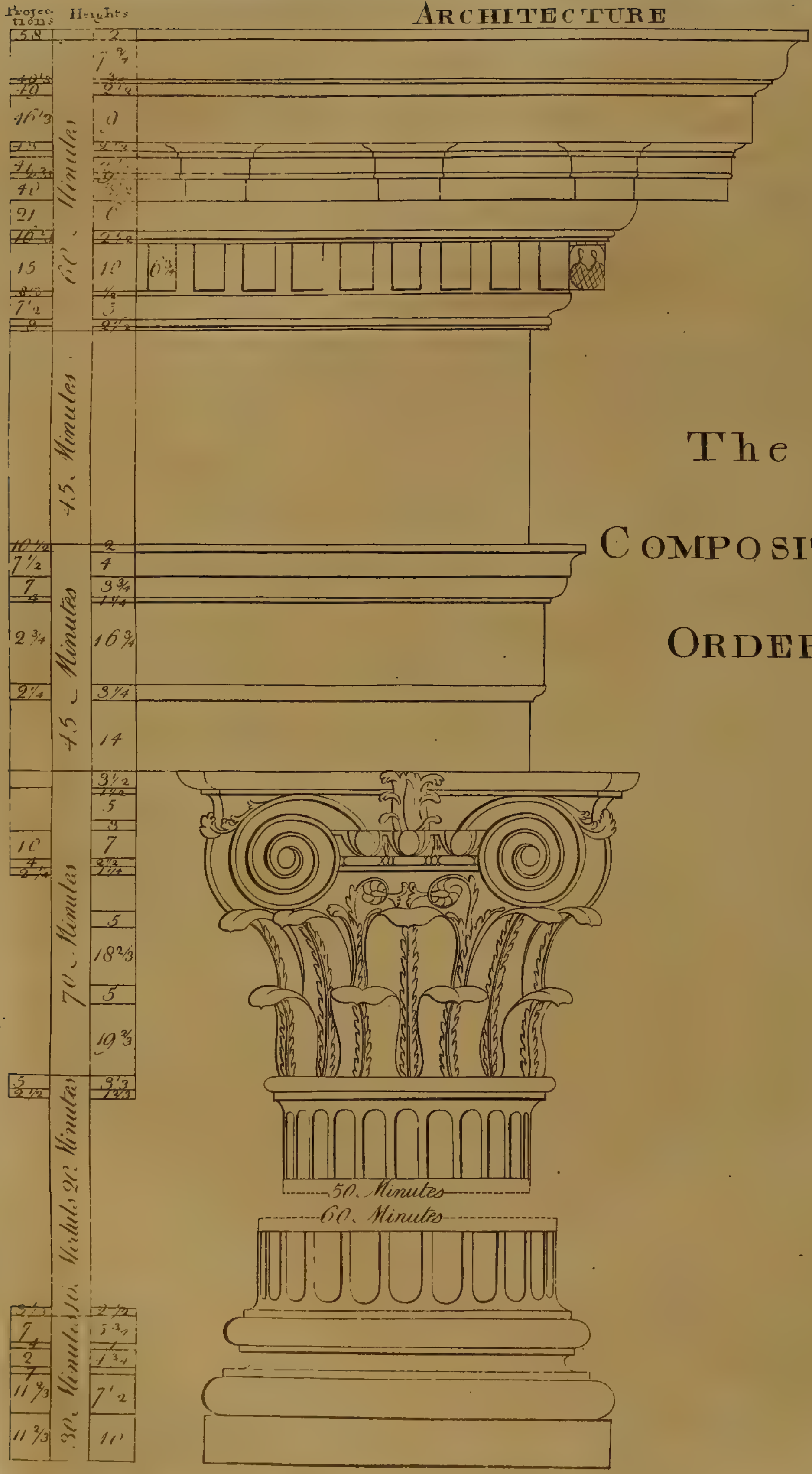
Lee Sculp.

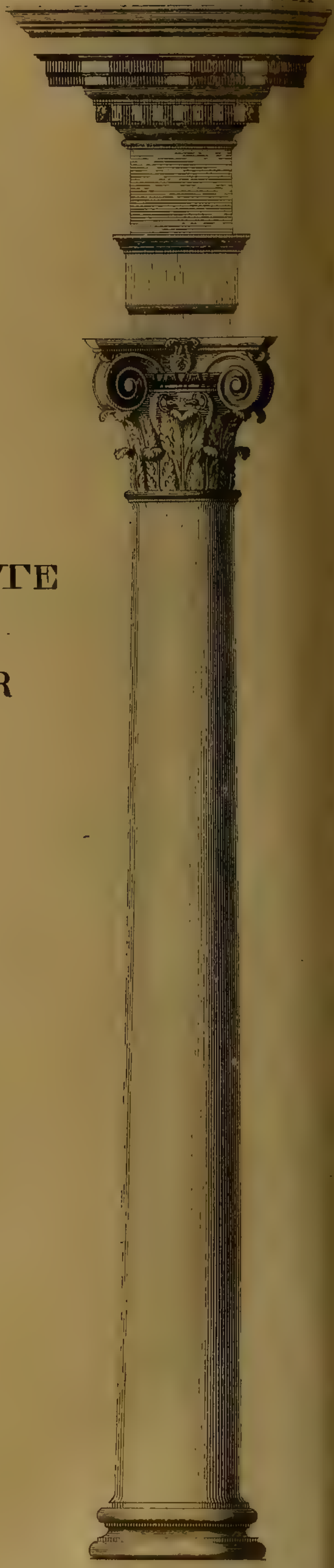


The
CORINTHIAN
ORDER

R. Scot Sculp. Philad.

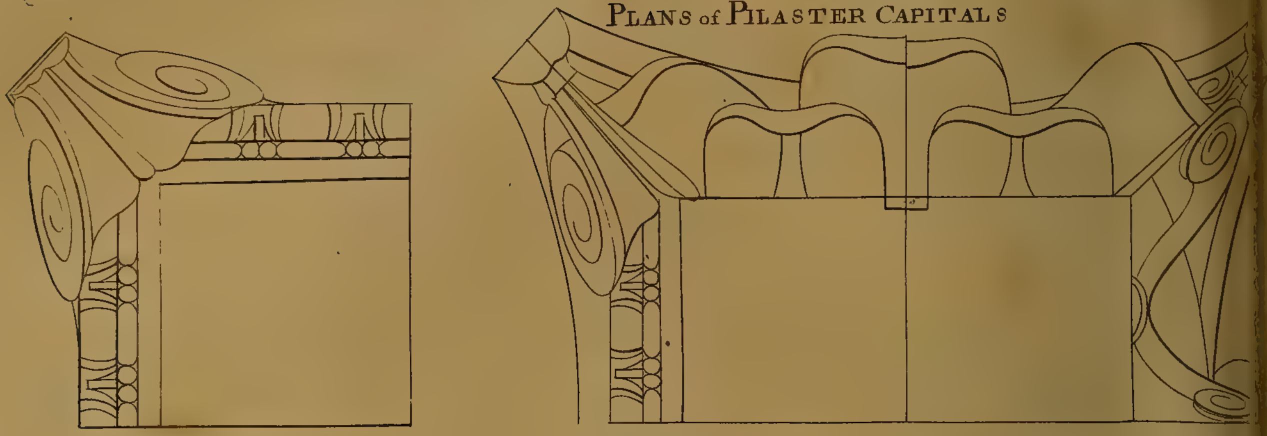
The COMPOSITE ORDER



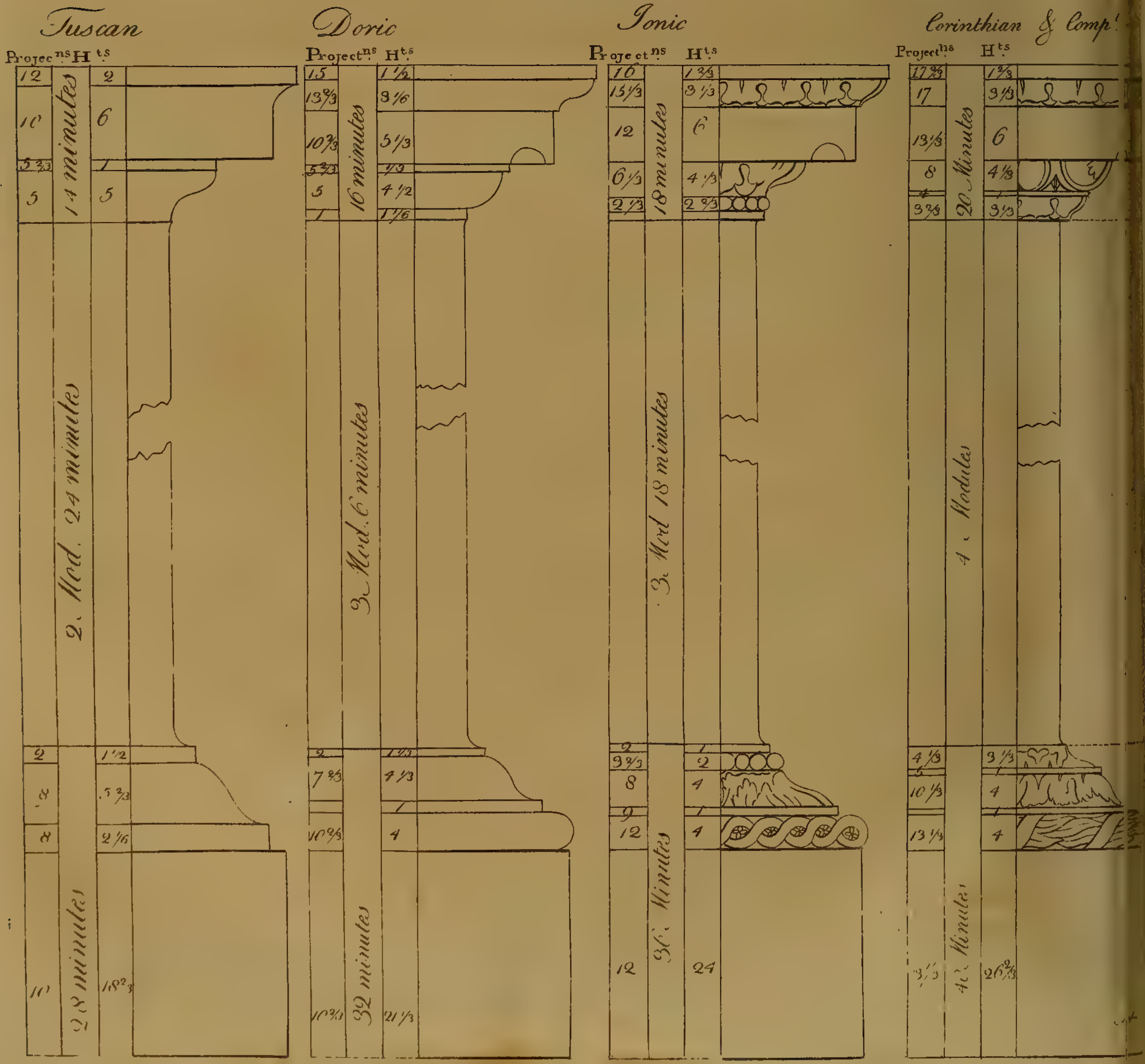


R. Scot Sculp. Philada

PLANS of PILASTER CAPITALS



PEDESTALS



meaſures are common to all pedeſtals. See Plate XLIII.

62 CHAP. VI. *Of Intercolumniations.*

COLUMNS are either engaged, or inſulated; and, when inſulated, are either very near the wall, or at a conſiderable diſtance from it. Engaged columns, or ſuch as are near the walls of a building, are not limited in their intercolumniations, as theſe depend on the breadths of the arches, windows, niches, or other decorations placed between the columns. But columns that are entirely detached, and perform alone the office of ſupporting the entablature, as in periſtyles, porches and galleries, muſt be near each other for the ſake both of real and apparent ſolidity.

63 Different intercolumniations uſed by the ancients. The intercolumniations among the ancients were various. Thoſe uſed in the Ionic and Corinthian orders were the pycnoſtyle, of which the interval was equal to one diameter and a half of the column; the ſyſtyle, whoſe interval was equal to two diameters; the euſtyle, to two and a quarter; the diaſtyle to three, and the aræoſtyle to four. In the Doric order, they uſed other intercolumniations, regulating them by the triglyphs, one of which was always placed directly over the middle of each column; ſo that they were either ſyſtyle, monotryglyph, of one diameter and a half; diaſtyle, of two diameters and three quarters; or aræoſtyle, of four diameters; and the Tuſcan intervals were very wide, ſome of them being above ſeven diameters, which was very practicable, as the architraves were of wood.

Among theſe different intercolumniations, the pycnoſtyle and ſyſtyle are too narrow; for although the ancients made frequent uſe of them, that ought rather to be aſcribed to neceſſity than choice. For, as the architraves were compoſed of ſingle ſtones, extending from the middle of one column to the middle of another, it would have been difficult, eſpecially in large buildings, to find blocks of a ſufficient length for diaſtyle intervals. With regard to the aræoſtyle and Tuſcan intercolumniations, they are by much too wide, and can only be uſed in ruſtic buildings, where the architraves are of wood: neither is the diaſtyle ſufficiently ſolid in large compoſitions. The euſtyle is a medium between the narrow and broad intervals; and being at the ſame time both ſpacious and ſolid, hath been preferred to any of the reſt by the ancients as well as the moderns.

64 Uſed by Vignola. Vignola obſerved nearly the ſame proportion in all his intercolumniations; which practice, though condemned by ſeveral writers, is certainly preferable to any other; as it preſerves the character of each order, and maintains in all of them an equal degree of real ſolidity. Setting aſide therefore the pycnoſtyle and ſyſtyle diſpoſitions on account of their want of ſpace, and the aræoſtyle for its deficiency in point of ſtrength, it may be eſtabliſhed, that the diaſtyle and euſtyle intercolumniations (the latter of which, on moſt occaſions, ought to have the preference) may be employed in all the orders without diſtinction, excepting the Doric; in which the moſt perfect interval is ditriglyph; neither the monotriglyph, nor the aræoſtyle, being to be ſuffered but in caſes of neceſſity.

Sometimes, on account of the windows, doors, niches, and other decorations, which correſpond with the intercolumniations of the periſtyle, or gallery, it is not poſſible to make the intervals ſo narrow as euſtyle, or even as diaſtyle: wherefore the moderns, authoriſed by ſome few examples of the ancients, where grouped columns are employed, have invented a manner of diſpoſing them, called by Perrault *aræoſtyle*, which admits of a larger interval, without any detriment to the apparent ſolidity of the building. This kind of diſpoſition is compoſed of two ſyſtyle intercolumniations; the column that ſeparates them being approached towards one of thoſe at the extremities, ſufficient room only being left between them for the projection of the capitals; ſo that the great ſpace is three diameters and a half wide, and the little one half a diameter.

In periſtyles, galleries, or porticoes, all the intercolumniations muſt be equal; but in a logio, or porch, the middle interval may be broader than the others, by a triglyph or modilion, or three or four dentils; unleſs the columns at the angles be coupled, or grouped with pilaſters; in which caſe, all the intervals ſhould be of the ſame dimenſions.

When buildings are very ſmall, as is frequently the caſe in temples and other inventions uſed for ornamenting gardens, the intercolumniations may be broader, in proportion to the diameter of the columns, than uſual; becauſe, when they are nearer each other than three feet, there is hardly room for a bulky perſon to paſs between them.

CHAP. VII. *Of Arches.*

65 Arches where proper. ARCHES are not ſo magnificent as colonnades; but they are more ſolid and leſs expenſive. They are proper for triumphal entrances, gates of cities, of palaces, of gardens, and of parks, and in general for all openings that require an extraordinary breadth.

66 How adorned. There are various manners of adorning arches. Sometimes their piers are ruſticated; ſometimes they are adorned with pilaſters, termini, or caryatides; and ſometimes they are made ſufficiently broad to admit nitches or windows. The circular part of the arch is either ſurrounded with ruſtic key-ſtones, or with an archivolt enriched with mouldings; which, in the middle, is ſometimes interrupted by a conſole, a maſk, ſerving at the ſame time as a key to the arch, and as a ſupport to the architrave of the order. The archivolt is ſometimes ſupported by an impoſt, at the head of the pier; and at others by columns placed on each ſide of it, with a regular entablature, or architrave and cornice. There are likewiſe inſtances of arcades without piers, the arches being turned on ſingle columns, as in the temple of Faunus at Rome, &c. This practice, however, ought to be ſeldom imitated, as it is neither ſolid nor handſome.

When arches are large, the key-ſtone ſhould never be omitted, but cut in the form of a conſole, and carried cloſe under the ſoffit of the architrave, which, on account of its extraordinary length, requires a ſupport in the middle. The impoſts of arches ſhould never be omitted; at leaſt, if they be, a platform ought to ſupply their place. If columns are employed without pedeſtals in arcades, they ſhould always be raiſed on a plinth. In all arches, the circular part ought not to ſpring immediately from the impoſt, but

take

Principles. take its riſe at ſuch a diſtance above it as is neceſſary in order to have the whole curve ſeen at the proper point of view.

67 Proportions. The void or aperture of arches ſhould never be higher nor much lower, than double their breadth; the breadth of the pier ſhould ſeldom exceed two-thirds, nor be leſs than one-third, of the breadth of the arch; and the angular pier ought to be broader than the other, by one-half, one-third, or one-fourth; the impoſt ſhould not be more than one-ſeventh, nor leſs than one-ninth of the aperture; and the archivolt muſt not be more than one-eighth, nor leſs than one-tenth of it. The breadth of the conſole muſt, at the bottom, be equal to that of the archivolt; and its ſides muſt be drawn from the centre of the arch: the length of it muſt not be leſs than one and a half of its ſmalleſt breadth, nor more than double. The thickneſs of the pier depends on the breadth of the portico; for it muſt be ſtrong enough to reſiſt the preſſure of its vault. But with regard to the beauty of the building, it ſhould not be leſs than one-quarter of the breadth of the arch, nor more than one-third. Theſe are the general dimenſions of arches.

68 CHAP. VIII. *Of Orders above Orders.*

WHEN, in a building, two or more orders are employed, one above another, the laws of ſolidity require the ſtrongeſt ſhould be placed lowermoſt.—Hence the Tuſcan muſt ſupport the Doric, the Doric the Ionic, the Ionic the Compoſite or Corinthian, and the Compoſite the Corinthian.

This rule, however, is not always ſtrictly adhered to. Moſt authors place the Compoſite above the Corinthian. There are likewiſe examples where the ſame order is repeated, as in the theatre of Statilus Taurus, and the Coliſeum; and others, where an intermediate order is omitted, and the Ionic placed on the Tuſcan, or the Corinthian on the Doric. But none of theſe practices ought to be imitated.

In placing columns above one another, the axis of all the columns ought to correſpond, or be in the ſame perpendicular line, at leaſt in front.

69 Proportions of columns placed above each other. With regard to the proportions of columns placed above each other, Scamozzi's rule, That the lower diameter of the ſuperior column ſhould conſtantly be equal to the upper diameter of the inferior one, is univerſally eſteemed the beſt, and gives all the columns the appearance of one long tapering tree, cut into ſeveral pieces. According to this rule, the Doric column will be to the Tuſcan as $13\frac{1}{3}$ to 14; the Ionic to the Doric, as 15 to 16; the Compoſite or Corinthian to the Ionic, as $16\frac{2}{3}$ to 18; and the Corinthian to the Compoſite, as $16\frac{2}{3}$ to 20.

In Britain there are few examples of more than two ſtories of columns in the ſame aſpect; and though in Italy, and other parts of Europe, we frequently meet with three, and ſometimes more; yet it is a practice by no means to be imitated; for there is no poſſibility of avoiding many ſtriking inconſiſtencies, or of preſerving the character of each order in its intercolumnial decorations.

70 CHAP. IX. *Of Baſements.*

INSTEAD of employing ſeveral orders one above the other in a compoſition, the ground-floor is ſometimes made in the form of a *baſement*, on which the order that decorates the principal ſtory is placed. The proportion of theſe baſements is not fixed, but depends on the nature of the rooms on the ground-floor. In the palace of the Porti in Vicenza, the height of the baſement is equal to that of the order. In ſome buildings, its height exceeds two-thirds of that of the order; and, in others, only half the height of the order. It is not, however, adviſable to make the baſement higher than the order it ſupports; neither ſhould it be lower than one half of the order.

71 Decorations, &c. of baſements. The uſual method of decorating baſements is with ruſtics of different kinds. The beſt, where neatneſs and finiſhing is aimed at, are ſuch as have a ſmooth ſurface. Their height, including the joint, ſhould never be leſs, nor much more, than half a module of the order placed on the baſement. Their figure may be from a ſquare to a ſeſquialtera; and their joints may be either ſquared or chamfered. The ſquare ones ſhould not be broader than one-eighth of the height of the ruſtic, nor narrower than one-tenth; and their depth muſt be equal to their breadth; thoſe that are chamfered muſt form a rectangle; and the breadth of the whole joint may be from one-fourth to one-third of the height of the flat ſurface of the ruſtic.

CHAP. X. *Of Pediments.* 72

PEDIMENTS, among the Romans, were uſed only as coverings to their ſacred buildings, till Cæſar obtained leave to cover his houſe with a pointed roof, after the manner of temples. In the remains of antiquity we meet with two kinds of pediments, the triangular and the circular. The former of theſe are promiſcuouſly applied to cover ſmall or large bodies: But the latter, being of a heavier figure, are never uſed but as coverings to doors, niches, windows, or gates.

As a pediment repreſents the roof, it ſhould never be employed but as a finiſhing to the whole compoſition.

The ancients introduced but few pediments into their buildings, uſually contenting themſelves with a ſingle one to adorn the middle or principal part. But ſome of the moderns, and particularly the Italians, have been ſo immoderately fond of them, that their buildings frequently conſiſt of almoſt nothing elſe.

The girder being a neceſſary part in the conſtruction of a roof, it is an impropriety to intermit the horizontal entablature of a pediment, by which it is repreſented to make room for a niche, an arch, or a window.

73 Forms, &c. of pediments. In regular architecture, no other form of pediments can be admitted, beſides the triangular and circular. Both of them are beautiful; and when a conſiderable number of pediments are introduced, as when a range of windows are adorned with them, theſe two figures may be uſed alternately, as in the niches of the Pantheon, and in thoſe of the temple of Diana at Niſmes.

The proportion of pediments depend upon their ſize; for the ſame proportions will not do in all caſes.

When the baſe of the pediment is ſhort, its height muſt be increaſed; and when the pediment is long, the height muſt be diminiſhed. The beſt proportion for the height is from one-fifth to one-fourth of the baſe, according to the extent of the pediment, and the character of the body it covers. The materials of the roof muſt alſo be attended to; for if it be covered with tiles, it will be neceſſary to raiſe it more than one-quarter of the baſe, as was the cuſtom of the ancients in their Tuſcan temples.

The tympan is always on a line with the front of the frize; and when large, admits of various ornaments.

74

CHAP. XI. *Of Balluſtrades.*

BALLUSTRADES are ſometimes of real uſe in buildings; and at other times they are only ornamental. Such as are intended for uſe, as when they are employed in ſtair-caſes, before windows, or to incloſe terraſſes, &c. muſt always be nearly of the ſame height; never exceeding three feet and a half, nor ever leſs than three. But thoſe that are principally deſigned for ornament, as when they finiſh a building, ſhould be proportioned to the architecture they accompany: and their height ought never to exceed four-fifths of the height of the entablature on which they are placed; nor ſhould it ever be leſs than two-thirds thereof, without counting the zocholo, or plinth, the height of which muſt be ſufficient to leave the whole balluſtrade expoſed to view.

75 Proportion, &c. of balluſters.

The beſt proportion for balluſtrades is to divide the whole given height into thirteen equal parts; eight of theſe for the height of the balluſter, three for the baſe, and two for the cornice or rail; or into fourteen, (if it be required to make the balluſter leſs), giving eight parts to the balluſter, four to the baſe, and two to the rail. One of theſe parts may be called a *module*; and being divided into nine minutes, may ſerve to determine the dimenſions of the particular members.

In balluſtrades, the diſtance between two balluſters ſhould not exceed half the diameter of the balluſter meaſured in its thickeſt part, nor be leſs than one-third of it.

The breadth of the pedeſtals, when they are placed on columns or pilaſters, is regulated by them; the dye never being made broader than the top of the ſhaft, nor much narrower; and when there are neither columns nor pilaſters on the front, the dye ſhould not be much lower than a ſquare, and ſeldom higher. On ſtairs, or on any other inclined planes, the ſame proportions are to be obſerved as on horizontal ones.

CHAP. XII. *Of Gates, Doors, and Piers.*

76 Doors and Gates.

THERE are two kinds of entrances, *viz.* doors and gates. The former ſerve only for the paſſage of perſons on foot; but the latter likewiſe admit horſemen and carriages. Doors are uſed as entrances to churches and other public buildings, to common dwelling-houſes, and apartments: And gates ſerve for inlets to cities, fortreſſes, parks, gardens, palaces, &c. The apertures of gates being always wide, they are generally made in the form of an arch, that figure being the ſtrongeſt. But doors, which are generally of ſmall dimenſions, are commonly parrallelograms, and cloſed horizontally.

The general proportion for the apertures, both of gates and doors, whether arched or ſquare, is, that the height be about double the breadth.

77 Piers.

The moſt common, and indeed almoſt the only ornaments for gates are the piers by which they are ſupported, and which were originally no more than bare poſts into which the hinges of the gate were driven. Though this, however, is the only proper uſe of piers, it muſt be concealed as much as poſſible, and they muſt ſeem as if placed there only for ornament. As they are to be fixed to the wall before the houſe, ſo they muſt alſo be proportioned to it; and as they are to be ſeen in the ſame view with the front of the houſe, their correſpondence with it is equally neceſſary. They are to be placed on a plinth, and ſomething muſt be allowed by way of ornament and finiſhing at the top. All the luxuriance of fancy may be employed in the decoration of piers: but it will be proper to obſerve this general rule, that the pier being an inferior building, it muſt never be richer than the front of the houſe. If, for inſtance, the front of the houſe is ornamented with columns of the Doric order, the Ionic muſt not be uſed in the piers; and it will be found better to omit columns altogether, than to make uſe of the Tuſcan order for piers in any caſe. If the Ionic or Corinthian orders are employed in the front of the houſe, the Doric or Ionic may be uſed with propriety in the piers. One piece of ornament is almoſt univerſal in piers, namely, a niche with its ſeat, made as if for the conveniency of weary travellers. On this account, it will be proper to raiſe the columns on pedeſtals, becauſe the continued moulding from their cap will be a good ornament under the niche. The baſe of the columns ought always to be the Attic.

Inſide-doors, however ſmall the building may be, ſhould never be narrower than two feet nine inches; nor ſhould they ever, in private houſes, exceed three feet ſix inches in breadth, which is more than ſufficient to admit the bulkieſt perſon. Their height ſhould at leaſt be ſix feet three or four inches; otherwiſe a tall perſon cannot paſs without ſtooping. In churches, palaces, &c. where there is a conſtant ingreſs and egreſs of people, the apertures muſt be larger. The ſmalleſt breadth that can be given to a gate is 8½ or 9 feet, which is but juſt ſufficient for the paſſage of a coach.

Plate XLIV. fig. 1. Is a ruſtic door, compoſed by the celebrated Vignola, in which the aperture occupies two-thirds of the whole height, and one-half of the whole breadth; the figure of it being a double ſquare. The ruſtics may be either ſmooth or hatched; their joints muſt form a rectangle, and the breadth of each joint may be one-third, or two-ſevenths, of the vertical ſurface of a ruſtic. The joints of the claveaux, or key-ſtones, muſt be drawn to the ſummit of an equilateral triangle, whoſe baſe is the top of the aperture. The architrave ſurrounding the aperture may be compoſed either of a large ogee and fillet, or of a platband and fillet. Its whole breadth muſt be one-tenth of the breadth of the aperture; the remaining part of each pier being for the ruſtics. The entablature is Tuſcan: the cornice is to be one-fifteenth of the whole height of the door; and what remains below it being divided into 21 equal parts, the two uppermoſt of them will be for the frize and architrave, and the remaining 19 for the ruſtics and plinth at the foot of the door.

Fig. 2. Is a diſpoſition of Michael Angelo's. The windows of the Capitol at Rome are of this kind; and Sir Chriſtopher Wren hath executed doors of the ſame kind under the ſemicircular porches in the flanks of St Paul's. The figure of the aperture may be a double ſquare; the architrave one-ſixth of the breadth of the aperture; and the whole entablature one-quarter of its height. The front of the pilaſters or columns on each ſide, muſt be on a line with the faſcia of the architrave; and their breadth muſt be a ſemidiameter.

Fig. 3. Is likewiſe a deſign of Vignola's. It is of the Corinthian order, and executed in the Cancellaria at Rome. The height is equal to double its breadth; and the whole ornament at the top is equal to one-third of the height of the aperture. The architrave is in breadth one-fifth of the breadth of the aperture; and the pilaſters that ſupport the conſoles are half as broad as the architrave. The whole is well imagined, but rather heavy; and it will be beſt to reduce the architrave to one-ſixth of the aperture, diminiſhing the entablature proportionally.

Fig. 4. Is a deſign of Serlio's. The aperture may be either twice as high as broad, or a trifle leſs. The diameter of the columns may be equal to one-quarter of the breadth of the aperture; and their height may be from eight diameters to eight and a half. The entablature muſt be ſomewhat leſs than one-quarter of the height of the columns; and the height of the pediment may be one-quarter of its baſe.

Fig. 5. Is a door in the ſalon of the Farneſe at Rome, deſigned by Vignola. The aperture forms a double ſquare. The entablature is equal to three-elevenths of its height, the architrave being one of theſe elevenths; and the whole ornaments on the ſides, conſiſting of the architrave and pilaſters, is equal to two-ſevenths of the breadth of the aperture: the cornice is Compoſite, enriched with mutules and dentils; and the frize is adorned with a feſtoon of laurel.

Fig. 6. Is copied from a door at Florence, ſaid to be a deſign of Cigoli's. The height of the aperture is a trifle more than twice its breadth. It is arched; and the impoſt is equal to half a diameter. The columns are Ionic, ſomewhat above nine diameters high; and their ſhafts are garniſhed each with five ruſtic cinctures. The entablature is leſs than one-quarter of the column; and the breadth of the tablet, in which there is an inſcription, is equal to the breadth of the aperture.

Plate XLV. fig. 1. Is a pier invented by Mr Chambers. Its diameter may be one-quarter of its height, excluſive of the plinth and vaſe; and the height of both theſe may be equal to one diameter of the pier, or a trifle leſs. The ruſtics may either be plain, hatched, or vermiculated: the height of each courſe may be one-eleventh part of the height of the pier, counting to the top of the entablature; the entablature two-elevenths; and the baſe of the pier one-eleventh part.

Fig. 2. Is likewiſe a compoſition of Mr Chambers, imitated from M. Angelo Buonaroti's deſign for Cardinal Sermonetti. The height of the aperture is ſomewhat more than twice its breadth; which breadth occupies one-third of the breadth of the whole compoſition. The order is Compoſite; and the height of the entablature is equal to one-quarter of the height of the column. He has made a break in it over each column: but, unleſs the column project conſiderably, it will be as well to carry the entablature on in a ſtraight line. The dimenſions of the particular parts may be meaſured on the deſign.

Fig. 3. Is alſo a compoſition of Mr Chambers, executed at Goodwood, the ſeat of his grace the duke of Richmond, in Suſſex. The diameter is one-quarter of the height, excluſive of the finiſhing, which is equal to one diameter: and the height of the pier, from the top of the entablature downwards, being divided into eleven and a half parts, one of theſe parts is given to the baſe, one to each ruſtic, and one and a half to the aſtragal, frize, and cornice.

Fig. 4. Is a compoſition of the late earl of Burlington's, that great architect and patron of the fine arts, which is executed at Chiſwick, and at Bedford-houſe in Bloomſbury-ſquare with ſome little difference.

Fig. 5. Is an invention of Mr Chambers.

Fig. 6. Is one of Inigo Jones's; of which kind he hath executed a couple at Aimſbury in Wiltſhire, the ſeat of his grace the duke of Queenſberry.

CHAP. XIII. *Of Windows.*

78 Proportions of windows.

THE firſt conſiderations with regard to windows is their ſize, which varies according to the climate, the deſtination of the building, &c. In Britain, the windows of the ſmalleſt private houſes are commonly from 3 to $3\frac{1}{4}$ feet broad; and being generally twice their breadth in height, or ſomewhat more, in the principal apartments, they generally riſe to within a foot or two of the ceilings of the rooms, which are frequently no higher than 10 feet, and at moſt 12 or 13. But, in more conſiderable houſes, the apartments are from 15 to 20 feet high, and ſometimes more; and in theſe the windows are from 4 to 5 and $5\frac{1}{4}$ feet broad, and high in proportion. Theſe dimenſions are ſufficient for dwelling-houſes of any ſize in that country; when they are larger, they admit too much of the cold air in winter. But churches, and other buildings of that kind, may have larger windows, proportioned to the ſize of the ſtructures.

The proportions of the apertures of windows depend upon their ſituation. Their breadth in all the ſtories muſt be the ſame; but the different heights of the apartments make it neceſſary to vary the height of the windows likewiſe. In the principal floor, it may be from $2\frac{1}{8}$ of the breadth to $2\frac{1}{3}$, according as the rooms have more or leſs elevation. In the ground-ſtory, where the apartments are lower, the apertures of the windows ſeldom exceed a double ſquare; and, when they are in a ruſtic baſement, they are frequently made much lower. The height of the windows of the ſecond floor may be from $1\frac{1}{4}$ of their breadth to $1\frac{4}{7}$; and Attics and Mezzanines may be either a perfect ſquare, or ſomewhat lower.

79 How ornamented.

The windows of the principal floor are generally moſt enriched. The ſimpleſt method of adorning them is, with an architrave ſurrounding the aperture, and

ARCHITECTURE

Plate XLIV

Fig 1

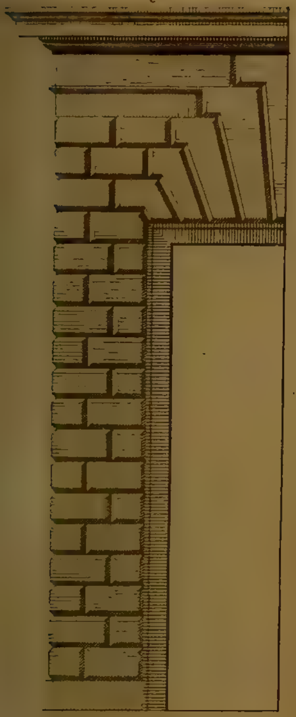


Fig 2

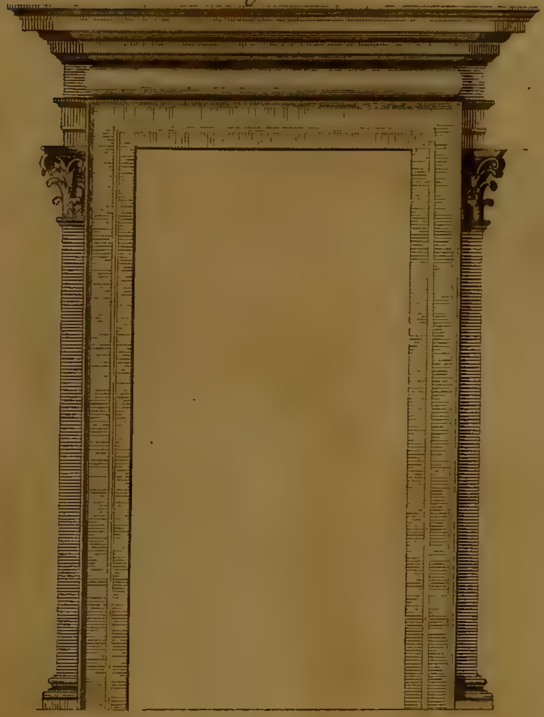


Fig 3

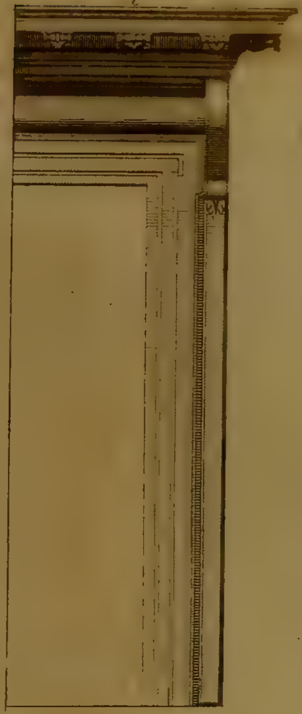


Fig 4

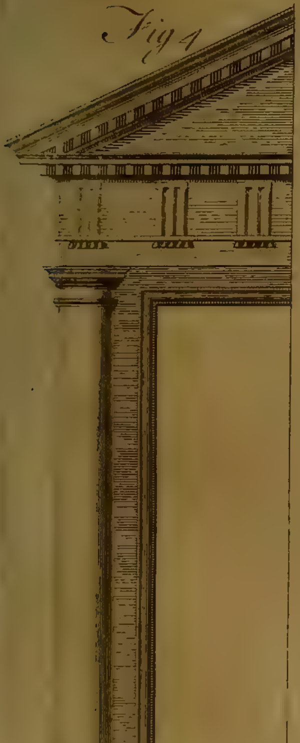


Fig 5

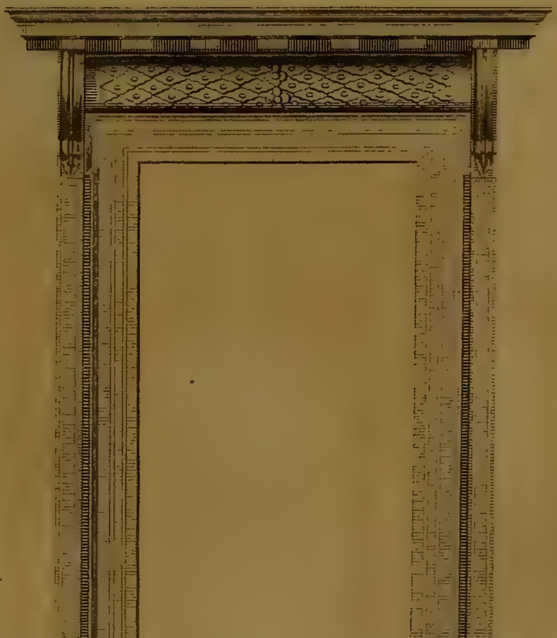
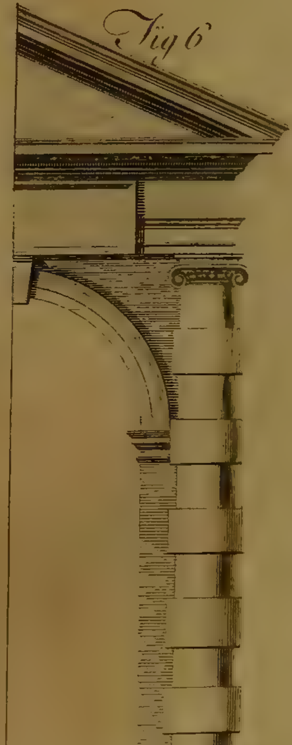
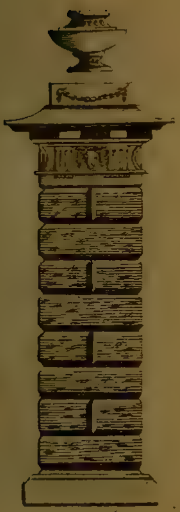


Fig 6



R. Scot Sculp. Phil^{a}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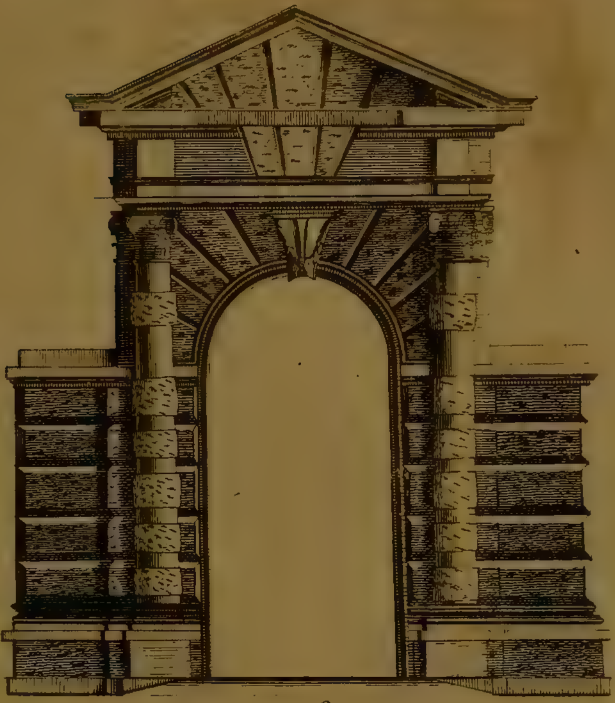
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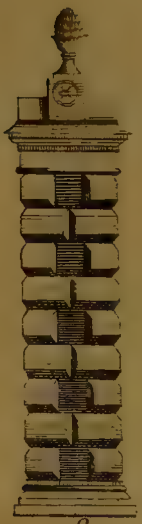
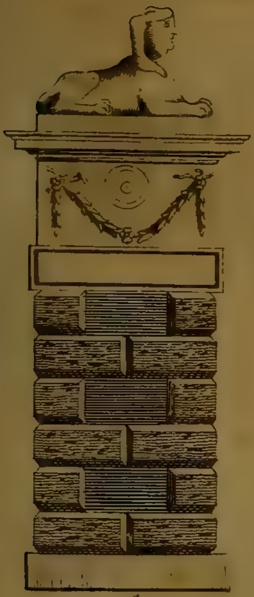

3

Deſigns for Gates & Piers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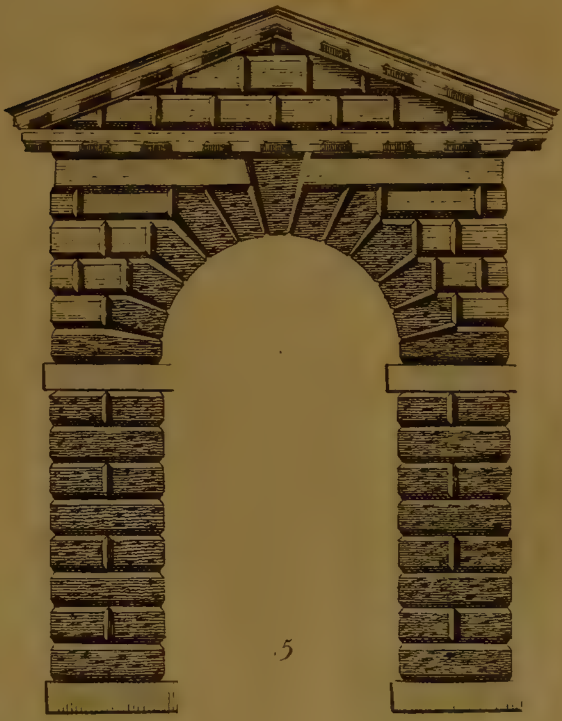
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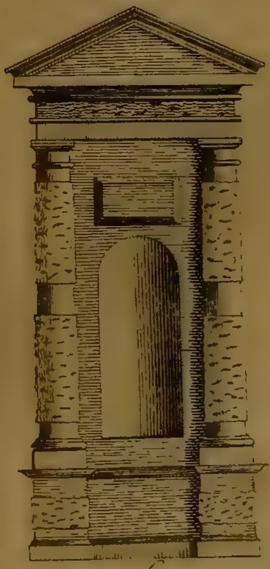

6

Scot Philada

Fig 1

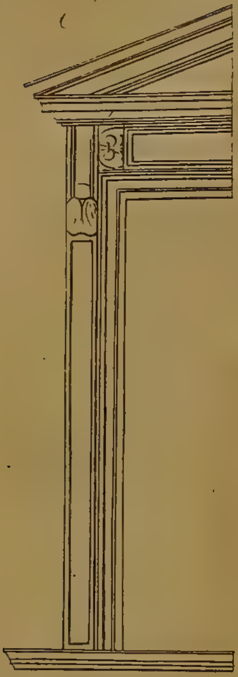


Fig. 2

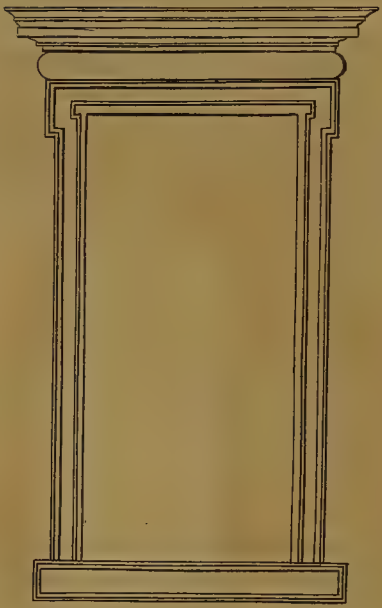


Fig 3

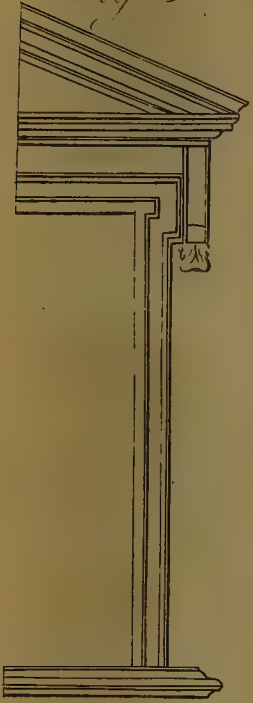


Fig. 4

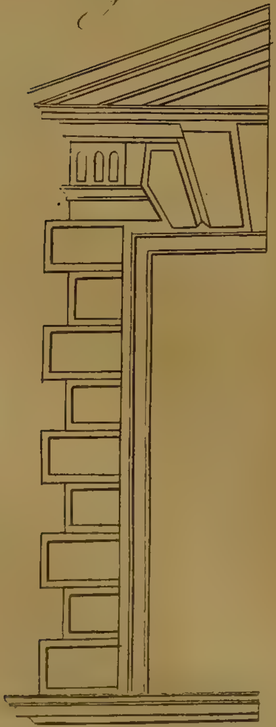


Fig. 5

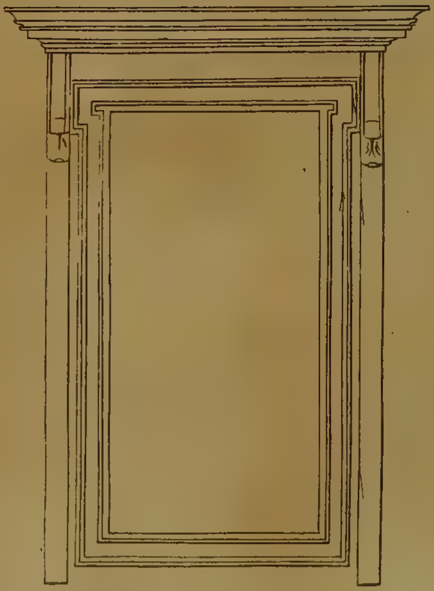
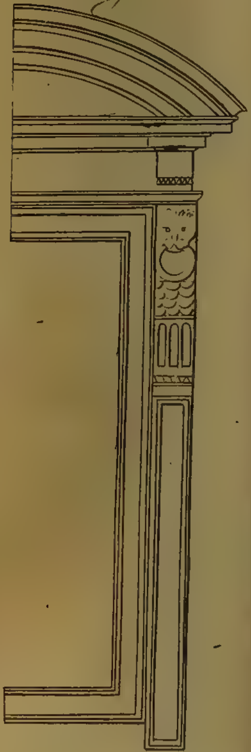


Fig. 6



Scot. Philad^a

and crowned with a frize and cornice. The windows of the ground-floor are ſometimes left entirely plain, without any ornament; and at others they are ſurrounded with ruſtics, or a regular architrave with a frize and cornice. Thoſe of the ſecond floor have generally an architrave carried entirely round the aperture; and the ſame is the method of adorning Attic and Mezzanine windows: but the two laſt have ſeldom either frize or cornice; whereas the ſecond-floor windows are often crowned with both.

The breaſts of all the windows on the ſame floor ſhould be on the ſame level, and raiſed above the floor from two feet nine inches to three feet ſix inches at the very moſt. When the walls are thick, the breaſts ſhould be reduced under the apertures, for the conveniency of looking out. In France, the windows are frequently carried quite down to the floor. When the building is ſurrounded with gardens, or other beautiful objects, this method renders the rooms exceeding pleaſant.

The interval between the apertures of windows depends in a great meaſure on their enrichments. The breadth of the aperture is the leaſt diſtance that can be between them; and twice that breadth ſhould be the largeſt in dwelling-houſes; otherwiſe the rooms will not be ſufficiently lighted. The windows in all the ſtories of the ſame aſpect muſt be placed exactly above one another.

Plate XLVI. fig. 1. Is a deſign of P. Leſcot, abbot of Clagny, executed in the old Louvre at Paris. The apertures may be a double ſquare, or a trifle more; the architrave from one-ſixth to one-ſeventh of the breadth of the aperture; the pilaſter is equal to that beadth, when the architrave is narrow; or leſs, by one-quarter, or one-fifth, when it is broad. The whole entablature ſhould not exceed one-quarter of the height of the aperture, nor be much lower. The conſoles may be equal in length to half the breadth of the aperture at moſt, and to one-third of it at leaſt.

Fig. 2. Is a deſign of Palladio's, executed at the Chiericato in Vicenza: its proportions are not much different from the following. The plat-band that ſupports the window is equal to the breadth of the architrave.

Fig. 3. Is likewiſe a deſign of Palladio's, executed by him in many of his buildings. The aperture is a double ſquare. The breadth of the architrave is one-ſixth of the breadth of the aperture; and the frize and cornice together are double the height of the architrave. The breadth of the conſoles is two-thirds of the breadth of the architrave.

Fig. 4. Is a deſign of Ludovico da Cigoli; and executed in the ground-floor of the Ranunchini palace at Florence.

Fig. 5. Is a deſign of Inigo Jones, executed at the Banqueting-houſe. The aperture may be a double ſquare; the architrave may be one-ſixth of its breadth; the whole entablature one-quarter of its height; and the breadth of the conſoles two thirds of the breadth of the architrave.

Fig. 6. Is a deſign of M. Angelo Buonorati, executed at the Farneſe.

80

CHAP. XIV. *Of Niches and Statues.*

It hath been cuſtomary, in all ages, to enrich different parts of buildings with repreſentations of the human body. Thus the ancients adorned their temples, baths, theatres, &c. with ſtatues of their deities, heroes, and legiſlators. The moderns ſtill preſerve the ſame cuſtom, placing in their churches, palaces, &c. ſtatues of illuſtrious perſons, and even groups compoſed of various figures, repreſenting occurrences collected from hiſtory, fables, &c. Sometimes theſe ſtatues or groups are detached, raiſed on pedeſtals, and placed contiguous to the walls of a building, or in the middle of a room, court, or public ſquare. But they are moſt frequently placed in cavities made in the walls, called *niches*. Of theſe there are two ſorts; the one formed like an arch in its elevation, and ſemicircular or ſemi-elliptical in its plan; the other is a parallelogram both in its plan and elevation.

81 Different kinds of niches.

The proportion of both theſe niches depends on the characters of the ſtatues, or the general form of the groups placed in them. The loweſt are at leaſt a double ſquare in height; and the higheſt never exceed $2\frac{1}{5}$ of their breadth.

82 How decorated.

With regard to the manner of decorating them, when they are alone in a compoſition, they are generally incloſed in a pannel, formed and proportioned like the aperture of a window, and adorned in the ſame manner. In this caſe, the niche is carried quite down to the bottom; but on the ſides and at the top, a ſmall ſpace is left between the niche and the architrave of the pannel. And when niches are intermixed with windows, they may be adorned in the ſame manner with the windows, provided the ornaments be of the ſame figure and dimenſions with thoſe of the windows.

83 Statues.

The ſize of the ſtatues depends on the dimenſions of the niches. They ſhould neither be ſo large as to have the appearance of being rammed into the niches, as in Santa Maria Majora at Rome; nor ſo narrow as to ſeem loſt in them, as in the Pantheon. The diſtance between the outline of the ſtatue and ſide of the niche ſhould never be leſs than one-third of a head nor more than one half, whether the niche be ſquare or arched; and when it is ſquare, the diſtance from the top of the head to the cieling of the niche ſhould not be greater than the diſtance on the ſides. Statutes are generally raiſed on a plinth, the height of which may be from one-third to one-half of a head; and ſometimes, where the niches are large, the ſtatues may be raiſed on ſmall pedeſtals.

The character of the ſtatue ſhould always correſpond with the character of the architecture with which it is ſurrounded. Thus, if the order be Doric, Hercules, Jupiter, Mars, Æſculapius, and all male ſtatues, repreſenting beings of a robuſt and grave nature, may be introduced; if Ionic, then Apollo, Bacchus, &c.; and if Corinthian, Venus, Flora, and others of a delicate nature, ſhould be employed.

CHAP. XV. *Of Chimney-pieces.*

AMONG the ancients, there are very few examples of chimney-pieces to be met with. Neither the Italians nor French have excelled in compoſitions of this kind. Britain, by being poſſeſſed of many able ſculptors at different times, has ſurpaſſed all other nations, both in taſte of deſign, and workmanſhip.

85 Proportions and ſituations.

The ſize of the chimney muſt be regulated by the dimenſions of the room where it is placed. In the ſmalleſt apartments, the breadth of the aperture ſhould never be leſs than three feet, or three feet ſix inches. In rooms from 20 to 24 feet ſquare, or of equal ſuperficial dimenſions, it may be from four to $4\frac{1}{2}$ feet broad; in thoſe of 24 to 27, from $4\frac{1}{2}$ to 5; and, in ſuch as exceed theſe dimenſions, the aperture may even be extended to $5\frac{1}{2}$ or 6 feet.

The chimney ſhould always be ſituated ſo as to be immediately ſeen by thoſe who enter the room. The middle of the partition wall is the moſt proper place in halls, ſalons, and other rooms of paſſage; but in drawing-rooms, dreſſing-rooms, and the like, the middle of the back-wall is the beſt ſituation. In bed-rooms, the chimney is always in the middle of one of the partition-walls; and in cloſets, and other very ſmall places, to ſave room, it is put in a corner. Wherever two chimneys are uſed in the ſame room, they ſhould be placed either directly facing each other, if in different walls, or at equal diſtances from the centre of the wall in which they both are.

The proportion of the apertures of chimney-pieces of a moderate ſize is generally a perfect ſquare; in ſmall ones, it is a trifle higher; and in large ones, a trifle lower. Their ornaments conſiſt in architraves, frizes, cornices, columns, pilaſters, termini, caryatides, conſoles, and all kinds of ornaments of ſculpture, repreſenting animals and vegetables, &c. likewiſe vaſes, chalices, trophies of arms, &c. In deſigning them, regard muſt be had to the nature of the place where they are to be employed. Such as are intended for halls, ſalons, guard-rooms, galleries, and other large places, muſt be compoſed of large parts, few in number, of diſtinct and ſimple forms, and having a bold relief; but chimney-pieces for drawing-rooms, dreſſing-rooms, &c. may be of a more delicate and complicated nature.

Chimney-pieces are compoſed of wood, ſtone, or marble; the laſt of which ought to be preferred, as figures or profiles are beſt repreſented in a pure white.

Plate XLVII. exhibits different deſigns for chimney-pieces by Palladio and Inigo Jones. Their proportion may be gathered from the deſigns, which are accurately executed.

86

Chap. XVI. *Of the Proportions of Rooms.*

The proportions of rooms depend in a great meaſure on their uſe, and actual dimenſions: but, with regard to beauty, all figures, from a ſquare to a ſeſquilateral, may be employed for the plan.

The height of rooms depends on their figure. Flat cieled ones may be lower than thoſe that are coved. If their plan be a ſquare, their height ſhould not exceed five-ſixths of the ſide, nor be leſs than four-fifths; and f8 when it is oblong, their height may be equal to their breadth. But coved rooms, if ſquare, muſt be as high as broad; and when oblong, they may have their height equal to their breadth, more one-fifth, one-quarter, or even one-third of the difference between the length and breadth: and galleries ſhould at leaſt be in height one and one-third of their breadth, and at moſt one and a half, or one and three-fifths.

87 High rooms improper in Britain.

The coldneſs of the Britiſh climate is a ſtrong objection to high rooms; ſo that it is not uncommon to ſee the moſt magnificent apartments not above 15, 16, or at moſt 18 feet high; though the extent of the rooms would require a much more conſiderable elevation. But where beauty is aimed at, this practice ought not to be imitated.

When rooms are adorned with an entire order, the entablature ſhould never exceed one-ſixth of the whole height in flat-cieled rooms, and one-ſixth of the upright part in coved ones; and when there are neither columns nor pilaſters, but only an entablature, its height ſhould not be above one-ſeventh of theſe heights. If the rooms be finiſhed with a ſimple cornice, it ſhould never exceed one-fourteenth, nor ever be leſs than one-fifteenth part of the above-mentioned height.

Chap. XVII. *Of Cielings.* 88

Cielings are either flat or coved, in different manners. The ſimpleſt of the flat kind are thoſe adorned with large compartments, ſurrounded with one or ſeveral mouldings, either let into the cieling, or projecting beyond its ſurface: and when the mouldings that form the compartments are enriched, and ſome of the compartments adorned with well-executed ornaments, ſuch cielings have a good effect, and are very proper for common dwelling-houſes, and all low apartments. Their ornaments and mouldings do not require a bold relief; but, being near the eye, they muſt be finiſhed with taſte and neatneſs. For higher rooms, a flat cieling which has the appearance of being compoſed of various joiſts framed into each other, and forming compartments of various geometrical figures, ſhould be employed. The ſides of the joiſts forming the compartments are generally adorned with mouldings, and repreſent either a ſimple architrave, or an architrave cornice, according to the ſize of the compartments and the height of the room.

Coved cielings are more expenſive; but they are likewiſe more beautiful. They are uſed promiſcuouſly in large and ſmall rooms, and occupy from one-fifth to one-third of the height of the room. If the room be low in proportion to its breadth, the cove muſt likewiſe be low; and when it is high, the cove muſt be ſo likewiſe: by which means the exceſs of the height will be rendered leſs perceptable. But, where the architect is at liberty to proportion the height of the room to its ſuperficial dimenſions, the moſt eligible proportion for the cove is one-fourth of the whole height. In parallelogram-figured rooms, the middle of the cieling is generally formed into a large flat pannel. This pannel, with the border that ſurrounds it, may occupy from one-half to three-fifths of the breadth of the room. The figure of the cove is commonly either a quadrant of a circle or of an ellipſe, taking its riſe a little above the cornice, and finiſhing at the border round the great pannel in the centre. The border projects ſomewhat beyond the coves on the outſide; and, on the ſide towards the pannel, it is generally made of ſufficient depth to admit the ornaments of an architrave, or architrave and cornice.

In Britain circular rooms are not much in uſe; but they are very beautiful. Their height muſt be the ſame with that of ſquare rooms; their ceilings may be flat; but they are handſomer when coved, or of a concave form.

Arcs doublaux, or ſoffits of arches, when narrow, are ornamented with *guillochs*, or frets; but when broad, they may be adorned in a different manner.

When the profiles of the room are gilt, the ceilings ought likewiſe to be gilt. The uſual method is to gild all the ornaments, and to leave the grounds white, pearl colour, light blue, or of any other tint proper to ſet off the gilding to advantage. Painted ceilings, ſo common in France and Italy, are but little uſed in Britain.

89 CHAP. XVIII. *Of Stairs and Stair-caſes.*

THERE are many kinds of ſtair-caſes; for, in ſome, the ſteps are made ſtrait; in others, winding; in others, mixed of both. Of ſtraight ſtairs, ſome fly directly forward, others are ſquare, others triangular. Others are called *French flights*, or *winding-ſtairs*, (which in general are called *ſpiral*, or *cockle-ſtairs*); of which ſome are ſquare, ſome circular or round, and ſome elliptical or oval; and theſe again are various, ſome winding about a ſolid, others about an open newel. Stairs mixed of ſtraight and winding ſteps are alſo of various kinds; ſome are called *dog-legged*; ſome there are that wind about a ſolid newel, and others that fly about a ſquare open newel.

90 Stair-caſes where to be placed. Great care ought to be taken in placing of the ſtair-caſe in any building; and therefore ſtair-caſes ought to be deſcribed and accounted for juſtly when the plan of a building is made. For want of this, ſometimes unpardonable errors have been committed: ſuch as having a little blind ſtair-caſe to a large houſe, or, on the other hand, a large ſpacious ſtair caſe to a little one.

Palladio ſays, in placing ſtair-caſes, the utmoſt care ought to be taken; it being difficult to find a place convenient for them, that will not at the ſame time prejudice the reſt of the building. But commonly the ſtairs are placed in the angle, wing or middle of the front.

To every ſtair-caſe are required three openings.

Firſt, the door leading thereto.

Secondly, the window, or windows that give light to it;

And, thirdly, the landing.

Firſt, the door leading to the ſtair-caſe ſhould be ſo placed, that moſt of the building may be ſeen before you come at the ſtairs, and in ſuch a manner that it may be eaſy for any perſon to find out.

Secondly, for the windows; if there be but one, it muſt be placed in the middle of the ſtair-caſe, that thereby the whole may be enlightened.

Thirdly, the landing of ſtairs ſhould be large and ſpacious for the convenient entering into rooms: in a word, ſtair-caſes ſhould be ſpacious, light, and eaſy in aſcent. The height of large ſteps muſt never be leſs than ſix inches, nor more than ſeven inches and a half.

The breadth of ſteps ſhould never be leſs than 10 inches, or more than 18 inches; and the length of them not leſs than three feet, nor more than 12.

91 Plate XLVIII. fig. 1. A ſtair-caſe of two flights.—*A* ſhews the manner of drawing the *ramp*, which is to riſe equal to the height of the firſt ſtep of the next flight, and as much as its *kneeling*; as is ſhewn by the *ramp* interſecting the rail of the ſecond flight.

Fig. 2. Shews the ſtraight rail interſecting a circular cap.

Fig. 3. Section of two different hand rails.

Fig. 4. Shews the manner of dove-tailing the riſer into the ſtep.

92 Plate XLIX. fig. 1. repreſents a ſtair-caſe, with flights, and its landing rail.

Fig. 2. Shews the ſolid part of the ſtep out of which the ſcroll is formed: where *a* repreſents the *overſail* of the ſtep; *b*, The thickneſs of the bracket, with its *mitring* to the *riſer*; and, *c*, The *ſtring-board*.

Fig. 4. Shews the ſcale for drawing the ſcroll of fig. 3.—To perform which, take the diſtance from 1 to the centre, in fig. 3. and ſet it up from 1 to the centre in fig. 4.; divide that extent into three parts, then ſet 4 ſuch parts on the upper ſide of the ſcale, and draw the line from 4 to one; ſet one foot of your compaſſes at 4, and ſtrike the circular line; let that be divided into 12 equal parts, and then draw lines from 4 through thoſe diviſions to the upright line.

The ſcale being thus made, draw the ſcroll of fig. 3. by it in the following manner.

Set one foot of your compaſſes in 1, and deſcribe a ſtroke at *c*; take the ſame diſtance, and with one foot in 2, croſs the ſtroke at *c*; then from *c*, turn the part from 1 to 2, and proceed in the ſame manner; for if the diſtance were taken in the ſcale from 1 to the centre, it would ſtrike the circle too flat; and if taken from 2, it would ſtrike the circle too quick.

When this is well underſtood, there will be little difficulty in drawing the ſcroll below figure 2.; which throws itſelf out farther in proportion than that in fig. 3.; for this will always be the caſe when the upper line of the ſcale, which conſiſts of four diviſions in fig. 4. is made but with three diviſions or leſs; whence it appears, that the upper line of the ſcale may be drawn at what length you pleaſe, according as you would bring in or keep out the ſcroll.

93 Plate L. Shews the manner of ſquaring twiſt-rails.

Fig. 2. Exhibits the pitch-board, to ſhew what part of the ſtep the twiſted part of the rail contains; the three dotted lines drawn from the rail to the pitch-board repreſent the width of the rail, which is to be kept level. The dotted lines *a* and *b* ſhew how much half the width of the rail turns up from its firſt beginning to 3.

Fig. 3. Shews the ſame pitch-board with the manner of the rail's turning up. If the ſides of the twiſted part of the rail be ſhaped by the rail-mould, ſo that they direct down to its ground plan, that is, the upper ſide of the rail being firſt ſtruck by the mould, then apply the mould to the under ſide, as much back as the level of the pitch-board ſhews, by being ſtruck on the ſide of the rail, and then fig. 3. being applied to the outſide of the rail, from its firſt twiſting part to 3, will ſhow how much wood is to be taken off.

Fig. 5. Exhibits the ſquare of the rail, with the raking line of the pitch-board drawn through the middle on the upper ſide; then draw the depth of the ſide of the rail parallel to this, and the dotted lines from the diagonal of the rail; theſe lines ſhew what quantity of wood will be wanting on the upper and lower ſides of the rail. Set your compaſſes at *c*, and draw the circular ſtroke from the raking part of the pitch-board to *b*; take the diſtance *a b* and transfer it from *a* to *b*, in fig. 7. The ſeveral diſtances thus found may be ſet at any number of places, ranging with the ſtraight part of the rail; and it then forms the width of the mould for the twiſting part of the rail.

Fig. 7. Shows the ſweep of the rail. The rail cannot be fixed leſs than one-fourth part from the *noſing* or front of the ſtep.

The remaining part of the pitch-board may be divided into any number of parts, as here into four; from theſe diviſions draw lines acroſs the pitch-board to the raking line; then take the diſtances from the ground line of the pitch-board to the plan of the rail and ſet them perpendicular from the raking line of the pitch-board; and theſe diviſions when the rail is in its proper poſition, lie directly over the diviſions on the ground plan.

In this figure, *l*, *m*, and *n*, riſe as much above *o* as the dotted line in fig. 5. does above the width of the rail; and they ſink as much below *o* as the other dotted line in fig. 5. falls below the width of the rail; the ſame thickneſſes muſt be glued upon *o*, though the greateſt part will come off in ſquaring. The reaſon of placing the letters *l*, *m*, and *n*, where they are, is, that they might not obſtruct the ſmall diviſions of the rail-mould.

Fig. 4. Shews how to find the rail when it takes more than one ſtep. The remaining part of the pitch-board is divided into four parts, as before in fig. 7. and it takes in two ſuch parts of the next ſtep. Draw lines from theſe diviſions to the diagonal of the pitch-board as in fig. 7. then take the diſtance *a b*, and ſet it from *c* to *d*, and ſo proceed with the other diviſions.

Another way to find the outſide of the rail-mould is, to draw all the diviſions acroſs the plan of the rail; then take the diſtance from the ground line of the pitch-board to 4, transfer it from the diagonal of the pitch-board to 4 on the rail; and ſo proceeed with the other diſtances. Now, when the rail is put in its proper ſituation *c* will be perpendicular to *b*, and all the diviſions, as 1, 2, 3, 4, *&c.* in the rail, will be perpendicular to 1, 2, 3, 4, *&c.* in the ground plan.

Fig. 6. Shews the plan of a rail of five ſteps.

To find the rail.—Set five diviſions, as from *e* to *h*, which is the height of the five ſteps; draw the diagonal *h* to the plan of the rail; then take the diſtance *e f*, and transfer in to *g h*, and proceed in the ſame manner with the other ſeven diſtances.

To find the width of the rail mould.—Draw the lines acroſs the plan of the rail, as at *k*; ſet that diſtance from the diagonal to *i*; and ſo proceed with the reſt, as was ſhewn in fig. 4.

Having formed the ſides of the rail perpendicular to its ground plan, and having ſquared the lower end of the rail, then take a thin lath, and bend it with the rail, as is repreſented by *m*, fig. 1.

This is the readieſt method of ſquaring a ſolid rail; but if the rail be bent in the thickneſſes, the noſing of the ſteps muſt be drawn upon a cylinder, or ſome other ſolid body of a ſufficient width to contain the width of the rail or ſtring-board.

r repreſents the depth of the rail, touching the noſe of each ſtep. Take a ſufficient number of thickneſſes of this width, to make the thickneſs of your rail; glue them all together upon your cylinder or templet, confine them till they are dry, and the rail taken off is ready ſquared. Proceed in the ſame manner with the architrave, marked *a*.

Chap. XIX. *Of Roofs.* 94

Plate LI. Fig. 1. Shews the form of a truſſed roof, with three ring-poſts, that may carry ſeventy feet, or upwards.

Fig. 2. Exhibits an *M* roof, capable of carrying as great an extent as the former. Indeed both theſe deſigns are capable of carrying almoſt any extent.

Fig. 3. Repreſents two different ſorts of truſſes.

Fig. 4. Shews the manner of piecing timber. Sometimes the joint may be extended as far as *a*, with another bolt through it. To the right is ſhewn a different ſort of joint.

Fig. 5. Shews the manner of truſſing a girder. If the truſſes are full long, with the pieces *b* and *c* you may make them as light as you pleaſe.

Fig. 6. Repreſents the manner of truſſing partitions.

PART II. PRACTICE OF ARCHITECTURE.

Having thus deſcribed and given rules for the moſt generally received proportions of the different parts of buildings, both of the uſeful and ornamental kind, we muſt next give an account of the method of erecting different kinds of edifices; and here the judgment of the architect muſt neceſſarily be very much employed, as no fixed rules have been laid down by which he can be directed in all caſes. As a neceſſary preliminary, however, to the conſtruction, we muſt firſt conſider,

95 Chap. I. *The Situations of Houſes.*

Though it muſt be, in many caſes, impoſſible to chuſe ſuch a ſituation as might be agreeable either to the architect or the proprietor, yet where a choice can be made, there are certainly a great many circumſtances that will determine one ſituation to be preferable to another. Theſe circumſtances depend entirely on the perſon who is to inhabit the houſe. A farmer, for inſtance, ough to dwell in the moſt centrical part of his farm; an independent gentleman muſt regard the healthineſs, the neighbours with whom he can converſe, the proſpect from his houſe, and alſo the aſpect of the ground near it. To anſwer theſe purpoſes of health and pleaſure, an open elevated ſituation is the beſt, as the air is there pure, and the proſpect extenſive; but too elevated a ſituation is diſagreeable, as being both difficult of acceſs, and expoſed to cold and bleak winds. To build in bottoms between hills is both unhealthful and unpleaſant, the houſe being in a manner buried, ARCHITECTURE Plate XLVII.

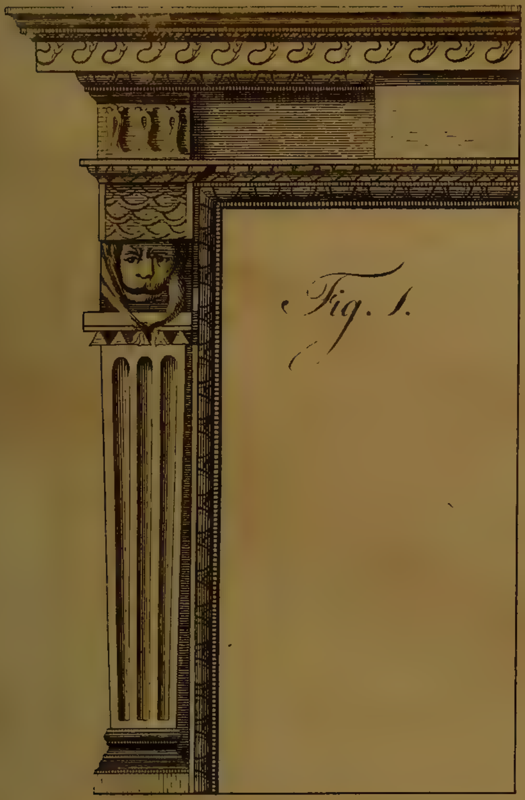


Fig. 1.

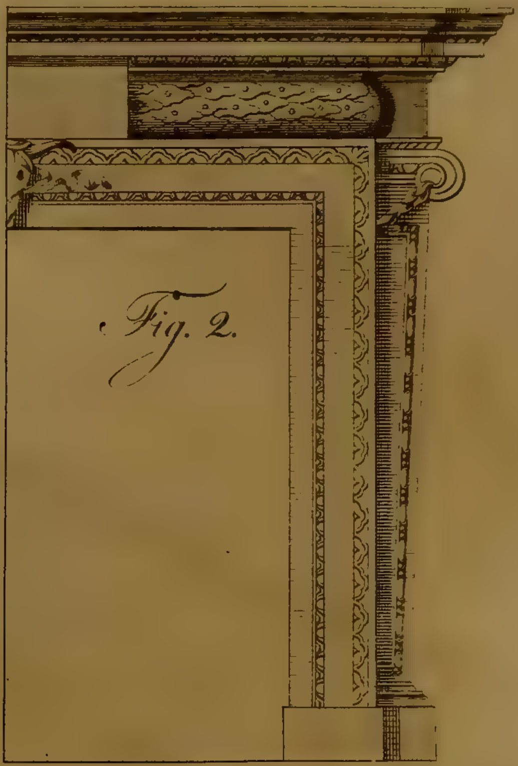


Fig. 2.

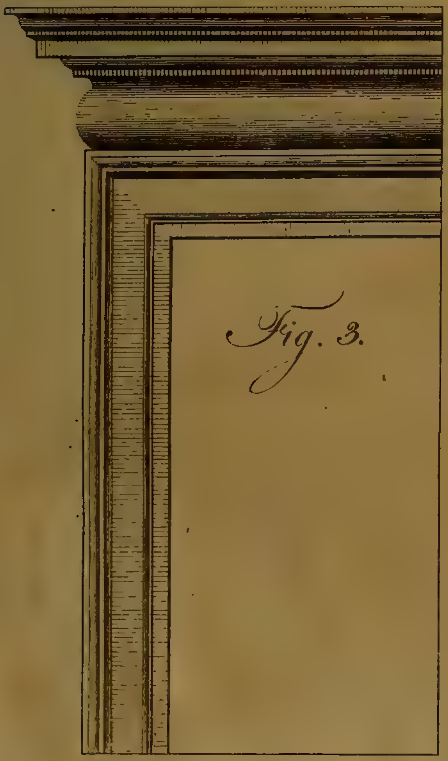


Fig. 3.

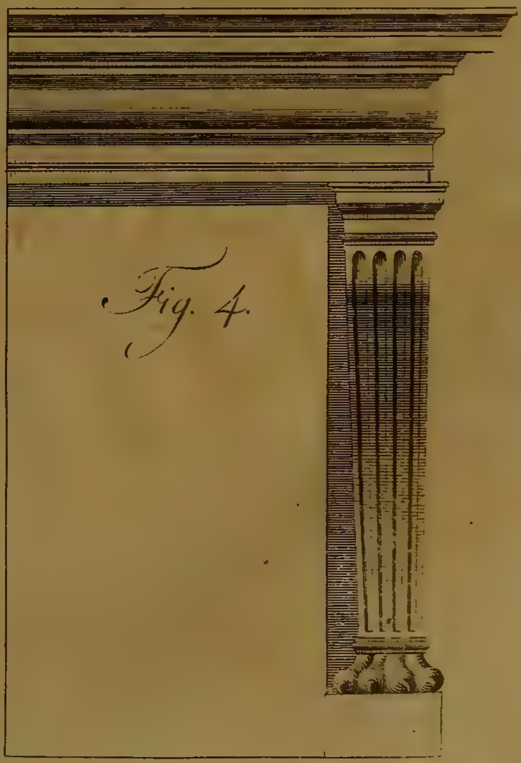


Fig. 4.

Thackara & Vallance Sculp.

Plate XLVIII

ARCHITECTURE

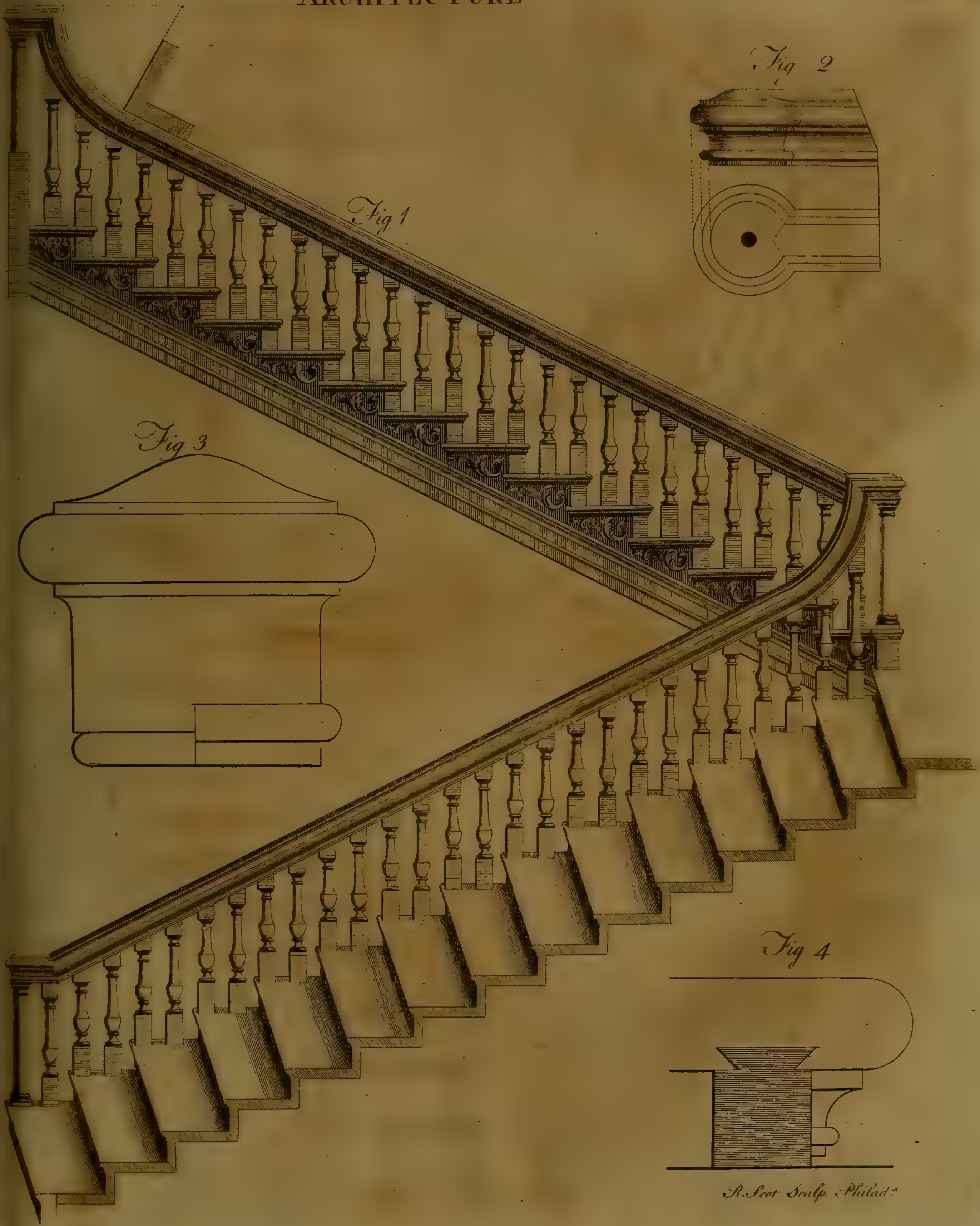


Fig 1

Fig 2

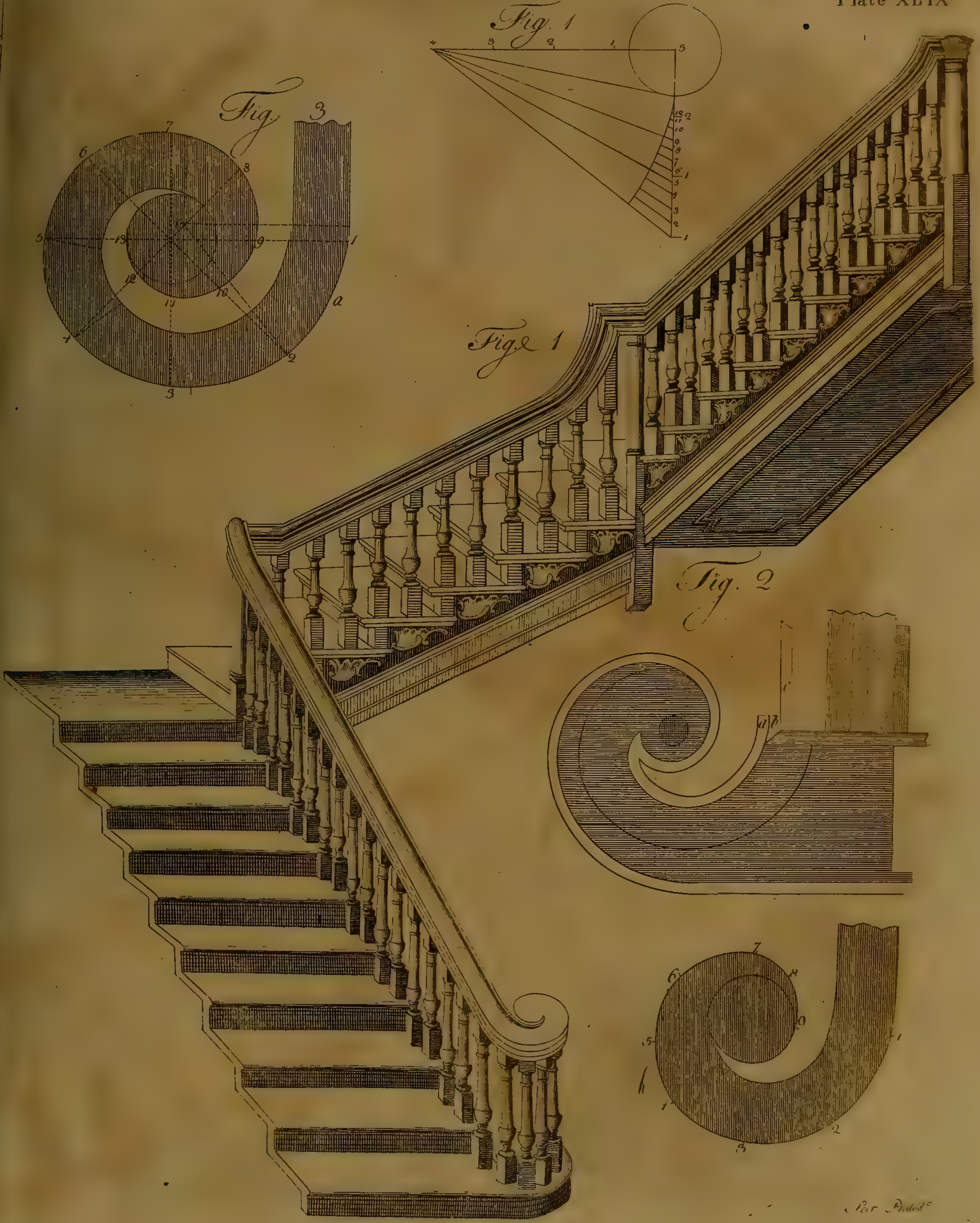
Fig 3

Fig 4

R. Scot Sculp. Philad.a

ARCHITECTURE

Plate XLIX



Scot Sculpt

ARCHITECTURE Plate L

Fig: 1

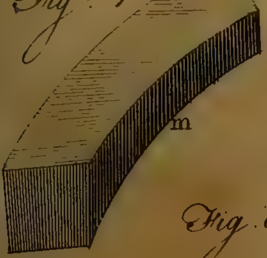


Fig. 6

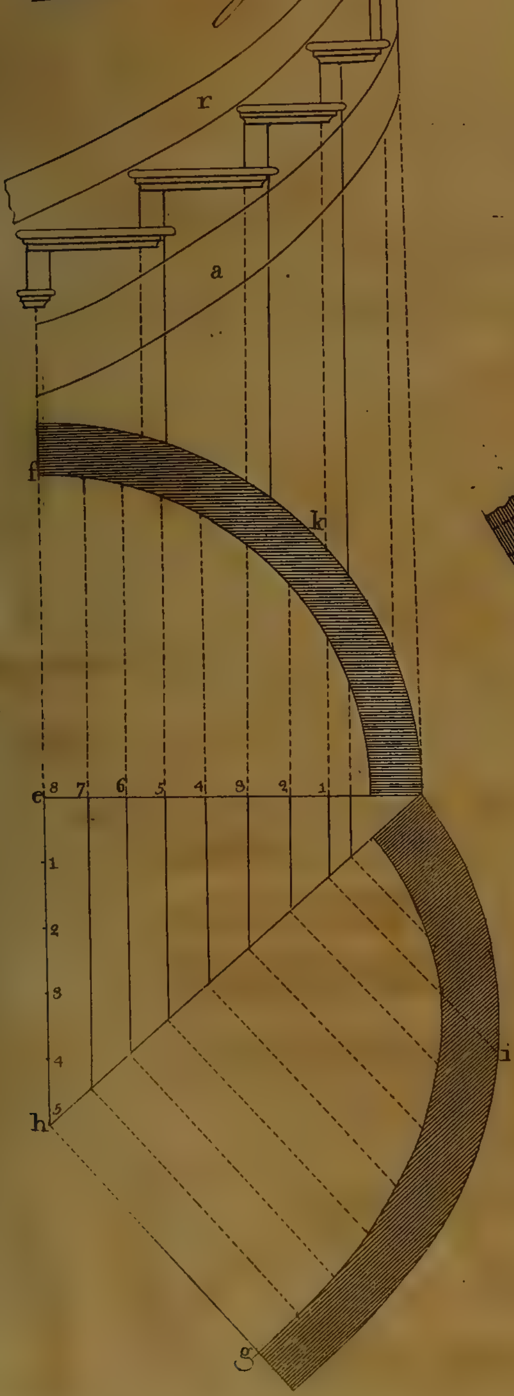


Fig. 2

Fig. 3

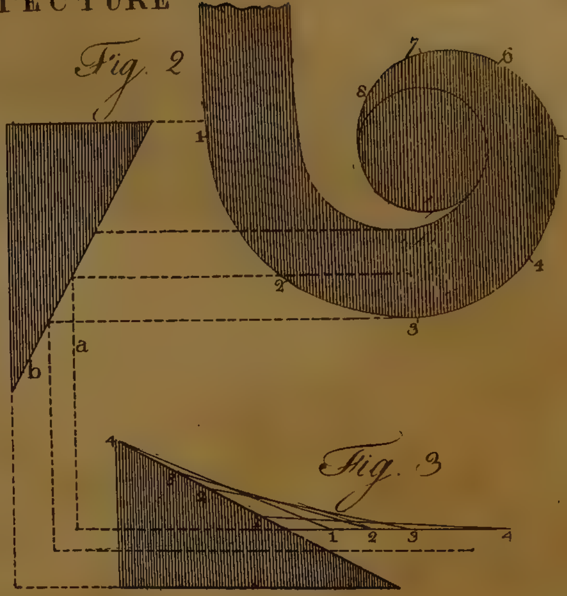


Fig. 4

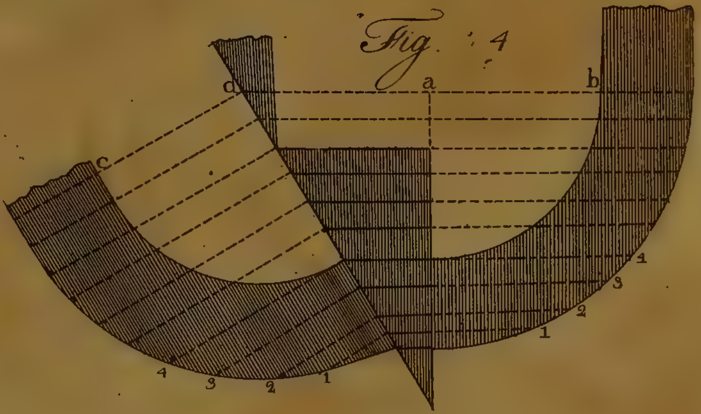


Fig. 5

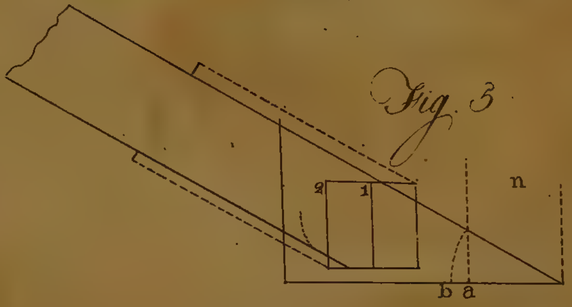
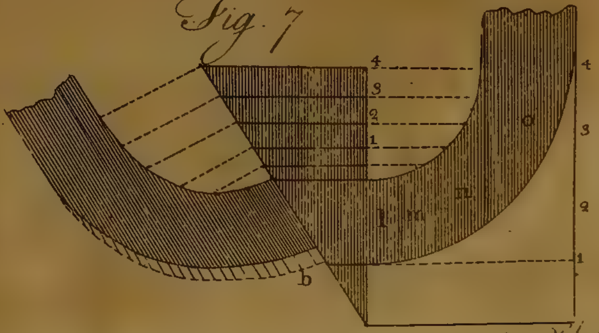


Fig. 7



Scot Philad^a

Fig 1

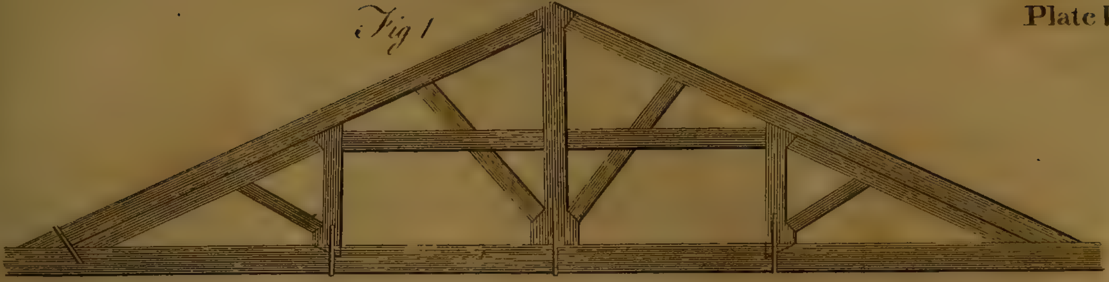


Fig 2

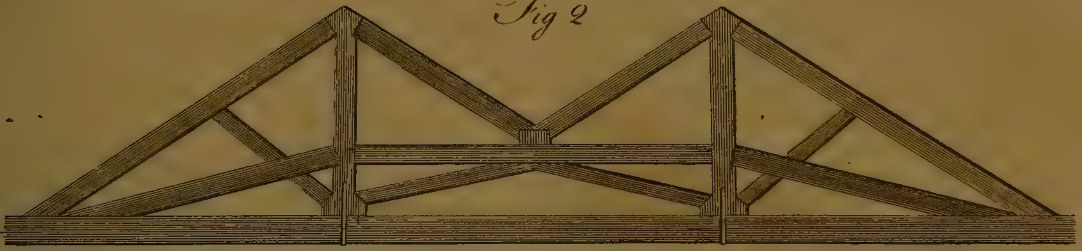


Fig 3

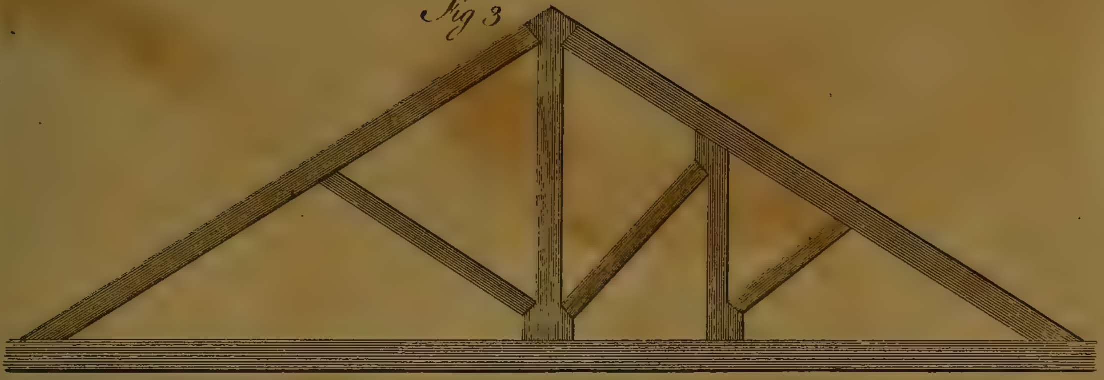


Fig 4

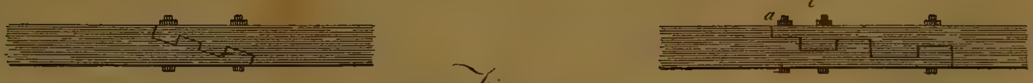


Fig 5

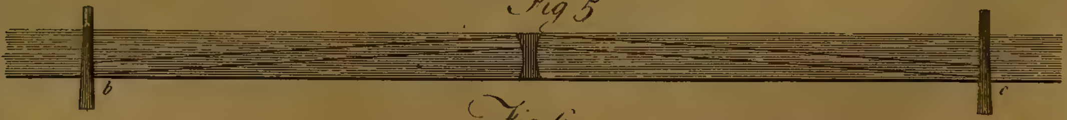
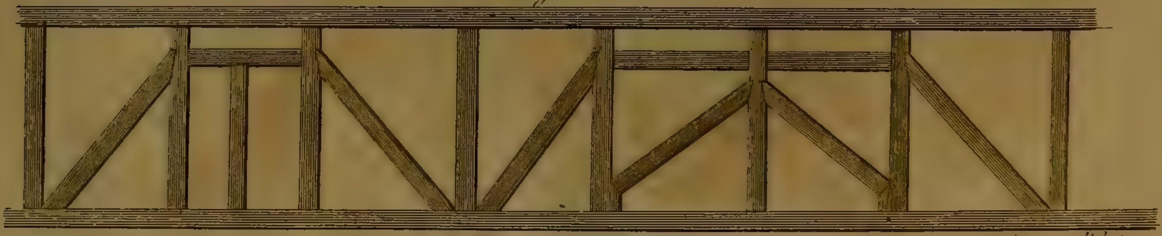


Fig 6



Scot Philad.

buried, and the ground near it generally marſhy from the rain-water which runs down from the hills, which renders the air unwholeſome. As a garden alſo is a very neceſſary article to a country habitation, the ſoil is by no means a matter of indifference; and therefore it may be concluded, that an elevated ſituation on a gravelly loam, near ſome running water, is the beſt ſituation for a country houſe.

CHAP. II. *Of the conſtruction of Edifices in general.*

THE proper ſituation of a houſe, or any other building, being choſen, according to its intended nature, the next thing to be conſidered is to lay the foundation in a proper manner. The only ſecurity of a houſe, or any other building whatever, is in having a good foundation, and no error is ſo dangerous as that which is committed here; as the ſhrinking of the foundation but the breadth of a ſtraw may cauſe a rent of five or ſix inches wide in the ſuperſtructure. To guard againſt errors of this kind, the qualities of the ground for a conſiderable depth muſt be carefully obſerved.

96 Qualities of the ground neceſſary to be examined.

The beſt foundation is that which conſiſts of gravel or ſtone; but, in order to know whether the inferior ſtrata are ſufficient for the ſupport of the building, it will be adviſable to ſink wells at ſome little diſtance. By attending to what is thrown up in digging theſe, the architect will be acquainted with what lies under the ſtony or gravelly bed which on the ſurface promiſes ſo much ſecurity, and will know what meaſures to take.

97 Rocky ground ſometimes dangerous.

But though a ſtony or gravelly bottom is undoubtedly the moſt ſure and firm, where all is ſound beneath, there is no kind of ground which may prove more fallacious, or occaſion ſuch terrible accidents. The reaſon of this is, that ſuch kind of ground often contains abſolute vacuities; nor is rock itſelf, though a foundation upon a rock is ſtrong even to a proverb, free from dangers of the ſame kind. Caverns are very frequent in rocky places; and ſhould an heavy building be erected over one of theſe, it might ſuddenly fall down altogether. To guard againſt accidents of this kind, Palladio adviſes the throwing down great weights forcibly on the ground, and obſerving whether it ſounds hollow, or ſhakes; and the beating of a drum upon it, by the ſound of which an accuſtomed ear will know whether the earth is hollow or not.

Where the foundation is gravel, it will be proper to examine the thickneſs of the ſtratum, and the qualities of thoſe that lie under it, as they have appeared in digging. If the bed of gravel is thick, and the under ſtrata of a ſound and firm kind, there needs no aſſiſtance; if otherwiſe, we muſt have recourſe to various methods in order to ſupply the defect.

98 Sandy or boggy ground how managed.

The other matters which may occur for a foundation are clay, ſand, common earth, or rotten boggy ground. Clay will often both raiſe and ſink a foundation; yet it has a ſolidity which, with proper management, is very uſeful. The marſhy, rotten, or boggy ground is of all others the worſt; yet even upon this great buildings may be raiſed with perfect ſafety, provided proper care be taken. In caſe of boggy earths, or unfirm ſand, piling is one of the moſt common methods of ſecuring a foundation; and, notwithſtanding the natural diſadvantage of the earth, piles, when properly executed, are one of the firmeſt and moſt ſecure foundations.

99 Foundations near waters dangerous.

In foundations near the edge of waters, we ſhould always be careful to ſound to the very bottom, as many terrible accidents have happened from the ground being undermined by rivers. The ſame method is to be followed when the ground on which we build has been dug or wrought before. It ought never to be truſted in the condition in which it is left; but we muſt dig through it into the ſolid and unmoved ground, and ſome way into that, according to the weight and bigneſs of the intended edifice. The church of St Peter's at Rome is an inſtance of the importance of this laſt obſervation. That church is in great part built upon the old circus of Nero; and the builders having neglected to dig through the old foundation, the ſtructure is conſequently ſo much the weaker. The walls were judged of ſtrength enough to bear two ſteeples upon the corners of the frontiſpiece; but the foundation was found too weak when it was impoſſible to remedy the defect perfectly.

100 Defect in St Peter's at Rome.

Before the architect, however, begins to lay the foundation of the building, it will be proper to conſtruct ſuch drains as may be neceſſary for carrying off the rain, or other refuſe water that would otherwiſe be collected and lodge about the houſe. In making of drains for carrying off this water, it will be neceſſary to make large allowances for the different quantities that may be collected at different times. It muſt alſo be conſidered, that water of this kind is always loaded with a vaſt quantity of ſediment, which by its continual falling to the bottom will be very apt to choak up the drain, eſpecially at thoſe places where there happen to be angles or corners in its courſe. The only method of preventing this is by means of certain cavities diſpoſed at proper diſtances from one another. Into theſe the ſediment will be collected, and they are for that reaſon called *ſeſpools*. With regard to theſe, the only directions neceſſary are, that they be placed at proper diſtances, be ſufficiently large, and placed ſo as to be eaſily cleaned. It is a good rule to make a ſeſspool at each place where the water enters the drain; as by this means a conſiderable quantity of ſediment will be prevented from entering the channel at all. Others are to be made at proper diſtances, eſpecially where there are any angles. They muſt be made ſufficiently large; the bigger, in moderation, the better; and they muſt alſo be covered in ſuch a manner as to be eaſily got at in order to be cleaned. But, as putrid water is exceedingly noxious, it will be neceſſary to carry up a brick funnel over every ſeſspool, in order to prevent the collection of the putrid effluvia, which would otherwiſe occaſion the death of the perſon who cleaned it.

101 Drains how made.

102 Seſspools.

103 Proportions of drains.

All drains ought to be arched over at top, and may be moſt conveniently built of brick. According to their different ſizes, the following proportions of height and thickneſs may be obſerved. If the drain is 18 inches wide, the height of the walls may be one foot, and their thickneſs nine inches; the bottom may be paved with brick laid flatwiſe, and the arch turned four inches. If the drain is 22 inches wide, the ſide walls are then to be one foot three inches in height, and the reſt conſtructed as before. If it is 14 inches wide, the height of the walls may be 9 inches, and the ſweep of the arch four. A drain of a yard wide ſhould have the ſame height, and the arch turned over it ought to be 9 inches thick. Upon the ſame principles and proportions may other drains of any ſize be conſtructed.

104 Foundation of buildings how laid.

The ſewers and drains being conſtructed in a manner proportioned to the ſize of the intended building, the architect may next proceed to lay the foundation of the walls. Here the firſt care muſt be, that the floor of the foundation be perfectly ſmooth and level. The Italians begin with laying over it an even covering of ſtrong oak plank; and upon that they lay, with the moſt exact care, the firſt courſe of the materials. Whether we take this method, or begin upon the naked floor, all muſt be laid with the moſt exact truth by rule and line. When the board plat is laid, a courſe of ſtone is the beſt firſt bed, and this is to be laid without mortar; for lime would make the wood decay, which otherwiſe, in a tolerably good ſoil, will laſt for ages. After this, all the courſes ſhould follow with the ſame perfect evenneſs and regularity. If the materials are brick, they ſhould be laid on with an equal, and not too great quantity of mortar: if ſtone, they ought to be placed regularly, and in the ſame ſituation in which they lay in the quarry: for many ſtones, which will bear any weight flatwiſe, and in their natural poſition, are of ſuch a grain, that they will ſplit otherwiſe. The joinings of the under courſe muſt be covered by the ſolid of the next courſe all the way up; and the utmoſt care muſt be taken that there be no vacuity left in the wall, for the weight will moſt certainly cruſh it in. The leſs mortar there is in a foundation, the better. Its uſe is to cement the bricks and ſtones together; and the evener they are, the leſs will be required for the purpoſe. Where mortar is uſed to fill up the cavities, it becomes part of the wall; and not being of equal ſtrength with the ſolid materials, it takes from the firmneſs of the building. For the ſame reaſon, nothing can be more abſurd, than to fill up a foundation with looſe ſtones or bricks thrown in at random; and where this is done, the ruin of the building is inevitable. Where the foundation of a principal wall is laid upon piles, it will be neceſſary alſo to pile the foundations of the partitions, though not ſo ſtrongly.

105 Thickneſs and diminutions of walls, &c.

The thickneſs of foundation-walls in general ought to be double that of the walls which they are to ſupport. The looſer the ground, the thicker the foundation-wall ought to be; and it will require the ſame addition alſo in proportion to what is to be raiſed upon it. The plane of the ground muſt be perfectly level, that the weight may preſs equally every where: for when it inclines more to one ſide than another, the wall will ſplit. The foundations muſt diminiſh as they riſe, but the perpendicular is to be exactly kept in the upper and lower parts of the wall; and this caution ought to be obſerved all the way up with the ſame ſtrictneſs. In ſome ground, the foundation may be arched; which will ſave materials and labour, at the ſame time that the ſuperſtructure has an equal ſecurity. This practice is peculiarly ſerviceable where the foundation is piled.

106 Diminution of the thickneſs of walls.

As the foundation-walls are to diminiſh in thickneſs, ſo are thoſe which are built upon them. This is neceſſary in order to ſave expence, but is not abſolutely ſo to ſtrengthen the wall; for this would be no leſs ſtrong though it was continued all the way to the top of an equal thickneſs, provided the perpendicular was exactly kept. In this the ancients were very expert; for we ſee, in the remains of their works, walls thus carried up to an exorbitant height. It is to be obſerved, however, that, beſides perfect truth in their perpendiculars, they never grudged iron work, which contributed greatly to the ſtrength of their buildings. The thickneſs and diminution of walls is in a great meaſure arbitrary. In common houſes built of brick, the general diminution from the bottom to the top is one-half the thickneſs at the bottom; the beginning is two bricks, then a brick and a half, and laſtly one brick, thickneſs. In larger edifices, the walls muſt be made proportionally thicker; but the diminution is preſerved much in the ſame manner. Where ſtones are uſed, regard muſt be had to their nature, and the propriety of their figures for holding one another. Where the wall is to be compoſed of two materials, as ſtone and brick the heavieſt ought always to be placed undermoſt.

107 Angles how fortified.

There is one farther particular regarding the ſtrength of a plain wall, and that is, the fortifying its angles. This is beſt done with good ſtone on each ſide, which gives not only a great deal of ſtrength, but a great deal of beauty. Pilaſters properly applied are a great ſtrengthening to walls. Their beſt diſtance is about every 20 foot, and they ſhould riſe five or ſix inches from the naked of the wall. A much ſlighter wall of brick with this aſſiſtance, is ſtronger than a heavier and maſſier one built plain. In brick walls of every kind, it is alſo a great addition to their ſtrength to lay ſome chief courſes of a larger and harder matter; for theſe ſerve like ſinews to keep all the reſt firmly together, and are of great uſe where a wall happens to ſink more on one ſide than another.

108 Windows improper near the corners.

As the openings in a wall are all weakenings, and as the corners require to be the ſtrongeſt parts, there ſhould never be a window very near a corner. Properly, there ſhould always be the breadth of the opening firm to the corner. In the moſt perfect way of forming the diminution of walls, the middle of the thinneſt part being directly over the middle of the thickeſt, the whole is of a pyramidal form; but where one ſide of the wall muſt be perpendicular and plain, it ought to be the inner, for the ſake of the floors and croſs walls. The diminiſhed ſide, in this caſe, may be covered with a faſcia or cornice, which will at once be a ſtrength and ornament.

109 Chimneys.

Along with the conſtruction of walls, that of the chimneys muſt alſo conſidered; for errors in the conſtruction of theſe will render the moſt elegant building extremely diſagreeable. The common cauſes of ſmoaking are either that the wind is too much let in above at the mouth of the ſhaft, or the ſmoke is ſtifled below: and ſometimes a higher building, or a great elevation of the ground behind, is the ſource of the miſchief; or laſtly, the room in which the chimney is, may be ſo ſmall or cloſe, that there is not a ſufficient current of air to drive up the ſmoke. Almoſt all that can be done, while the walls are conſtructing, to prevent ſmoke, is, to make the chimney vent narrower at bottom than at top: yet this muſt not be carried to an extreme; becauſe the ſmoke will then linger in the upper part, and all the force of the draught will not be able to ſend it up.—As for the methods of curing ſmoky chimneys in houſes already built, ſee the article CHIMNEY.

After

Fig. 1.

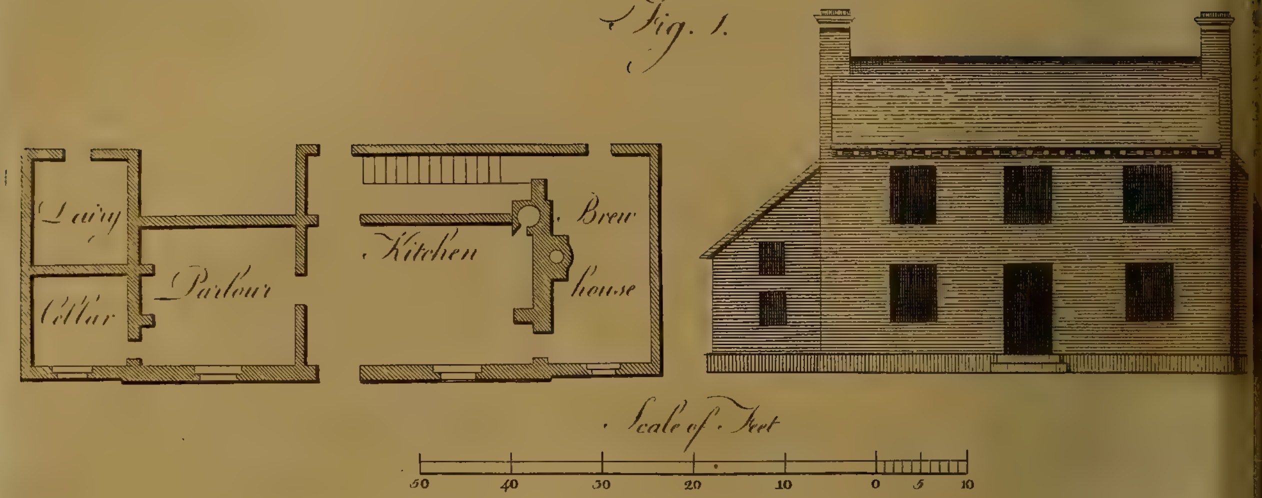
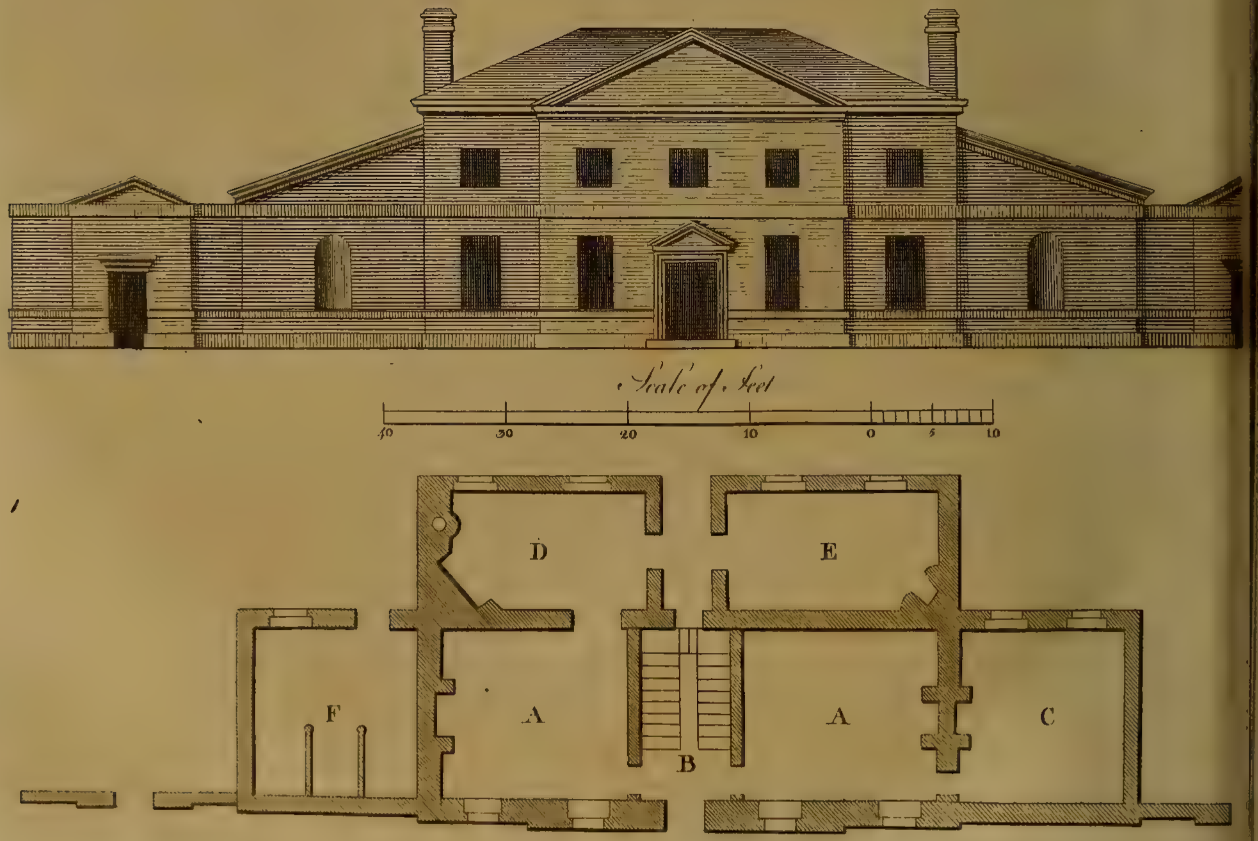


Fig. 2.



A.A are two Parlours 15 feet.
B. Stair Case.
C. Study.
D. Kitchen } are Shades
E Wash house } are Shades
F. Stable.

Thackara & Vallance.

117
Roofs.

After the walls are finiſhed, the roof is the next conſideration: but concerning it very little can be ſaid; only that its weight muſt be proportioned to the ſtrength of the walls. It muſt alſo be ſo contrived as to preſs equally upon the building; and the inner walls muſt bear their ſhare of the load as well as the outer ones. A roof ought neither to be too maſſy nor too light; as being neceſſary for keeping the walls together by its preſſure, which it is incapable of doing while too light; and if too heavy, it is in danger of throwing them down. Of theſe two extremes, however, the laſt is to be accounted the worſt.

117
Floors.

With regard to the floors, they are moſt commonly made of wood; in which caſe, it will be neceſſary that it ſhould be well ſeaſoned by being kept a conſiderable time before it is uſed. The floors of the ſame ſtory ſhould be all perfectly on a level; not even a threſhold riſing above the reſt: and if in any part there is a room or cloſet whoſe floor is not perfectly level, it ought not to be left ſo, but raiſed to an equality with the reſt; what is wanting of the true floor being ſupplied by a falſe one.

In mean houſes, the floors may be made of clay, ox blood, and a moderate portion of ſharp ſand. Theſe three ingredients, beaten thoroughly together and well ſpread, make a firm good floor, and of a beautiful colour. In elegant houſes, the floors of this kind are made of plaſter of Paris, beaten and ſifted, and mixed with other ingredients. This may be coloured to any hue by the addition of proper ſubſtances; and, when well worked and laid, makes a very beautiful floor. Beſides theſe, halls, and ſome other ground-rooms, are paved or floored with marble or ſtone; and this either plain or dotted, or of a variety of colours: but the univerſal practice of carpeting has in a great meaſure ſet aſide the beſtowing any ornamental workmanſhip upon floors. In country buildings, alſo, floors are frequently made of bricks and tiles. Theſe, according to their ſhapes, may be laid in a variety of figures; and they are alſo capable of ſome variation in colour, according to the nature of the earth from which they were made. They may be laid at any time; but for thoſe of earth or plaſter, they are beſt made in the beginning of ſummer, for the ſake of their drying.

Chap. III. *Of the Diſtribution of the Apartments of Houſes, with other conveniences.*

As houſes are built only for the ſake of their inhabitants, the diſtribution of the apartments muſt of neceſſity be directed by the way of life in which the inhabitants are engaged.

118
Plan of a farm-houſe.

In the country, this is commonly farming; and here, beſides the houſe for the family, there is alſo neceſſary a barn for the reception of the produce of the ground, a ſtable for cattle, a cart-houſe for keeping the utenſils under cover, and ſheds for other uſes.—To accompliſh theſe purpoſes, let a piece of ground be taken of five times the extent of the front of the houſe, and incloſed in the leaſt expenſive manner. Back in the centre of this let the houſe be placed, and in the front of the ground the barn and the ſtable, with the adjoining ſheds. Theſe are to be ſet, one on each ſide, to the extreme meaſure of the incloſed ground: they will thus fill up a part of the entrance, and will leave all about the houſe ſome incloſed ground by way of yard. From the barn to the ſtable may be extended a fence with a gate in the middle, and this gate ought to front the door of the houſe.

This much being ſettled, the plan of the houſe and out-buildings may be made as follows. The door may open into a plain brick paſſage, at the end of which may be carried up a ſmall ſtair-caſe. On one ſide of the paſſage may be a common kitchen; and on the other ſide a better or larger room, which will ſerve the family by way of parlour. Beyond this may ſtand on one ſide the pantry, and on the other the dairy room, the laſt being twice the ſize of the former. They are placed on the ſame ſide with the parlour, on account of the heat of the kitchen, which renders it improper to be near them. On the kitchen ſide, a brew-houſe may very conveniently be placed. More rooms may be added on the ground-floor as occaſion requires; and the upper ſtory is to be divided into bed-chambers for the family, with garrets over them for the ſervants.—A houſe of this kind is repreſented Plate LII. fig. 1.; and one of a ſomewhat better kind fig. 2. where a private gentleman who has a ſmall family may find conveniency.

119
Of an elegant country ſeat.

On Plate LIII. is repreſented a gentleman's country-ſeat, built on a more elegant plan. Here the front may extend 65 feet in length, the depth in the center being 40 feet, and in each of the wings 45. The offices may be diſpoſed in wings; the kitchen in the one, and the ſtables in the other; both of which, however, may correſpond in their front with the reſt of the building, which they ought alſo to do with one another. Theſe wings may have a projection of 13 feet from the dwelling-houſe, to which they ought to be connected, not by ſtraight lines, but by curves, as repreſented fig. 2.

The beſt proportion of theſe offices to a houſe extending 65 feet in front, is 35 feet. If they are ſmaller, the houſe will look gigantic; if larger, they will leſſen its aſpect. To a front of 35 feet, a depth of 48 is a very good proportion. There ought alſo to be a covered communication between the dwelling-houſe and offices, which muſt not appear only to be a plain blank wall, but muſt be ornamented with gates, as in the figure. The arch by which the offices are joined to the dwelling-houſe muſt be proportioned to the extent of the buildings; and there cannot be a better proportion than five feet within the angles of the buildings. By this means the wings, which have only a projection of 13 feet, will appear to have one of 18, and the light will be agreeably broken.

With regard to the internal diſtribution of a houſe of this kind, the under ſtory may be conveniently divided into three rooms. The hall, which is in the centre will occupy the whole of the projecting part, having a room on each ſide. The length of the hall muſt be 24 feet, and its breadth 12: the rooms on each ſide of it muſt be 16 feet long, and 11 wide. Of theſe two front rooms, that on the right hand may be conveniently made a waiting-room for perſons of better rank, and that on the left hand a dreſſing-room for the maſter of the houſe. Behind the hall may run a paſſage of four feet and an half, leading to the apartments in the hinder part of the houſe and the ſtair-caſe. Theſe may be diſpoſed as follows. Directly behind the hall and this paſſage, the ſpace may be occupied by a ſaloon, whoſe length is 24 feet and its breadth 17. On the left hand of the paſſage, behind the hall, is to be placed the grand ſtair-caſe; and as it will not fill the whole depth, a pleaſant common parlour may terminate on that ſide of the houſe. On the other ſide, the paſſage is to lead to the door of the great dining parlour, which may occupy the whole ſpace.

120 Another. A plan of a houſe of the ſame kind, but ſomewhat different in the diſtribution, is repreſented below in the ſame plate. The front here extends 68 feet, and the wings project 28 feet; their depth is 48, and their breadth 36. The hall may be 26 feet long and 17 broad. On the left hand of the hall may be a waiting-room 16 feet long and 10 broad; behind which may be a handſome dining-room. The paſſage into this waiting-room ſhould be at the lower end of the hall; and it muſt have another opening into the room behind it. On the right hand of the hall is the place of the great ſtair-caſe, for which a breadth of 16 feet three inches is to be allowed. In the centre of the building, behind the hall, may be a drawing-room 26 feet long and 16 broad; and behind the ſtair-caſe will be a room for a common parlour of 16 feet ſquare. The paſſage of communication between the houſe and wings may be formed into colonnades in a cheap manner behind: a flight of ſteps, raiſed with a ſweep, occupying the centre of each, and leading up to a door, and the covering being no more than a ſhed ſupported by the plaineſt and cheapeſt columns.

The two wings now remain to be diſpoſed of. That on the right hand may contain the kitchen and offices belonging to it, and the other the ſtables. The front of the right-hand wing may by occupied by a kitchen entirely, which will then be 30 feet long and 16½ wide; or it may be made ſmaller, by ſetting off a ſmall room to the right. Twenty-two feet by 16 will then be a good bigneſs. The other room will then have the ſame depth of 16 feet, and the width to the front may be 7½. Beyond the kitchen may ſtand the ſtair-caſe, for which 7½ feet will be a proper allowance; and to the right of this may be a ſcullery 12 feet 10 inches deep from the back front by 7 in breadth. To the left of the ſtair may be a ſervants hall 16 feet ſquare, and behind that a larder 12 feet 10 by 14 feet 6. In the centre of the other wing may be a double coach-houſe: for which there ſhould be allowed the whole breadth of the wing, with 10 feet 6 inches in the clear; and on each ſide of this may be the ſtables. The external decorations of the front and wings will be better underſtood from the figure than they can be by any deſcription.

121 Of the Eral of Wemyſs's houſe. Plate LIV. ſhows the plan and elevation of the houſe of the Earl of Wemyſs at Newmills. The proportions of the rooms are marked in the plan; and the front, being decorated with columns of the Ionic order, will ſufficiently ſhow in what manner any of the five orders may be induced with propriety and elegance.

Chap. IV. *Of Aquatic Buildings.*

1. Of Bridges.

122 These are conſtructed either of wood or ſtone; of which the laſt are evidently the ſtrongeſt and moſt durable, and therefore in all caſes to be preferred where the expence of erecting them can be borne. The proper ſituation for them is eaſily known, and requires no explanation; the only thing to be obſerved is, to make them croſs the ſtream at right angles, for the ſake of the boats that paſs through the arches, with the current of the river; and to prevent the continual ſtriking of the ſtream againſt the piers, which in a long courſe may endanger their being damaged and deſtroyed in the end.

Bridges built for a communication of high roads, ought to be ſo ſtrong and ſubſtantial as to be proof againſt all accidents that may happen, to have a free entrance for carriages, afford an eaſy paſſage to the waters, and be properly adapted for navigation, if the river admits of it. Therefore the bridge ought to be at leaſt as long as the river is wide in the time of its greateſt flood: becauſe the ſloping of the waters above may cauſe too great a fall, which may prove dangerous to the veſſels, and occaſion the under graveling the foundation of the piers and abutments; or, by reducing the paſſage of the water too much in time of a great flood, it might break though the banks of the river, and overflow the adjacent country, which would cauſe very great damages; or if this ſhould not happen, the water might riſe above the arches, and endanger the bridge to be overſet, as has happened in many places.

When the length of the bridge is equal to the breadth of the river, which is commonly the caſe, the current is leſſened by the ſpace taken up by the piers: for which reaſon this thickneſs ſhould be no more than is neceſſary to ſupport the arches; and it depends, as well as that of the abutments, on the width of the arches, their thickneſs, and the height of the piers.

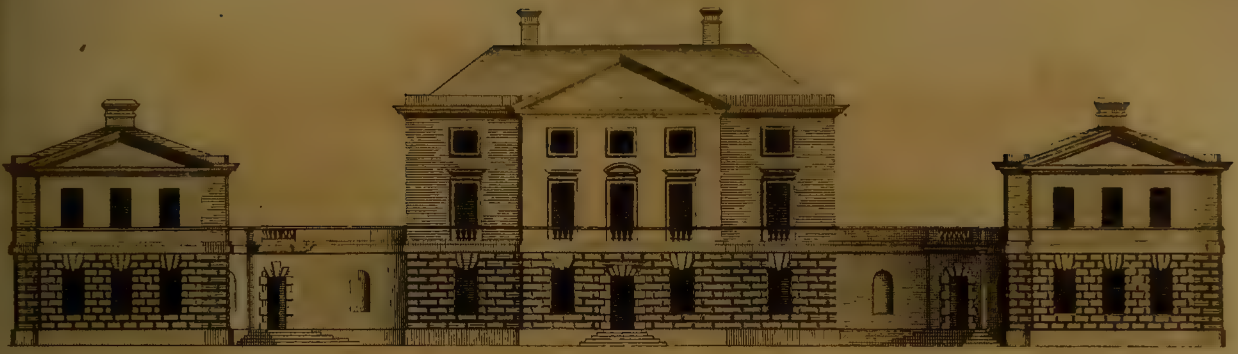
123 Proper form of arches. The form of the arch is commonly ſemicircular; but when they are of any great width, they are made elliptical, becauſe they would otherwiſe become too high. This has been done at the Pont Royal at Paris, where the middle arch is 75 feet, and its height would have been 37.5 feet, inſtead of which it is only 24 by being made elliptical.

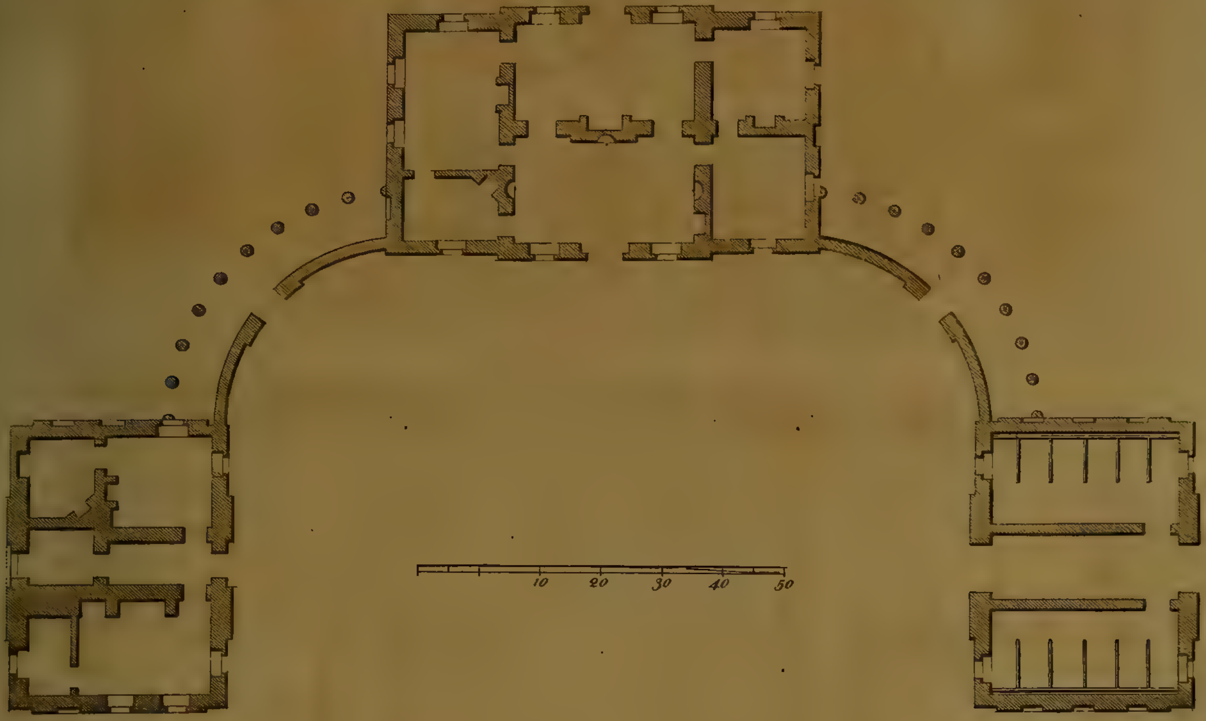
Another advantage of much more importance ariſes from the oval figure, which is, that the quantity of maſonry of the arches is reduced in the ſame proportion as the radius of the arch is to its height. That is, if the radius is 36 feet, and the height of the arch 24, or three-fourths of the radius, the quantity of maſonry of the arches is likewiſe reduced to three-fourths; which muſt leſſen the expence of the bridge conſiderably. Notwithſtanding theſe advantages, however, the lateſt experiments have determined ſegments of circles to be preferable to curves of any other kind; and of theſe the ſemicircle is undoubtedly the beſt, as preſſing moſt perpendicularly on the piers.

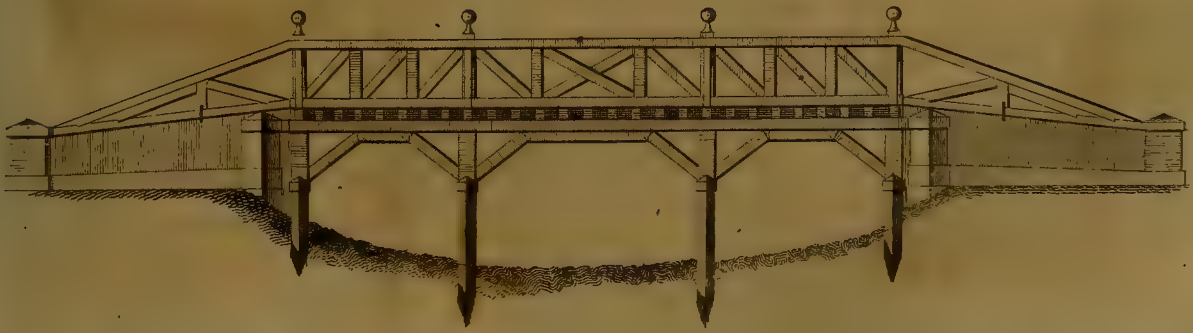
When the height of the piers is about ſix feet, and the arches are circular, experience has ſhown, ſays Mr Belidor,

Plate LIII

ARCHITECTURE







R. Scot Sculp. Philad.

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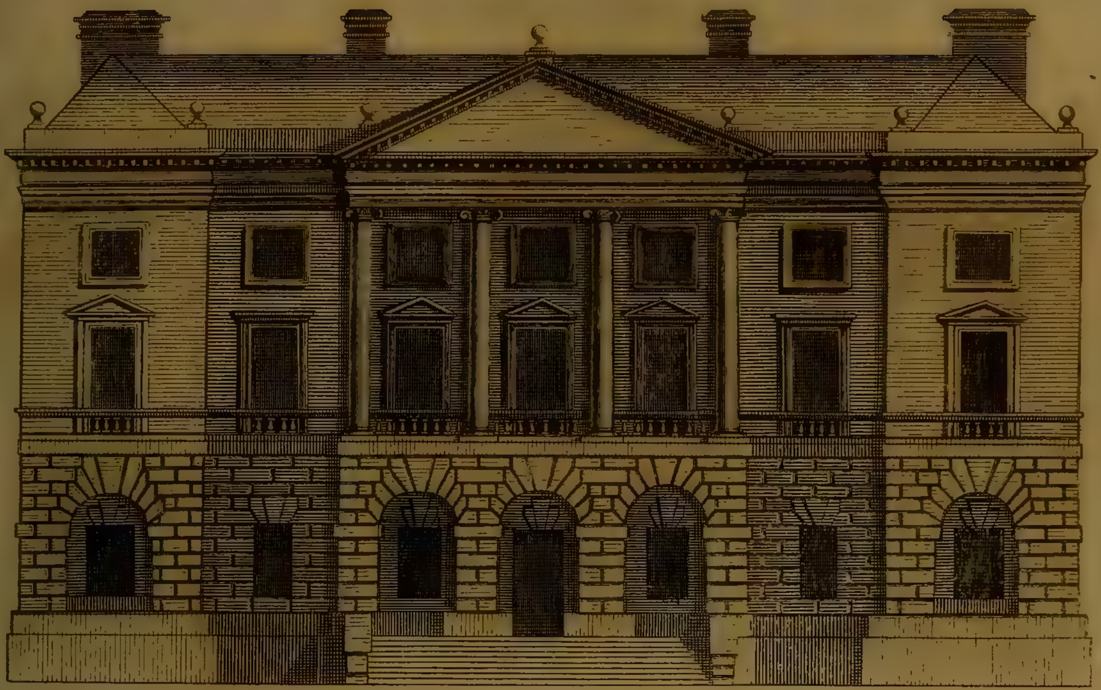

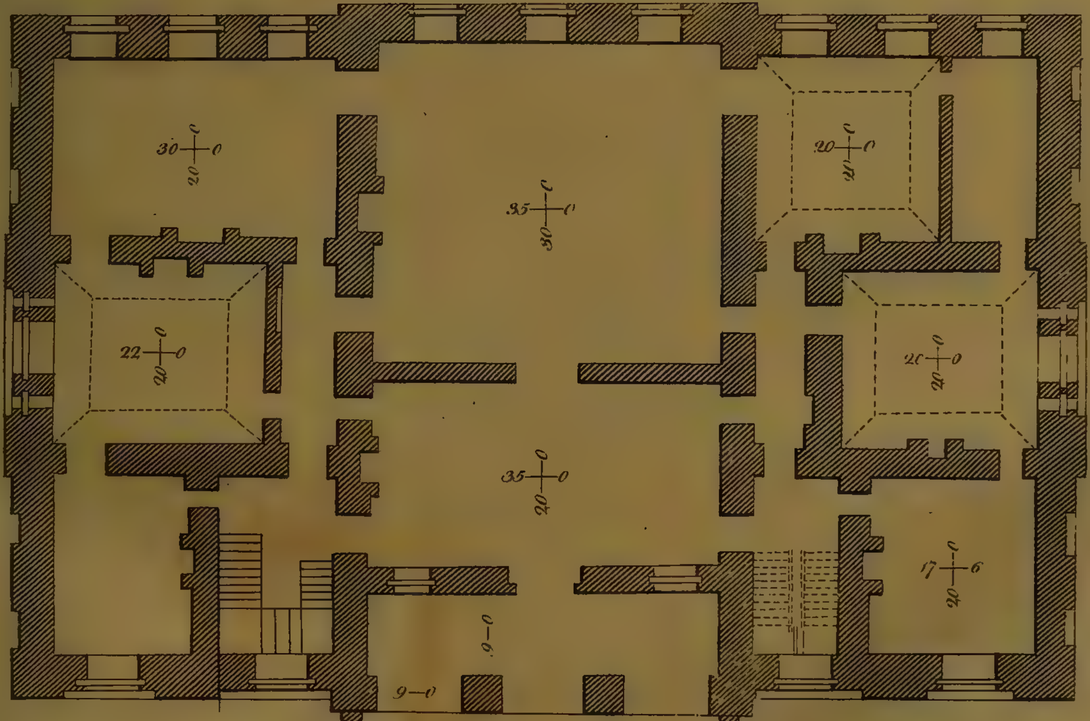

Thackara, & Vallance, Sculp.t

Belidor, that it is ſufficient to make the thickneſs of the piers the ſixth-part of the width of the arch, and two feet more; that is, the thickneſs of the piers of an arch of 36 feet, ought to be 8 feet; thoſe of an arch of 48 feet, to be 10.

124 Thickneſs of the piers. When the arches are of a great width, the thickneſs of the piers may be reduced to the ſixth-part of that width; but the depreſſion of the two feet is not done at once; that is, in an arch above 48 feet, 3 inches are taken off for every 6 feet of increaſe of the width of the arch. For inſtance, the thickneſs of the piers ſupporting an arch of 72 feet wide, ſhould be 14 feet, according to the preceding rule; but by taking off 3 inches for every ſix feet, above an arch of 48 wide, the thickneſs of the piers is reduced to 13 feet: conſequently, by following the ſame rule, the thickneſs of the piers ſupporting an arch of 16 fathoms wide, will be 16 feet; all the others above that width are the ſixth-part of the width.

After this, Mr Belidor gives a rule for finding the thickneſs of the piers which ſupport elliptic arches, and makes them ſtronger than the former: the abutments he makes one-ſixth part more than the piers of the largeſt arch. But it is plain that theſe rules are inſufficient, being merely gueſs-work, determined from ſome works that have been executed.

125 Of the arch ſtones. The thickneſs of the arch-ſtones is not to be determined by theory, nor do thoſe authors who have written on the ſubject agree amongſt themſelves. Mr Gautier, an experienced engineer, in his works, makes the length of the arch-ſtones, of an arch 24 feet wide, 2 feet; of an arch 45, 60, 75, 90 wide, to be 3, 4, 5, 6, feet long reſpectively, when they are hard and durable, and ſomething longer when they are of a ſoft nature: on the contrary, Mr Belidor ſays, they ought to be always one twenty-fourth part of the width of the arch, whether the ſtone be hard or ſoft; becauſe, if they are ſoft, they weigh not ſo much.

But that the length of the arch-ſtones ſhould be but a foot in an arch of 24 feet wide, 2, 3, 4, in arches of 48, 72, 96 feet, ſeems incredible; becauſe the great weight of the arches would cruſh them to pieces, by the preſſure againſt one another; and therefore Mr Gautier's rule appears preferable: as he made the length of the arch-ſtones to increaſe in a ſlower proportion, from 10 to 45 feet wide, than in thoſe above that width, we imagine that the latter will be ſufficient for all widths, whether they are great or little: therefore we ſhall ſuppoſe the length of the arch-ſtones of 30 feet in width to be two feet, and to increaſe one foot in 15; that is, 3 feet in an arch of 45 feet; 4, 5, 6, in an arch of 60, 75, and 90 feet: and ſo the reſt in the ſame proportion.

Table containing the thickneſs of piers of bridges.

	6	90	12	15	18	21	24
20	4.574	4.918	5.165	3.350	5.492	5.610	5.698
25	5.490	5.913	6.216	6.455	6.645	6.801	7.930
30	6.386	6.816	7.225	7.513	7.746	7.939	8.102
35	7.258	7.786	8.200	8.532	8.807	9.037	9.233
40	8.404	8.691	9.148	9.523	9.835	10.101	10.328
45	8.965	9.579	10.077	10.489	10.837	11.136	11.394
50	9.805	10.454	10.987	11.435	11.817	12.146	12.434
55	10.640	11.245	11.882	12.364	13.019	13.149	13.218
60	11.400	12.110	12.718	13.281	13.723	14.109	14.314
65	12.265	13.025	13.648	14.185	14.654	15.082	15.433
70	13.114	13.869	14.517	15.049	15.573	16.011	16.400
75	14.000	14.705	15.336	15.965	16.480	16.940	17.354
80	14.747	15.542	16.234	16.842	17.381	17.864	18.298
85	15.513	16.328	17.041	17.674	18.237	18.742	19.198
90	16.373	17.201	17.929	18.578	19.157	19.679	20.152
95	17.184	17.826	18.772	19.438	20.036	20.577	21.068
100	17.991	18.848	19.610	20.293	20.908	21.466	21.976

125 Explanation of the table. The firſt horizontal line expreſſes the height of the piers in feet, from 6 to 24 feet, each increaſing by 3; the firſt vertical column, the width of arches from 20 to 100 feet, for every five feet.

The other columns expreſs the thickneſs of piers in feet and decimals, according to the reſpective height at the head of the column, and the width of the arch againſt it in the firſt column.

Thus, for example, let the width of the arch be 60 feet, and the height of the piers 12; then the number 12.718, under 12, and againſt 60, expreſſes the thickneſs of the piers, that is 12 feet and 8.6 inches: we muſt obſerve again, that the length of the key-ſtone is 2 feet in an arch of 30 feet wide 3, 4, 5, 6, in an arch of 45, 60, 75, 90; that of 20 feet wide, 1 foot four inches; and the length of any other width is found by adding 4 inches for every 5 feet in width.

As this table contains the thickneſſes of piers in reſpect to arches that are commonly uſed in practice, we imagined, that to carry it farther would be needleſs; becauſe the difference between the thickneſs of the piers of any contiguous arches being but ſmall, thoſe between any two marked here, may be made equal to half the ſum of the next below and above it: thus the thickneſs of the piers of an arch 52 or 53 feet wide is nearly equal to 10.222, half the ſum of the thickneſſes 9.805 and 10.64 of the arches 50 and 55 feet wide, when the height of the piers is 6 feet.

127 Form of piers. Rectangular piers are ſeldom uſed but in bridges over ſmall rivers. In all others, they project the bridge by a triangular priſm, which preſents an edge to the

ſtream, in order to divide the water more eaſily, and to prevent the ice from ſheltering there, as well as veſſels from running foul againſt them: that edge is terminated by the adjacent ſurfaces at right angles to each other at Weſtminſter-bridge, and make an acute angle at the Pont Royal of about 60 degrees; but of late the French terminate this angle by two cylindric ſurfaces, whoſe baſes are arcs 60 degrees, in all their new bridges.

128
Slope of the bridge on each ſide.

When the banks of the rivers are pretty high, the bridge is made quite level above, and all the arches of an equal width: but where they are low, or for the ſake of navigation a large arch is made in the middle of the ſtream, then the bridge is made higher in the middle than at the ends: in this caſe, the ſlope muſt be made eaſy and gradual on both ſides, ſo as to form above one continued curve line, otherwiſe it appears diſagreeable to the eye. Mr Belidor will have the deſcent of that ſlope to be one twenty-fourth part of the length: but this is undoubtedly too much, as one-fiftieth part of the length is quite ſufficient for the deſcent.

129
Width, &c.

The width commonly allowed to ſmall bridges is 30 feet: but in large ones near great towns, theſe 30 feet are allowed clear for horſes and carriages, beſides a banquet at each ſide for foot paſſengers of 6 to 9 feet each, raiſed about a foot above the common road; the parapet-walls on each ſide are about 18 inches thick and 4 feet high: they generally project the bridge with a corniſh underneath; ſometimes balluſtrades of ſtone or iron are placed upon the parapet, as at Weſtminſter; but this is only practiſed where a bridge of a great length is made near the capital of a country.

The ends of bridges open from the middle of the two large arches with two wings, making an angle of 45 degrees with the reſt, in order to make their entrance more free and eaſy: theſe wings are ſupported by the ſame arches of the bridge next to them being continued in the manner of an arch, of which one pier is much longer than the other.

How the work is to be carried on.

130
Methods of laying the foundation

As the laying the foundation of the piers is the moſt difficult part of the whole work, it is neceſſary we ſhould begin with an eaſy caſe, that is, when the depth of the water does not exceed 6 or 8 feet; and then proceed to thoſe which may happen in a greater depth of water.

131
By batardeaus.

One of the abutments with the adjacent piers is incloſed by a dyke called *batardeau* by the French, of a ſufficient width for the work, and room for the workmen. This batardeau is made by driving a double row of piles, whoſe diſtance is equal to the depth of water, and the piles in each row are 3 feet from each other; they are faſtened together on the outſide by bonds of 6 by 4 inches: this being done, frames of about 9 feet wide are placed on the inſide to receive the boards which are to form the incloſure: the two uprights of theſe frames are two boards of an inch and half thick, ſharpened below to be driven into the ground, and faſtened together by double bonds, one below and the other above, each ſeparated by the thickneſs of the uprights; theſe bonds ſerve to ſlide the boards between: after theſe frames have been driven into the ground as hard as can be, then the boards themſelves are likewiſe driven in till they reach the firm ground underneath.

Between every two piles tie-beams are faſtened to the bonds of the piles, to faſten the inſide wall to the outſide one; theſe tie-beams are let into the bonds and bolted to the adjacent piles: this being done, the bottom is cleared from the looſe ſand and gravel, by a machine like thoſe uſed by ballaſt-heavers; and then well prepared clay is rammed into this coffer very tight and firm, to prevent the water from oozing through.

Sometimes theſe incloſures are made with piles only driven cloſe to each other; at others, the piles are notched or dove-tailed one into the other; but the moſt uſual method is to drive piles with grooves in them, 5 or 6 feet diſtant from each other, and boards are let down between them.

This being done, pumps and other engines are uſed to draw the water out of the incloſures, ſo as to be quite dry; then the foundation is dug, and the ſtones are laid with the uſual precautions, obſerving to keep ſome of the engines always ſtanding, in order to draw out the water that may ooze through the batardeau.

The foundation being cleared, and every thing ready to begin the work, a courſe of ſtones is laid; the outſide all round with the largeſt ſtretchers and headers that can be had, and the inſide filled with aſhlers well jointed, the whole laid in terraſs mortar: the facings are crampt together, and ſet in lead; and ſome cramps are alſo uſed to faſten the facings with the inſide. The ſame manner is to be obſerved throughout all the courſes to the height of low-water mark; after which the facings alone are laid in terraſs mortar, and the inſide with the beſt of the common ſort. When the foundation is carried to the height of low-water mark, or to the height where the arches begin, then the ſhaft or middle wall is to be carried up nearly to the height of the arches, and there left ſtanding till all the piers are finiſhed, in order that the maſonry may be ſufficiently dry and ſettled before the arches are begun.

132
Proper form of the baſe.

As the piers end generally with an arch at each end, it is cuſtomary to lay the foundation in the ſame manner: which is not ſo well as to continue the baſe rectangular quite to the ends of the piers, and as high as low-water mark; both becauſe the foundation becomes then ſo much broader, and alſo becauſe the water will not be able to get under it: for when the current ſets againſt a flat ſurface, it drives the ſand and mud againſt it ſo as to cover it entirely; whereas if a ſharp edge be preſented to the ſtream, it carries every thing away, and expoſes the foundation to the continual action of the water, which in courſe of time muſt deſtroy it.

After the intervals between the arches are filled up with ſtones laid in a regular manner without mortar, and the gravel is laid over them; two drains or gutters are to be made lengthwiſe over the bridge, one on each ſide next to the foot-path, about 6 feet wide and a foot deep; which being filled with ſmall pebble ſtones, ſerve to carry off the rain-water that falls on the bridge, and to prevent its filtering through the joints of the arches, as often happens.

133
Method of building with coffers, as was practiſed at Weſtminſter bridge.

The former method of laying the foundation by means of batardeaus is very expenſive, and often meets with great difficulties: for when the depth of water is 8 feet or more, it is ſcarcely poſſible to make the batardeaus ſo tight as to prevent the water from oozing through them; and in that caſe the number of engines required, as well as the hands to work them, become very extenſive; and if part of the batardeau ſhould break by ſome extraordinary wind or tide, the workmen would be expoſed to very great danger.

The next and beſt method therefore is to build with coffers, when it is practicable, ſuch as were uſed at Weſtminſter bridge. Here the height of water was 6 feet at a medium when loweſt, and the tide roſe about 10 feet at a medium alſo: ſo that the greateſt depth of water was about 16 feet. At the place where one of the piers of the middle or great arch was to be, the workmen began to drive piles of about 13 or 14 inches ſquare, and 34 feet long, ſhod with iron, ſo as to enter into the gravel with more eaſe, and hooped above to prevent their ſplitting in driving them: theſe piles were driven as deep as could be done, which was 13 or 14 feet below the ſurface of the bed of the river, and 7 feet diſtant from each other, parallel to the ſhort ends of the pier, and at about 30 feet diſtant from them: the number of theſe piles was 34, and their intent to prevent any veſſels or barges from approaching the work; and in order to hinder boats from paſſing between them, booms were placed ſo as to riſe and fall with the water.

This being done, the ballaſt-men began to dig the foundation under the water, of about 6 feet deep, and 5 wider all round than the intended coffer was to be, with an eaſy ſlope to prevent the ground from falling in: in order to prevent the current from waſhing the ſand into the pit, ſhort grooved piles were driven before the two ends and part of the ſides, not above 4 feet higher than low-water mark, and about 15 feet diſtant from the coffer: between theſe piles rows of boards were let into the groves down to the bed of the river, and fixed there.

The bottom of the coffer was made of a ſtrong grate, conſiſting of two rows of large timbers, the one longwiſe, and the other croſswiſe, bolted together with wooden trunnels ten feet wider than the intended foundation. The ſides of the coffer were made of fir timbers laid horizontally cloſe one over another, pinned with oaken trunnels, and framed together at the corners, excepting at the two ſaliant angles, where they were ſecured with proper irons, ſo that the one-half might be looſened from the other if it ſhould be thought neceſſary; theſe ſides were lined on the inſide as well as on the outſide with three-inch planks placed vertically; the thickneſs of thoſe ſides was 18 inches at the bottom, reduced to 15 above, and they were 16 feet high; beſides, knee timbers were bolted at the angles, in order to ſecure them in the ſtrongeſt manner. The ſides were faſtened to the bottom by 28 pieces of timber on the outſide, and 18 within, called *ſtraps*, about 8 inches broad, and 3 or four inches thick, reaching and lapping over the ends of the ſides: the lower part of theſe ſtraps had one ſide cut dove-tail faſhion, in order to fit the mortiſes made near the edge of the bottom to receive them, and were kept in their places by iron wedges, which being drawn out when the ſides were to be taken away, gave liberty to clear the ſtraps from the mortiſes.

Before the coffer was launched, the foundation was examined, in order to know whether it was level; for which purpoſe ſeveral gauges were made, each of which conſiſted of a ſtone of about 15 inches ſquare and three thick, with a wooden pole in the middle of about 18 feet long. The foundation being levelled and the coffer fixed directly over the place with cables faſtened to the adjacent piles, the maſons laid the firſt courſe of the ſtones for the foundation within it; which being finiſhed a ſluice made in the ſide was opened near the time of low water; on which the coffer ſunk to the bottom; and if it did not ſet level, the ſluice was ſhut, and the water pumped out, ſo as to make it float till ſuch time as the foundation was levelled: then the maſons crampt the ſtones of the firſt courſe, and laid a ſecond; which being likewiſe crampt, a third courſe was laid: then the ſluice being opened again, proper care was taken that the coffer ſhould ſettle in its due place. The ſtone-work being thus raiſed to within two feet of the common low-water mark, about two hours before low-water the ſluice was ſhut, and the water pumped out ſo far as that the maſons could lay the next courſe of ſtone, which they continued to do till the water was riſen ſo high as to make it unſafe to proceed any farther: then they left off the work, and opened the ſluice to let in the water. Thus they continued to work night and day at low-water, till they had carried their work ſome feet higher than the low-water mark: after this, the ſides of the coffer were looſened from the bottom, which made them float; and then were carried aſhore to be fixed to another bottom, in order to ſerve for the next pier.

It muſt be obſerved, that the coffer being no higher than 16 feet, which is equal to the greateſt depth of water, and the foundation being 6 feet under the bed of the river; the coffer was therefore 6 feet under water when the tide was in; but being loaded with three courſes of ſtones, and well ſecured with ropes faſtened to the piles, it could not move from its place. By making it no higher, much labour and expence were ſaved: yet it anſwered the intent full as well as if it had been high enough to reach above the higheſt flood.

The pier being thus carried on above low-water mark, the maſons finiſhed the reſt of it during the intervals of the tides in the uſual way; and after all the piers and abutments were finiſhed in a like manner, the arches were begun and completed as mentioned before: the whole bridge was built in about ſeven years, without any accidents happening either in the work or to the workmen, which is ſeldom the caſe in works of this nature.

134
Materials employed.

It may be obſerved, that all the piers were built with ſolid Portland ſtone, ſome of which weighed four tons. The arch-ſtones were likewiſe of the ſame ſort: but the reſt of the maſonry was finiſhed with Kentiſh *rag-ſtones*; and the paths for foot paſſengers were paved with *purbec*, which is the hardeſt ſtone to be had in England, excepting Plymouth marble.

135
This method ſometimes impracticable.

This method of building bridges is certainly the eaſieſt and cheapeſt that can be thought of, but cannot be uſed in many caſes: when the foundation is ſo bad as not to be depended upon without being piled, or the depth of water is very great, with a ſtong current and no tide, it cannot then be practiſed. For if piles are to be uſed, it will be next to impoſſible to cut them off in the ſame level five or ſix feet below the bed of the river, notwithſtanding that ſaws have been invented for that purpoſe: becauſe if they are cut off ſeparately, it will be a hard matter to do it ſo nicely that the one ſhall not exceed the other in height; and if this is not done, the grating or bottom of the coffer will not be equally ſupported, whereby the foundation becomes precarious: neither can they be cut off all together; for piles are to be driven as far as the bottom of the coffer extends, which at Weſtminſter bridge was 27 feet; the ſaw muſt have 3 feet play, which makes the total length of the ſaw 30 feet; now if either the water is deeper than it is there, or the arches are wider, the ſaw muſt ſtill be longer; ſo that this method is impracticable in any ſuch caſes.

In a great depth of water that has a ſtrong current and no tide, the coffers muſt reach above the water, which makes them very expenſive, and unwieldy to manage, as well as very difficult to be ſecured in their places, and kept ſteady: ſo that there is no probability of uſing them in ſuch a caſe.

136
Ruſſian method.

In ſome caſes, when there is a great depth of water, and the bed of the river is tolerably level, or where it can be made ſo by any contrivance, a very ſtrong frame of timber about four times as large as the baſe of the piers may be let down with ſtones upon it round the edges to make it ſink: after fixing it level, piles muſt be driven about it to keep it in its place; and then the foundation may be laid in coffers as before, which are to be kept ſteady by means of ropes tied to the piles.

This method has frequently been uſed in Ruſſia; and though the bed of the river is not very ſolid, yet ſuch a grate, when once well ſettled with the weight of the pier upon it, will be as firm as if piles had been driven under the foundation; but to prevent the water from gulling under the foundation, and to ſecure it againſt all accidents, a row of dove-tail piles muſt be driven quite round the grating: this precaution being taken, the foundation will be as ſecure as any that can be made.

137
French method.

The French engineers make uſe of another method in raiſing the foundations of maſonry under water; which is, to drive a row of piles round the intended place, nearer to, or farther from, each other, according as the water is more deep or ſhallow: theſe piles, being ſtrongly bound together in ſeveral places with horizontal tie-beams, ſerve to ſupport a row of dove-tail piles driven within them: when this is done, and all well ſecured according to the nature of the ſituation and circumſtances, they dig the foundation by means of a machine with ſcoops, invented for that purpoſe, until they come to a ſolid bed of gravel or clay; or if the bed of the river is of a ſoft conſiſtence to a great depth, it is dug only to about ſix feet, and a grate of timber is laid upon it, which is well ſecured with piles driven into the oppoſite corners of each ſquare, not minding whether they exceed the upper ſurface of the grate much or little.

When the foundation is thus prepared, they make a kind of mortar called *beton*, which conſiſts of twelve parts of pozolano or Dutch terraſs, ſix of good ſand, nine of unſlacked lime, the beſt that can be had, thirteen of ſtone ſplinters not exceeding the bigneſs of an egg, and three parts of tile-duſt, or cinders, or elſe ſcales of iron out of a forge: this being well worked together muſt be left ſtanding for about 24 hours, or till it becomes ſo hard as not to be ſeparated without a pick-ax.

This mortar being thus prepared, they throw into the coffer a bed of ruble-ſtone, not very large, and ſpread them all over the bottom as nearly level as they can; then they ſink a box full of this hard mortar, broken into pieces, till it comes within a little of the bottom; the box is ſo contrived as to be overſet or turned upſide down at any depth; which being done, the pieces of mortar ſoften, and ſo fill up the vacant ſpaces between the ſtones; by theſe means they ſink as much of it as will form a bed of about 12 inches deep all over; then they throw in another bed of ſtone, and continue alternately to throw one of mortar and one of ſtone till the work approaches near the ſurface of the water where it is levelled, and then the reſt is finiſhed with ſtones in the uſual manner.

Mr Belidor ſays, in the ſecond part of his Hydraulics, vol. ii. p. 188, that Mr Millet de Montville having filled a coffer containing 27 cubit feet, with maſonry made of this mortar, and ſunk it into the ſea, it was there left ſtanding for two months, and when it was taken out again it was harder than ſtone itſelf.

138
Impoſſibility of building bridges in ſome caſes.

We have hitherto mentioned ſuch ſituations only where the ground is of a ſoft nature: but where it is rocky and uneven, all the former methods prove ineffectual; nor indeed has their yet been any one propoſed which can be always uſed upon ſuch occaſions, eſpecially in a great depth of water. When the water is not ſo deep but that the unevenneſs of the rock can be perceived by the eye, piles ſtrongly ſhod with iron may be raiſed and let fall down, by means of a machine, upon the higher parts, ſo as to break them off piece by piece, till the foundation is tolerably even, eſpecially when the rock is not very hard; which being done, either this or any other way that can be thought of, a coffer is made without any bottom, which is let down and well ſecured, ſo as not to move from its place: to make it ſink, heavy ſtones ſhould be fixed on the outſide; then ſtrong mortar and ſtones muſt be thrown into it; and if the foundation is once brought to a level, large hewn ſtones may be let down ſo as to lie flat and even: by theſe means the work may be carried on quite up to the ſurface of the water. But when the water is ſo deep, or the rock ſo hard as not to be levelled, the foundation muſt be ſounded, ſo as to get nearly the riſings and fallings; then the lower part of the coffer muſt be cut nearly in the ſame manner, and the reſt finiſhed as before. It muſt however be obſerved, that we ſuppoſe a poſſibility of ſinking a coffer; but where this cannot be done, no method that we know of will anſwer.

139
Trajan's bridge over the Danube deſcribed.

Among the aquatic buildings of the ancients none appears to have been more magnificent than Trajan's bridge. Dion Caſſius gives the following account of it: "Trajan built a bridge over the Danube, which in truth one cannot ſufficiently admire; for though all the works of Trajan are very magnificent, yet this far exceeds all the others: the piers were 20 in number, of ſquare ſtones; each of them 150 feet high above the foundation, 60 feet in breadth, and diſtant from one another 170 feet. Though the expence of this work muſt have been exceeding great, yet it becomes more extraordinary by the rivers being very rapid, and its bottom of a ſoft nature: where the bridge was built, was the narroweſt part of the river thereabout, for in moſt others it is double or treble this breadth; and although on this account it became ſo much the deeper and the more rigid, yet no other place was ſo ſuitable for this undertaking. The arches were afterwards broken down by Adrian; but the piers are ſtill remaining, which ſeem as it were to teſtify that there is nothing which human ingenuity is not able to effect." The whole length then of this bridge was 1590 yards; ſome authors add, that it was built in one ſummer, and that Apollodorus of Damaſcus was the architect, who left behind him a deſcription of this great work.

140 Wooden bridges.

Where ſtone bridges cannot be erected on account of the expence, very ſtrong and durable ones may be conſtructed of wood: in which caſe they ought to be ſo framed, as that all the parts may preſs upon one another like the arch of a ſtone bridge; and thus, inſtead of being weakened by great weights paſſing over them, they will become the ſtronger. How this is to be accompliſhed, will be better underſtood from the figure at bottom of Plate LIII. which repreſents a wooden bridge conſtructed after this manner, than it can be by any deſcription.

2. Of Harbours.

141 Situation proper for harbours.

In theſe, the firſt thing to be conſidered is the ſituation; which may be ſome large creek or baſon of water, in or near the place where the harbour is intended to be made, or at the entrance of a large river, or near the ſea: for a harbour ſhould never be dug entirely out of dry land, unleſs upon ſome extraordinary occaſions, where it is impoſſible to do otherwiſe, and yet a harbour is abſolutely neceſſary. When a proper place is found, before it is fixed upon, it muſt be conſidered whether ſhips can lie there ſafe in ſtormy weather, eſpecially when thoſe winds blow which are moſt dangerous upon that coaſt; whether there be any hills, riſing ground, or high buildings, that will cover it; in theſe caſes, the ſituation is very proper: but if there be nothing already that will cover the ſhips, it muſt be obſerved whether any covering can be made at a moderate expence, otherwiſe it would be uſeleſs to build a harbour there.

The next thing to be conſidered is, whether there be a ſufficient depth of water for large ſhips to enter with ſafety, and lie there without touching the ground; and if not, whether the entrance and inſide might not be made deeper at a moderate expence: or, in caſe a ſufficient depth of water is not to be had for large ſhips, whether the harbour would not be uſeful for ſmall merchantmen; for ſuch a one is often of great advantage, when ſituated upon a coaſt much frequented by ſmall coaſting veſſels.

The form of the harbour muſt be determined in ſuch a manner, that the ſhips which come in when it is ſtormy weather may lie ſafe, and ſo as there may be ſufficient room for as many as paſs that way: the depths of water where the piers are to be built muſt be taken at every 10, 15, or 20, feet diſtance, and marked upon piles driven here and there, in order that the workmen may be directed in laying the foundation.

142 Materials.

This being done, it muſt be conſidered what kind of materials are to be uſed, whether ſtone, brick, or wood. When ſtones are to be had at a moderate price, they ought to be preferred, becauſe the work will be much ſtronger, more laſting, and need fewer repairs, than if made with any other materials: but when ſtones are ſcarce, and the expence becomes greater than what is allowed for building the harbour, the foundation may be made of ſtone as high as low-water mark, and the reſt finiſhed with brick. If this manner of building ſhould ſtill be too expenſive, wood muſt be uſed; that is, piles are driven as cloſe as is thought neceſſary; which being faſtened together by croſs-bars, and covered with ſtrong oaken planks, form a kind of coffer, which is filled with all kinds of ſtones, chalk, and ſhingles.

143 French method of building.

The manner of laying the foundation in different depths of water, and in various ſoils, requires particular methods to be followed. When the water is very deep, the French throw in a great quantity of ſtones at random, ſo as to form a much larger baſe than would be required upon dry land; this they continue to within 3 or 4 feet of the ſurface of the water, where they lay the ſtones in a regular manner, till the foundation is raiſed above the water: they then lay a great weight of ſtones upon it, and let it ſtand during the winter to ſettle; as likewiſe to ſee whether it is firm, and reſiſts the force of the waves and winds: after that, they finiſh the ſuperſtructure with large ſtones in the uſual manner.

144 A preferable one.

As this method requires a great quantity of ſtones, it can be practiſed only in places where ſtones are in plenty; and therefore the following one is much preferable. A coffer is made with dove-tail piles of above 30 yards long, and as wide as the thickneſs of the foundation is to be; then the ground is dug and levelled, and the wall is built with the beſt mortar.

As ſoon as the mortar is tolerably dry, thoſe piles at the end of the wall are drawn out, the ſide-rows are continued to about 30 yards farther, and the end incloſed; then the foundation is cleared, and the ſtones laid as before. But it muſt be obſerved, that the end of the foundation finiſhed is left rough, in order that the part next to it may incorporate with it in a proper manner: but if it is not very dry, it will incline that way of itſelf, and bind with the mortar that is thrown in next to it: this method is continued till the whole pier is entirely finiſhed.

It muſt likewiſe be obſerved, that the piers are not made of one continued ſolid wall; becauſe in deep water it would be too expenſive: for which reaſon, two walls are built parallel to each other, and the interval between them is filled up with ſhingles, chalk, and ſtone. As theſe walls are in danger of being thruſt out or overſet, by the corps in the middle, together with the great weight laid at times on the peir, they are tied or bound together by croſs-walls at every 30 or 40 yards diſtance, by which they ſupport each other in a firm and ſtrong manner.

In a country where there is a great plenty of ſtones, piles may be driven in as deep as they will go, at about two or three feet diſtance; and when the foundation is ſunk and levelled, large ſtones may be let down, which will bed themſelves: but care muſt be taken to lay them cloſe, and ſo as to have no two joints over each other; and when the wall is come within reach, the ſtones muſt be crampt together.

145 Another method with coffers.

Another method practiſed, is to build in coffers much after the ſame manner as has been done in building the piers of Weſtminſter bridge; but as in this caſe the ends of the coffers are left in the wall, and prevent their joining ſo well as to be water-tight, the water that penetrates through and enters into the corps may occaſion

ſion the wall to burſt and to tumble down. Another inconveniency ariſing from this manner of building is, that as there are but few places without worms, which will deſtroy wood where-ever they cand find it; by their means the water is let into the pier, and conſequently makes the work liable to the ſame accident as has been mentioned above.

149 Ruſſian method. To prevent theſe inconveniences, the beſt method is, to take the wood away, and joggle the ends of the walls together with large ſtones, pouring terraſs-mortar into the joints; when this is done, the water between the two walls may be pumpt out, and the void ſpace filled up with ſtone and ſhingle as uſual: or if theſe joggles cannot be made water-tight, ſome dove-tail piles muſt be driven at each end as cloſe to the wall as can be done, and ſtrong ſail-cloth put on the outſide of them, which, when the water is pumpt out, will ſtick ſo cloſe to the piles and wall, that no water can come in. This method is commonly uſed in Ruſſia.

147 Thickneſs of piers. The thickneſs of a pier depends on two conſiderations: it ought to be both ſuch as may be able to reſiſt the ſhock of the waves in ſtormy weather; and alſo to be of a ſufficient breadth above, that ſhips may be laden or unladen whenever it is thought neceſſary. Now, becauſe the ſpecific gravity of ſea-water is about one half that of brick, and as 2 to 5 in compariſon of ſtone; and ſince the preſſure of ſtagnated water againſt any ſurface is equal to the weight of the priſm of water whoſe altitude is the length of that ſurface, and whoſe baſe is a right angled iſoſceles triangle, each of the equal ſides being equal to the depth of the water; therefore a pier built with bricks, whoſe thickneſs is equal to the depth of the water, will weigh about four times as much as the preſſure of the water againſt it; and one of ſtone of the ſame breadth, about ſix times and a quarter as much. Now this is not the force to be conſidered, ſince this preſſure is the ſame within as without the pier: but it is that force with which the waves ſtrike againſt the piers, and that depends on the weight and velocity of the waves, which can hardly be determined; becauſe they vary according to the different depths of water, the diſtance from the ſhore, and according to the tides, winds, and other cauſes. Conſequently the proper thickneſs of the piers cannot be determined by any other means than by experience.

Practitioners ſuppoſe, that if the thickneſs of a pier is equal to the depth of the water, it is ſufficient; but for a greater ſecurity they allow 2, 3, or 4 feet more. This might probably do, if piers were built with ſolid ſtones crampt together; but as this is hardly ever the caſe, and on the contrary, as the inſide is filled up with ſhingle, chalk, or other looſe materials, their rule is not to be depended upon: beſides it makes the ſpace above too narrow for lading and unlading the ſhips, unleſs in a great depth of water; ſo that it does not appear that the method can be followed, excepting in a very few caſes where the water has but very little motion.

When ſtone can be had, no other materials ſhould be uſed, becauſe they being of a larger bulk than brick, will better reſiſt the waves by their own weight, till ſuch time as the mortar is grown hard; for after this is effected, brick will reſiſt better againſt the action of ſea-water than ſoft ſtones.

The wall muſt be built with terraſs mortar from the bottom to the height of low-water mark, and the reſt finiſhed with cinder or tile-duſt mortar, which has been found ſufficiently good in thoſe places where the wall is wet and dry alternately. The upper part of the pier ſhould be paved with flat hewn ſtones laid in ſtrong mortar, in order to prevent any water from penetrating into it: iron rings ought alſo to be fixed here and there at proper diſtances, to faſten the ſhips, and prevent them from ſtriking againſt the pier when agitated by the waves.

Wooden fenders or piles ſhould be driven at the inſide cloſe to the wall, and crampt to it with iron, to prevent the ſhips from touching them, and from being worn by the continual motion. Where the ſea breaks againſt the piers with great violence, breakers ſhould be made at proper diſtances; that is, two rows of piles are driven nearly at right angles to the piers for the length of about 12 or 15 feet, and at about 8 or 10 feet diſtant from each other; and then another to join the two former: theſe piles being covered with planks, and the inſide being filled with ſhingle and ruble-ſtones, then the top is paved with ſtones of about a foot in length, ſet long-wiſe to prevent the waves from tearing them up. This precaution is abſolutely neceſſary where the water ruſhes in very ſtrongly.

Military ARCHITECTURE, the ſame with what is otherwiſe called *fortification*. See FORTIFICATION.

Naval ARCHITECTURE, the art of building ſhips. See *Ship-Building*.

ARCHITRAVE, in architecture, that part of a column which lies immediately upon the capital, being the loweſt member of the entablature. See Plate XXXVII.

Over a chimney, this member is called the *mantle-piece*; and over doors or windows, the *hyperthyron*.

ARCHITRICLINUS, in antiquity, the maſter or director of a feaſt, charged with the order and œconomy of it, the covering and uncovering of the tables, the command of the ſervants, and the like.

The architriclinus was ſometimes called *ſervus triclinarcha*, and by the Greeks ϖρογευστης, i. e. *prægustator*, or *fore-taſter*. Potter alſo takes the architriclinus for the ſame with the ſympoſiarcha.

ARCHIVAULT, in architecture, implies the inner contour of an arch, or a band adorned with mouldings, running over the faces of the arch-ſtones, and bearing upon the impoſts. It has only a ſingle face in the Tuſcan order, two faces crowned in the Doric and Ionic, and the ſame mouldings as the architrave in the Corinthian and Compoſite.

ARCHIVE, or ARCHIVES, a chamber or apartment wherein the records, charters, and other papers and evidences, of a ſtate, houſe, or community, are preſerved, to be conſulted occaſionally.

We ſay, the *archives* of a college, of a monaſtery, &

&c. The archives of ancient Rome were in the temple of Saturn; the archives of the court of chancery are in the rolls office.

ARCHIVIST, Archiviſta, a keeper of an archive.

Under the emperors, the archiviſt was an officer of great dignity, held equal to the proconſuls, veſted with the quality of a count, ſtyled *clariſſimus*, and exempted from all public offices and taxes. Among the ancient Greeks and Perſians, the truſt was committed to none but men of the firſt rank; among the Franks, the clergy being the only men of letters, kept the office among themſelves.—Since the erection of the electoral college, the Archbiſhop of Mentz has had the direction of the archives of the empire.

ARCHMARSHAL, the grand marſhal of the empire, a dignity belonging to the elector of Saxony.

ARCHONS, in Grecian antiquity, were magiſtrates appointed after the death of Codrus[*]. They were choſen from the moſt illuſtrious families till the time of Ariſtides, who got a law paſſed, by which it was enacted, that, in electing theſe magiſtrates, leſs regard ſhould be paid to birth than to merit.

The tribunal of the archons was compoſed of nine officers. The firſt was properly the *archon;* by whoſe name the year of his adminiſtration was diſtinguiſhed. The title of the ſecond was *king;* that of the third, *polemarchus:* to theſe were added ſix *theſmothetæ*. Theſe magiſtrates, elected by the ſcrutiny of beans, were obliged to prove, before their reſpective tribes, that they had ſprung, both in their father's and their mother's ſide, for three deſcents, from citizens of Athens. They were likewiſe to prove that they were attached to the worſhip of Apollo, the tutelary god of their country; that they had in their houſe an altar conſecrated to Apollo; and that they had been reſpectfully obedient to their parents; an important and ſacred part of their character, which promiſed that they would be faithful ſervants to their country. They were likewiſe to prove, that they had ſerved in a military capacity the number of years which the republic required of every citizen: and this qualification gave the ſtate experienced officers; for they were not allowed to quit the army till they were 40 years old. Their fortune too, of which they were to inform thoſe before whom they were examined, was a warrant for their fidelity.

After the commiſſioners, who were appointed to inquire into their character and other requiſites, had made a report of them, they were then to ſwear that they would maintain the laws; which obligation if they neglected, they engaged to ſend to Delphi a ſtatue of the weight of their bodies. According to a law of Solon, if an archon got drunk, he was condemned to pay a heavy fine, and ſometimes even puniſhed with death. Such magiſtrates as the Athenian archons were well intitled to reſpect. Hence it was eternal infamy to inſult them; and hence Demoſthenes obſerved, that to treat the theſmothetæ with diſreſpect, was to ſhow diſreſpect to the republic.

Another qualification indiſpenſibly required of the ſecond officer of this tribunal, who was called the *king*, was, that he had married the daughter of an Athenian citizen, and that he had eſpouſed her a virgin. This was exacted of him, ſays Demoſthenes, becauſe part of his duty was to ſacrifice to the gods jointly with his wife, who, inſtead of appeaſing, would have irritated them, if ſhe had not poſſeſſed both thoſe honours.

The inquiry into the private title of the nine archons was very ſevere; and this attention was the more neceſſary, as they had a right to take a ſeat in the Areopagus, after they had quitted their office, and given an account of their adminiſtration.

When any obſcurity occurred in the laws relative to religion and the worſhip of the gods, the interpretation was ſubmitted to the tribunal of the archons.

Ariſtotle obſerves, that Solon, whoſe aim was to make his people happy, and who found their government in his time ariſtocratical, by the election of the nine archons, who were annual magiſtrates, tempered their power, by eſtabliſhing the privilege of appealing from them to the people, called by lot to give their ſuffrage, after having taken the oath of the Heliaſtæ, in a place near the Panathenæum, where Hiſſus had formerly calmed a ſedition of the people, and bound them to peace by an oath.

The archons were the principal officers, not only in civil, but likewiſe in ſacred matters, and eſpecially in the myſteries of Bacchus. The archons, however, who were ſurnamed *eponymi*, were chiefly employed in civil affairs; yet they preſided at the great feaſts, and held the firſt rank there. Hence they are ſometimes ſtyled *prieſts*.

Archon is alſo applied by ſome authors to divers officers, both civil and religious, under the eaſtern or Greek empire. Thus biſhops are ſometimes called *archontes;* and the ſame may be ſaid of the lords of the emperor's court. We alſo read of the *archon of the antimenſia, archon of archons, grand archon, archon of churches, archon of the goſpel, archon of the walls, &c.*

ARCHONTICI, in church-hiſtory, a branch of Valentinians, who maintained that the world was not created by God, but by angels called *Archontes*.

ARCHPRIEST, Archpreſbyter, a prieſt or preſbyter eſtabliſhed in ſome dioceſes, with a pre-eminence over the reſt. Anciently the archprieſt was the firſt perſon after the biſhop: he was ſeated in the church next after the biſhop; and even acted as his vicar, in his abſence, as to all ſpiritual concerns. In the ſixth century, there were found ſeveral archprieſts in the ſame dioceſe; from which time ſome will have them to have been called *deans*. In the ninth century, they diſtinguiſhed two kinds of cures or pariſhes: the ſmaller governed by ſimple prieſts; and the baptiſmal churches by archprieſts; who, beſide the immediate concern of the cure, had the inſpection of the other inferior prieſts, and gave an account of them to the biſhop, who governed the chief, or cathedral church, in perſon. There are archpreſbyters ſtill ſubſiſting in the Greek church; veſted with moſt of the functions and privileges of the chorepiſcopi or rural deans.

ARCHTREASURER, the great treaſurer of the German empire. This office was created with the eighth electorate, in favour of the elector Palatine, who had loſt his former electorate, which was given to the duke of Bavaria, by the emperor Ferdinand II. who took it away from Frederic V. elector Palatine, after the battle of Prague, where he was defeated in maintaining his election to the crown of Bohemia. The dignity of archtreaſurer was conteſted between the elector of Brunſwick, who claimed it in virtue of his deſcent from the elector of Frederic and the elector Palatine.

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[*] See the article *Attica*.

ARCHILUTE, Arcileuto, a long and large lute, having its baſs ſtrings lengthened after the manner of the theorbo, and each row doubled, either with a little octave or an uniſon. It is uſed by the Italians for playing a thorough baſs.

ARCHYTAS of Tarentum, a philoſopher of the Pythagorean ſect, and famous for being the maſter of Plato, Eudoxas, and Philolaus, lived about 408 years before Chriſt. He was an excellent mathematician, particularly in that part of the ſcience which regards mechanics: he is ſaid to have made a wooden pigeon that could fly, and to be the firſt that brought down mathematics to common uſes. He is ſaid to be the inventor of the ten categories. He aſſerted, that God was the beginning, the ſupporter, and the end, of all things. There are two epiſtles preſerved in Diogenes Laertius, one from Archytas to Plato, and another from Plato to Archytas. He acquired great reputation in his legiſlative capacity. He likewiſe commanded the army ſeven times, and was never defeated; but was at laſt caſt away in the Adriatic Sea, and thrown upon the coaſt of Apulia.

ARCIS-SUR-AUBE, a ſmall handſome town of France, in Champaigne, ſeated on the river Aube. E. Long. 4. 15. N. Lat. 48. 40.

ARCO, a ſtrong town and caſtle in the Trentin, belonging to the houſe of Auſtria. It was taken by the French in 1703, and abandoned ſoon after. It ſtands on the river Sarca, near the north extremity of the lake Garda. E. Long. 9. 55. N. Lat. 45. 52.

ARCONA, a ſtrong town ſituated on the iſland of Rugen in the Baltic. It ſtood on a high promontory, with the eaſt, north, and ſouth ſides defended by ſteep and lofty precipices, and the weſt by a wall fifty feet high, proportionably thick, and ſecured by a deep and broad ditch. It was, however, taken and ruined, in 1168, by Valdemar king of Denmark. One of the conditions impoſed by the conquerer was, that the inhabitants ſhould deſtroy a temple they had erected to St Vitus, and deliver up the vaſt treaſure belonging to this tutelary ſaint. Another was, that they ſhould pay 40 ſilver yokes for oxen, by way of tribute, and enter as ſoldiers in the Daniſh ſervice when called upon.

ARCOS, a ſtrong city of Andaluſia, in Spain, ſeated on a high craggy rock, at the bottom of which runs the Gaudeleto. Its ſtrength lies not only in its ſituation, but in the works erected for its defence, and it is inacceſſible on every ſide but one. The governor reſides in an old caſtle, from whence there is a delightful proſpect, which extends very far into the neighbouring country. W. Long. 2. 10. N. Lat. 36. 40.

ARCTIC, in aſtronomy, an epithet given to the north pole, or the pole raiſed above our horizon. It is called the *arctic pole*, on occaſion of the conſtellation of the little bear, in Greek called *αρκτος*; the laſt ſtar in the tail whereof nearly points out the north pole.

Arctic Circle is a leſſer circle of the ſphere, parallel to the equator, and 23° 30′ diſtant from the north pole; from whence its name. This, and its oppoſite, the *antarctic*, are called the two *polar circles*; and may be conceived to be deſcribed by the motion of the poles of the ecliptic, round the poles of the equator, or of the world.

ARCTIUM, Burdock: A genus of the polygamia æqualis order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ-capitatæ*: The calyx is globular; with ſcales having hooks reflected at the tops.—The ſpecies are three, viz. the lappa or common burdock, the tomentoſum, and the perſonata. All theſe are troubleſome weeds, ſo require no direction for their culture. The tender ſtems of the common kind, deprived of the bark, may be boiled and eat like aſparagus. When raw, they are good with oil and vinegar. Boys catch bats by throwing the prickly heads of this ſpecies up into the air. Cows and goats eat this herb; ſheep and horſes refuſe it; ſwine are not fond of it. The ſeeds, which have a bitteriſh ſubacrid taſte, are recommended as very efficacious diuretics, given either in the form of emulſion, or in powder to the quantity of a dram. The roots, which taſte ſweetiſh, with a ſlight auſterity and bitteriſhneſs, are eſteemed aperient, diuretic, and ſudorific; and ſaid to act without irritation, ſo as to be ſafely ventured upon in acute diſorders.

ARCTOPHYLAX, (from *αρκτος*, *bear*, and *φυλαττω*, *I guard*,) in aſtronomy, a conſtellation, otherwiſe called *Bootes*.

ARCTOPUS, in botany: A genus of the polygamia diœcia claſs; and in the natural method ranking under the 45th order, *Umbellatæ*. The umbella of the male is compound; the involucrum conſiſts of five leaves; the corolla has five petals; the ſtamina are five; and two piſtilli: The umbella of the hermaphrodite is ſimple; the involucrum is divided into four parts, is ſpinous, large, and contains many male flowers in the diſk. There is but one ſpecies of arctopus, viz. the echinatus, a native of Ethiopia.

ARCTOTIS, in botany: A genus of the polygamia neceſſaria order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ-diſcoides*. The receptacle is briſtly; the corona of the pappus is pentaphyllous; and the calyx is imbricated with ſcales looſe at the top. It is commonly called *anemoſpermos*, from the reſemblance of its ſeeds to thoſe of the anemone. The ſpecies are 11; all of them natives of Ethiopia, or the Cape of Good Hope. Of theſe the anguſtifolia with ſpear-ſhaped leaves, and the aſpera with wing-ſhaped woolly leaves, are moſt remarkable for their beauty, having rays of a fine yellow or deep gold colour. They flower in May and June.

Culture. All the ſpecies of arctotis, may be propagated by cuttings; which ſhould be frequently renewed, as the old plants are ſubject to decay in winter. They may be planted in any of the ſummer months, in a bed of light freſh earth; obſerving to ſhade them from the ſun until they have taken root. They ſhould be expoſed to the open air until the latter end of October, or longer, if the weather is favourable, when they muſt be removed into the green-houſe.

ARCTURUS, in aſtronomy, a fixed ſtar, of the firſt magnitude, in the conſtellation of Arctophylax, or Bootes. The word is formed of *αρκτος*, *bear*, and *ȣρα*, *tail*; q. d. *bear's tail*, as being very near it. This ſtar was known to the ancients, as in the following verſe of Virgil:

Arcturum, Pluviaſque Hyades, geminoſque Triones.

See Alſo Job ix. 9. xxxviii. 32.

ARCUATION, in gardening, the method of raiſing trees by layers, which is done in the following manner:

Strong mother-plants or ſtools muſt be planted in a clear border, and in a ſtraight line, about ſix feet aſunder. When theſe have ſhot five or ſix main branches from the root, and as many collateral branches, the former muſt be bent to the ground, and there faſtened. The ſmall branches muſt be covered three inches deep upon the joints, and have a large baſon of earth made round them to hold the water.

About the middle of September they may be opened, and, if they have taken root, may be immediately removed into the nurſery; but if they have not ſufficiently extended their roots, they muſt be ſuffered to remain till the ſpring, and then tranſplanted.

ARCUCCIO, ARCUTIO, a machine made of a board, covered with pieces of hoops, like the tilt of a waggon; uſed in Italy to prevent children from being overlaid and ſmothered by nurſes or others. Every nurſe in Florence is obliged to lay her child in an arcutio, under pain of excommunication.

ARDAMON, or ARDAMA, in antiquity, a veſſel of water placed at the door of a perſon deceaſed, till the time of burial, as a token that the family was in mourning, and to ſerve to ſprinkle and purify perſons as they came out of the houſe.

ARDASSES, in commerce, the coarſeſt of all the ſilks of Perſia; and as it were the refuſe of each kind. In this ſenſe they ſay, the *legis*, the *houſets*, the *chouſs*, and the *payas ardaſſes*, to ſignify the worſt of thoſe four ſorts of Perſian ſilks.

ARDASSINES, in commerce, called in France *ablaques*; a very fine ſort of Perſian ſilks, little inferior in fineneſs to the ſourbaſtis, or rather cherbaſſis, and yet it is little uſed in the ſilk manufactures of Lyons and Tours, becauſe that kind of ſilk will not bear hot water in the winding.

ARDEA, in ornithology, a genus of the order of grallæ. The general characters of this order are theſe: The bill is ſtraight, ſharp, long, and ſomewhat compreſſed, with a furrow that runs from the noſtrils towards the point; the noſtrils are linear; and the feet have four toes. Under this genus Linnæus comprehends the grus or crane, the ciconia or ſtork, and the ardea or heron, of other authors. See Plates LV. LVI.

1. The firſt ſpecies is the pavonia, or crowned crane, which has an erect briſtly creſt, with the temples and two wattles naked. The head is black; the creſt is yellowiſh, and tipped with black at the top; the wings are white; and the feathers of the tail black, and of an equal length. It is a native of Africa, particularly the coaſt of Guinea, as far as Cape Verd; at this laſt place they are ſaid to be exceedingly tame, and will often come into the court-yards to feed with the poultry. Theſe birds are often kept in our menageries, and, with ſhelter of nights, live a good while. Their chief food is ſuppoſed to be worms, and ſuch other things as the heron tribe uſually feed on; alſo vegetables of all kinds. It often ſleeps on one leg; runs very faſt; and is ſaid not only to fly well, but to continue on the wing for a long time together. The fleſh is ſaid to be very tough.

2. The Virgo, with a ſtraight greeniſh bill and crimſon irides. The crown of the head is aſh-colour; the reſt of the head, the upper part of the neck behind, and all the under parts to the breaſt, black; the back, rump, and tail, and all the under part from the breaſt, are of a bluiſh aſh-colour: behind each eye ſprings a tuft of long white feathers, which decline downwards, and hang in an elegant manner: the quills and tail are black at the ends; the legs black. This ſpecies is found in many parts of Africa and Aſia, where they frequent marſhes and the neighbourhood of rivers, as their food is fiſh, like moſt of the heron genus. It is frequently kept in menageries, being endowed with great gentleneſs of manners, added to its being an elegant bird. At various times it puts itſelf into ſtrange and uncouth attitudes, eſpecially thoſe which imitate dancing; and Keyſler mentions one in the Great Duke's gallery at Florence, which had been taught to dance to a certain tune, when played or ſung to it. The name this bird is known by in the Eaſt is *kurki*, or *querky*. Sometimes it will breed in confinement: one is recorded to have lived 24 years at Verſailles, where it had been bred.

3. The leucogeranos of Pallas, or Siberian crane of Pennant, is four and a half feet when ſtanding erect. The bill is a red colour; the irides are white: the plumage as white as ſnow, except the 10 firſt greater quills, with the coverts of them, which are black: the legs are long and red. This ſpecies inhabits the vaſt marſhes and lakes in Siberia, eſpecially thoſe about the Iſchim, and along the rivers Ob and Irtiſh. It makes its neſt among the reeds, ſeldom acceſſible by man, upon riſing green graſſy tufts, made up of herbs and graſs heaped together; and lays two aſh-coloured eggs, ſpotted with brown. They are ſhy birds, and always upon their guard againſt an enemy; having a centinel to warn them of an approach; on the leaſt alarm they cry aloud, not unlike the ſwan, and fly off directly. The ſportſman finds, in courſe, much difficulty in approaching them within gunſhot; for, as they ſtand near five feet high from the ground, they are enabled to eſpy him at a greater diſtance. Sometimes indeed he approaches them under cover of a ſtalking-horſe, or other object; at other times a ſmall dog will divert their attention, as they will without fear attack the dog, while his maſter gets within reach. In breeding time, however, they are more bold, as they will defend their young even againſt men, ſo as to make it dangerous to come near their haunts. The male and female are ſaid to guard their neſt by turns.

4. The grus, or common crane of Engliſh authors, has a naked papillous crown; the prime feathers of the wings are black; the body is aſh-coloured; the prime feathers of the tail are ragged. This ſpecies is far ſpread, being met with in great flocks throughout Northern Europe and Aſia; in Sweden, Ruſſia throughout, and Siberia as far as the river Anadyr, migrating even to the arctic circle. In Kamtſchatka they are only ſeen on the ſouthern promontory: are migratory, returning

northward to breed in the ſpring, and generally chooſing the ſame places which had been occupied by them the ſeaſon before. In the winter they inhabit the warmer regions, ſuch as Egypt, Aleppo, India, &c.: they are alſo met with at the Cape of Good Hope, changing place with the ſeaſon. In their migrations they frequently fly ſo high as not to be viſible; their paſſing only being known by the noiſe they make, which is louder than any other bird. In France they are ſeen in ſpring and autumn; but for the moſt part are mere paſſengers.—This ſpecies ſeems to have been formerly a native of Britain; as we find in Willoughby, page 52. that there was a penalty of twenty pence for deſtroying an egg of this bird; and Mr. Ray informs us, that in his time they were found during the winter in large flocks in Lincolnſhire and Cambridgeſhire: but at preſent the inhabitants of thoſe counties are ſcarcely acquainted with them; ſo that theſe birds ſeem now to have forſaken that iſland. We are told that they make their neſt in the marſhes, and lay two bluiſh eggs. The young birds are thought very good food. They feed on reptiles of all kinds, and in turn on green corn; of which laſt they are ſaid to make ſo great havock, as to ruin the farmers where-ever the flocks of theſe depredators alight.

5. The Americana, or hooping crane of Edwards, is a native of America: The crown of the head and temples are naked and papillous; the forehead, nape of the neck, and prime wing-feathers, are black; but the body is white: The under part of the head, as far as the lower chap, is red; the beak is yellowiſh, and jagged at the point; the feet are red, and the prime tail-feathers white. This is an American ſpecies, often ſeen at the mouths of the Savanna, Alatamaha, and other rivers near St. Auguſtine: in ſpring going to the north to breed, like the common crane, and returning like that bird, to the ſouth in autumn. In the ſummer they are found in Hudſon's Bay, at which place they arrive in May, and retire in September; and are chiefly met with in unfrequented places, in the neighbourhood of lakes, where they breed. The neſt is made on the ground, compoſed of graſs and feathers. They lay two white eggs, like thoſe of the ſwan, and ſit 20 days; the young are at firſt yellow, changing to white by degrees. Theſe birds have a loud long note, which may be heard at a great diſtance: their food is chiefly worms and inſects, which it ſearches for at the bottom of ponds. The natives of Hudſon's Bay call this ſpecies *Wapaw-uchechauk.*

6. The argil, or hurgil, of Ives, is a very large ſpecies; from tip to tip of the wings meaſuring 14 feet 10 inches; and from the tip of the bill to the claws ſeven feet and a half: the bill is 16 inches round at the baſe, of different colours, and nearly of a triangular ſhape; the feathers of the back and wings are very ſtrong, and of an iron colour; thoſe of the breaſt long: over the belly a great deal of down, of a dirty white: the legs and half the thighs are naked; the naked parts full three feet in length.

This monſter, as Ives terms it, inhabits Bengal, and is alſo found at Calcutta; at the laſt place called *Hurgill*, or *Argill*. It majeſtically ſtalks along before one, and appears at firſt like a naked Indian. The common opinion is, that the ſouls of the Bramins poſſeſs theſe birds. On opening one of theſe, a terapin, or land tortoiſe, 10 inches long, was found in its craw, and a large male black cat was found entire in its ſtomach. In Sumatra there is ſaid to be a great variety of the ſtork kind; ſome of a prodigious ſize, and otherwiſe curious; as the Boorong Cambing, and Booringoolar.

The ſame ſpecies ſeems to have been remarked by Mr Smeathman in Africa, while reſident there; an adult of one of which will often meaſure ſeven feet when ſtanding erect. He deſcribes the plumage much the ſame as in Mr Ive's bird; adding, that the gape is monſtrouſly wide; the head is covered with white down, thinly diſperſed, appearing not unlike a grey-headed man: on the middle of the neck before, a long conic membrane, like a bladder, ſprinkled very thinly with ſhort down, riſing or falling as the animal moves the beak, and always appearing inflated. Theſe birds are met with in companies. When ſeen at a diſtance, near the mouths of rivers, coming towards an obſerver, which they do with the wings extended, they may well be taken for canoes, upon the ſurface of a ſmooth ſea: when on the ſand-banks, for men and women picking up ſhell-fiſh or other things on the beach.

One of theſe, a young bird, about five feet in height, was brought up tame, and preſented to the chief of the Bananas, where Mr Smeathman lived; and being accuſtomed to be fed in the great hall, ſoon became familiar; duly attending that place at dinner-time, and placing itſelf behind its maſter's chair, frequently before any of the gueſts entered. The ſervants were obliged to watch it narrowly, and to defend the proviſions with ſwitches in their hands; but, notwithſtanding this, it would frequently ſnatch off ſomewhat or other, and was known once to have purloined a whole boiled fowl, which it ſwallowed in an inſtant. Its courage is not equal to its voracity; for a child of eight or ten years old ſoon puts it to flight with a ſwitch, though at firſt it ſeems to ſtand upon its defence, by threatening with its enormous bill widely extended, and crying out with a loud hoarſe voice like a bear or tiger. It is an enemy to ſmall quadrupeds, as well as birds and reptiles, and deſtroys fowls and chickens, though it dare not attack a hen with her young openly: it preys alſo on rats, young kittens, and the like: and has been known to ſwallow a cat whole: a bone of a ſhin of beef being broke aſunder, ſerves it but for two morſels. The individual abovementioned uſed to fly about the iſland, and rooſt very high upon the ſilk-cotton trees; from whence, at two or three miles diſtance it could ſpy the dinner carrying acroſs the yard; when, darting from its ſtation, it would enter promiſcuouſly with the women who carried in the diſhes. When ſitting, it was obſerved to reſt itſelf on the whole length of the hind part of the legs. It ſometimes ſtood near, for half an hour after dinner, with the head turning alternately, as if liſtening to the converſation; and during this time would every three or four minutes void the excrements, which were liquid and whitiſh; and took care always to do this on its legs, by wheeling the back parts round over one or the other, and this regularly on different legs; for if he had muted on the left leg laſt, he would be ſure to do the ſame on the right the next time, never making any miſtake.

7. The ciconia, or white ſtork of Ray, has naked eye-balls, and black prime wing-feathers. The ſkin be-

* *Latham's Synopſis*, vol. iii. part 1.

low the feathers, as alſo the beak, feet, and claws, are of a blood colour. It is a native of Europe, Aſia, and Africa; but is ſeldom or never to be met with in Italy. The ciconia feeds upon amphibious animals. It is ſuch an enemy to ſerpents, that it is reckoned almoſt a crime to kill a ſtork. From this favourable treatment, they are ſeen in Holland and the Low Countries walking unconcerned in the middle of the ſtreets. Storks are birds of paſſage; they ſpend the ſummer in Europe, and diſappear all at once, and go off to Egypt, Ethiopia, &c. before winter, and do not return till about the middle of March.

8. The major, or common heron, has a black creſt depending from the back part of the head, an aſh-coloured body, and a black line and belt on the neck and breaſt. It is a native of Europe. This bird is remarkably light in proportion to its bulk, ſcarce weighing three pounds and an half: the length is three feet two inches; the breadth five feet four inches. The body is very ſmall, and always lean; and the ſkin ſcarce thicker than what is called gold-beater's ſkin. It muſt be capable of bearing a long abſtinence, as its food, which is fiſh and frogs, cannot be readily got at all times. It commits great devaſtation in ponds; but being unprovided with webs to ſwim, nature has furniſhed it with very long legs to wade after its prey. It perches and builds in trees, and ſometimes in high cliffs over the ſea, commonly in company with others, like rooks. It makes its neſt of ſticks, lines it with wool, and lays five or ſix large eggs of a pale green colour. During incubation, the male paſſes much of his time perched by the female. They deſert their neſts during the winter, excepting in February, when they reſort to repair them. It was formerly in Britain a bird of game, heron-hawking being ſo favourite a diverſion of the inhabitants, that laws were enacted for the preſervation of the ſpecies, and the perſon who deſtroyed their eggs was liable to a penalty of twenty ſhillings for each offence. Not to know the hawk from the heron-ſhaw was an old proverb*, taken originally from this diverſion; but in courſe of time ſerved to expreſs great ignorance in any ſcience. This bird was formerly much eſteemed as food; made a favourite diſh at great tables, and was valued at the ſame rate as a pheaſant. It is ſaid to be very long-lived: by Mr Keyſler's account it may exceed 60 years; and by a recent inſtance of one that was taken in Holland by a hawk belonging to the Stadtholder, its longevity is again confirmed, the bird having a ſilver plate faſtened to one leg, with an inſcription, importing it had been before ſtruck by the elector of Cologne's hawks in 1735.—The cinerea of Linnæus is the female of this ſpecies.

9. The grazetta, or egret, is creſted behind; the body is white, the beak black, and the feet greeniſh. It is a moſt elegant bird. It weighs about one pound; and the length is 24 inches, to the end of the legs 32. It is a native of the eaſt. But that formerly it was very frequent in Britain, appears by ſome of the old bills of fare: in the famous feaſt of Archbiſhop Neville, we find no leſs than a thouſand aſterides, egrets or egrittes, as it is differently ſpelt. Perhaps the eſteem they were in as a delicacy during thoſe days occaſioned their extirpation in Britain; abroad they are ſtill common, eſpecially in the ſouthern parts of Europe, where they appear in flocks. The ſcapulars and the creſt were formerly much eſteemed as ornaments for caps and head-pieces; ſo that aigrette and egret came to ſignify any ornament to a cap, though originally the word was derived from *aigre, a cauſe de l'aigreur de ſa voix.*

10. The herodias, or criſtata maxima of Cateſby, is creſted behind, has a duſky-coloured back, reddiſh thighs, and the breaſt ſpeckled with oblong black ſpots. It is four feet and a half when erect; the bill is about eight inches from the angle of the mouth to the end of it; and the creſt is made up of long, narrow, brown feathers, the longeſt being five inches in length, which it can erect and let fall at pleaſure. It is a native of Virginia, and feeds not only upon fiſh and frogs, but on lizards, efts, &c.

11. The ſtellaris, or bittern, has a ſmooth head; it is variegated through the whole body with dark-coloured ſpots of different figures and ſizes. It is a native of Europe, and inhabits chiefly the fen-countries. It is met with ſkulking among the reeds and ſedges; and its uſual poſture is with the head and neck erect, and the beak pointed directly upwards. It will ſuffer perſons to come very near it without riſing; and has been known to ſtrike at boys and at ſportſmen, when wounded and unable to make its eſcape. It flies principally about the duſk of the evening, and then riſes in a very ſingular manner, by a ſpiral aſcent, till it is quite out of ſight. It makes a very ſtrange noiſe when it is among the reeds, and a different and a very ſingular one as it riſes on the wing in the night. It builds its neſt with the leaves of water plants on ſome dry clump among the reeds, and lays five or ſix eggs of a cinerous green colour. This bird and the heron are very apt to ſtrike at the fowler's eyes when only maimed. The food of the bittern is chiefly frogs; not that it rejects fiſh, for ſmall trouts have been met with in their ſtomachs. In the reign of Henry VIII. it was held in much eſteem at Britiſh tables, and valued at one ſhilling. Its fleſh has much the flavour of a hare, and nothing of the fiſhineſs of that of the heron.

12. The violacea, or creſted bittern of Cateſby, has a white creſt; the body is variegated with black and white, and bluiſh below. Theſe birds are ſeen in Carolina in the rainy ſeaſons: but in the Bahama Iſlands, they breed in buſhes growing among the rocks in prodigious numbers, and are of great uſe to the inhabitants there; who, while theſe birds are young and unable to fly, employ themſelves in taking them for the delicacy of their food. They are, in ſome of theſe rocky iſlands, ſo numerous, that in a few hours two men will load one of their *calapatches*, or little boats, taking them perching from off the rocks and buſhes, they making no attempt to eſcape, though almoſt full grown. They are called by the Bahamians, *crab-catchers*, crabs being what they moſtly ſubſiſt on; yet they are well-taſted, and free from any rank or fiſhy ſavour.

There are 67 other ſpecies enumerated by ornithologiſts.

ARDEA (anc. geog.), a town of Latium, the royal reſidence of Turnus king of the Rutuli, (Livy); ſo called, either from the augury of the heron, (Hyginus); or from the exceſſive heat of the country, (Martial). It was a marſhy, ſickly ſituation, (Strabo, Seneca). It was built by Danaë, the mother of Perſeus, (Virgil);

* In aftertimes this proverb was abſurdly corrupted to, He does not know a *hawk* from a *hand-ſaw*.

(Virgil); about five miles diſtant from the ſea, and 20 from Rome: now a hamlet. It was a Roman colony, (Livy); the inhabitants called *Ardeates*. E. Long. 17. 49. Lat. 41. 30.

ARDEBIL, or Ardevil, a town of Perſia, in the province of Aderbijan. It was taken and burnt by Jenghiz Khan in 1222, when moſt of the inhabitants were deſtroyed: but it has been ſince rebuilt; and is ſtill ranked for dignity among the beſt cities of the kingdom, on account of its having been the reſidence and burying-place of ſome of the Perſian kings; particularly the ſepulchre of Sheik Sefi is at this place, to which the people reſort in pilgrimage. He founded a place, which they call his kitchen, with a revenue ſufficient to maintain 1000 poor people, and to feed them three times a-day. Three or four of the largeſt principal ſtreets have ſhops, and are planted on each ſide with elms and linden trees, to keep off the exceſſive heat of the ſun; but the houſes are poorly built, with bricks dried in the ſun: yet moſt of them, that are not in the bazars or market-places, have the pleaſure and conveniency of a garden full of trees bearing fruit: and there are large ſpots in the out-parts of the town, where the houſes are at a diſtance from each other, and the ſpaces between planted with trees, which render the city of a large extent. The meidan, or great ſquare, is 300 paces long, and 150 broad, having ſhops all round; which, when this place was in a flouriſhing condition, were ſtored with all manner of valuable commodities.

Through the city there paſs two branches of a rivulet, which have been ſometimes enlarged by the melting of the ſnow on the mountains, that they have been forced to make canals to divert the ſtream. In the reign of Sha Abbas, it broke down the dykes, and carried away a great number of houſes. The city is without walls, and is ſeated in the midſt of a large plain encompaſſed with mountains, the higheſt of which lies weſtward, and is alway covered with ſnow. Theſe render the air ſometimes extremely hot, and at others intolerably cold, which occaſion epidemical diſtempers, that carry off great numbers of people. The ſoil produces no fruit near the city but apples, pears, and peaches; and yet is good both for corn and paſture. The ſheep are ſo numerous, that 100,000 have paſſed over the city-bridge in a day. There are here ſeveral ſorts of mineral waters, which ſerve both for common bathing, and for the cure of various diſeaſes; one of theſe is a ſulphureous ſpring, whoſe exhalations render the circumambient air extremely diſagreeable. There are three ſprings which produce as hot water as if it was boiling, and from which waters are conveyed to the public baths in the city. About half a league from the city, on the right hand of the public road, there is a pool of ſtanding water, which is covered all over with ſalt like ice. E. Long. 47. 30. N. Lat. 37. 55.

ARDEN, the common name of foreſts among the Celtæ, from the wildly extenſive one which ranged for 500 miles in length acroſs the country of Gaul, or covered more than half the county of Warwick in Britain, and the ſites of which ſtill retain the appellation of *Arden*, to the much ſmaller one of the ancient Mancenion, that covered and ſurrounded the ſite of the preſent Mancheſter. Written *Arduen* by Cæſar and Tacitus in ſpeaking of the foreſt in Gaul, and *Ardven* by Oſſian in mentioning the woods of Caledonia, it cannot (ſays Mr Whitaker) be compounded of *ar* the prepoſitive article in Celtic, and the ſubſtantive *den*, as Baxter and Cambden aſſert it to be; but is formed of *ard* an adjective, and *ven* the ſame as *den*. The meaning of the name therefore is not, as Mr Baxter renders it, ſimply *the hills*, or even, as the ingenious tranſlator of Oſſian interprets it, the *high hill*. *Ard* ſignifies either *high* or *great*, and *ven* or *den* either an *hill* or *wood*. *Arduen*, *Ardven*, or *Arden*, then, means a conſiderable wood. Hence, only, the name became applicable to ſuch very different ſites, as the *plains* of Warwickſhire and the *hills* of Scotland: and it was given not only to the moſt extenſive foreſts, to that which was the greateſt in Gaul, or ſo conſiderable in Britain; but to many that were important only within their own contracted diſtricts, as the wood of Mancenion abovementioned, and others.

ARDENBURG, a town of the Netherlands, in Dutch Flanders, and formerly the moſt conſiderable in that country; but has been diſmantled by the Dutch. E. Lon. 3. 30. N. Lat. 51. 16.

ARDENNE, a foreſt in France, formerly of vaſt extent; but the trees are in many places grubbed up, and where they ſtood are built cities, towns, and abbeys. At preſent it extends from Thionville, near the country of Leige, to Donchery and Sedan, on the confines of Champagne. The roads are ſo narrow in ſome places, that two waggons cannot paſs each other; and therefore the waggoners are obliged to provide themſelves with bells or horns to give one another notice to ſtop in time.

ARDENTES, in middle-age writers, an appellation given to thoſe afflicted with the Ignis Sacer, or Eryſipelas. They were thus called, as ſeeming to be ſcorched or burnt with the diſeaſe. Hence alſo the abbey of St Genevieve at Paris is called *Domus Ardentium*, by reaſon, as it is ſaid, that great numbers were cured of that diſtemper at the ſhrine of this ſaint, in the reign of Lewis VI.

ARDES, a town of France, in Lower Auvergne, and the principal place of the duchy of Mercoeur. It ſerves as a mart for the commodities and trade between Upper and Lower Auvergne. E. Long. 3. 10. N. Lat. 45. 22.

ARDFERT, a town of Ireland, was the ancient capital of Kerry, with an univerſity, which was held in the higheſt eſteem. It is a biſhop's ſee, and borough by ancient preſcription, and has been held *in commendam* with the biſhopric of Limerick ever ſince the Reſtoration. The biſhops were anciently called Biſhops of Kerry. St Brandon, to whom the cathedral is dedicated, had his firſt education in this county, under Biſhop Ert; but he finiſhed his ſtudies in Connaught, St Jarlath biſhop of Tuam being his preceptor. The ruins here are very extenſive. Near the Cathedral was an anchorite tower, the loftieſt and fineſt in the kingdom, being 120 feet high: it fell ſuddenly in 1771. In the ruined churches there are ſeveral inſcriptions round the mouldings of the tomb-ſtones: and over an arch, behind Lord Glandore's houſe, is an inſcription in relief done in a maſterly manner, but the characters unknown.

ARDRAH, a ſmall territory or kingdom of Africa, in Guinea, properly ſo called. It lies at the bottom of the gulph of St Thomas, and has a town called *Ardres*, ſuppoſed to be the capital. The inhabitants are very licentious, and have neither temple nor any place for religious worſhip. However, they are very courageous; and their king was abſolute till lately that the king of Dahomay made war upon this and the neighbouring territories, brought them under ſubjection, and burnt the towns, particularly Ardres. The air is very unwholeſome to Europeans; yet the natives live to a great age; but the ſmall-pox makes great deſtruction among them. This country is fertile in Indian corn, palm-wine, plants, and fruits, which laſt all the year; and they make a great deal of ſalt.

ARDRES, a ſmall but ſtrong town of France, in Lower Picardy. Here was an interview between Francis I. and Henry VIII. king of England in 1520. It is ſeated in the midſt of a moraſs. E. Long. 2. 0. N. Lat. 50. 35.

ARDS, barony of, in the county of Down in Ireland: it is a narrow ſlip of land, in ſome places three, and in none above ſix, miles broad; but the ſoil is for the moſt part tolerably good. It lies between the lake of Strangford and the ſea, and in the ſouth part it is oppoſite to Lycale. Sir Thomas Smith obtained a patent for this barony from Queen Elizabeth, and ſent his natural ſon with a colony to poſſeſs it; but he was intercepted and ſlain by an Iriſhman. After Sir Thomas's death, Ards was granted by James I. to ſome of the Scots nobility.

ARDUBA, an ancient city of the Pannonians. It was taken by Germanicus about the 7th year of the Chriſtian æra; but its reduction was more owing to the diſagreement that reigned among the inhabitants than to the valour of the Romans. The greater part of the citizens were for ſubmitting; but the women, more fond of their ancient laws and liberties than the men, joined ſome Roman deſerters, and falling upon their huſbands, killed a great number of them: but being at laſt overcome by the men, who then ſubmitted to the Romans, the women either threw themſelves headlong from the tops of the walls, or, ſetting fire to their houſes, burnt themſelves and their children to death.

AREA, in general, denotes any plain ſurface, whereon we walk, &c. The word is Latin, importing more properly a threſhing-floor; and is derived from *arere*, "to be dry."

AREA, in architecture, denotes the ſpace or ſite of ground on which an edifice ſtands. It is alſo uſed for inner courts, and thoſe portions of ground.

AREA, in geometry, denotes the ſuperficial content of any figure. Thus, if a figure, *e. g.* a field, be in form of a ſquare, and its ſide be 40 feet long, its area is ſaid to be 1600 ſquare feet; or it contains 1600 little ſquares, each a foot every way.

AREB, a kind of imaginary money uſed in the dominions of the great mogul. Four arebs are equal to one crou, or 100 lacs; one lac to 100,000 roupees.

AREBO, or AREBON, a town on the ſlave-coaſt of Guinea, in Africa, ſeated at the mouth of the river Formoſo. The Engliſh had once a factory there, as the Dutch have ſtill. It is a large oblong place, indifferently well peopled, and furniſhed with houſes built of reeds and leaves. E. Long. 5. 5. N. Lat. 5. 0.

ARECA, the FAUSEL-NUT, in botany, a genus of the order of palmæ pennatifoliæ. The male has no calyx, but three petals, and nine ſtamina; the female has no calyx; the corolla has three petals, and the calyx is imbricated. There are two ſpecies, viz.

1. The cathecu, a native of India. This has no branches, but its leaves are very beautiful: they form a round tuft at the top of the trunk, which is as ſtraight as an arrow. It grows to the height of 25 or 35 feet, and is a great ornament in gardens. The ſhell which contains the fruit is ſmooth without, but rough and hairy within; in which it pretty much reſembles the ſhell of the cocoa nut. Its ſize is equal to that of a pretty large walnut. Its kernel is as big as a nutmeg, to which it bears a great reſemblance without, and has alſo the ſame whitiſh veins within when cut in two. In the centre of the fruit, when it is ſoft, is contained a greyiſh and almoſt liquid ſubſtance, which grows hard in proportion as it ripens. The extract of this nut has been ſuppoſed to be the terra japonica of the ſhops, at leaſt that it is a very ſimilar ſubſtance both in colour and taſte: But according to later obſervations, the genuine drug ſeems to be obtained from the *Mimosa Catechu*. The fruit when ripe is aſtringent, but not unpalatable, and the ſhell is yellowiſh. Of this fruit there is a prodigious conſumption in the Eaſt Indies, there being ſcarce any perſon, from the richeſt to the pooreſt, who does not make uſe of it; and the trade they drive in it is incredible. The chief uſe that is made of areca is to chew it with the leaves of betel, mixing with it lime made of ſea-ſhells.*. In order to chew it, they cut the areca into four quarters, and take one quarter of it, which they wrap up in a leaf of betel, over which they lay a little of the lime; afterwards they tie it, by twiſting it round. This bit prepared for maſtication is called *pinang*; which is a Malayan word uſed all over the Eaſt Indies. The pinang provokes ſpitting very much, whether it be made with dried or freſh areca; the ſpittle is red, which colour the areca gives it. This maſtication cools the mouth, and faſtens the teeth and gums. When they have done chewing the pinang, they ſpit out the groſs ſubſtance that remains in the mouth. They are under a miſtake who imagine that freſh areca melts entirely in the mouth. Nor is it a leſs miſtake to think that the teeth which are tinged red during the time of chewing, always retain that colour. As ſoon as they have done chewing the pinang, they waſh their mouth with freſh water, and then their teeth are white again. The Europeans who live at Batavia, or Malaca, and in the Sunda and Molucca iſlands, uſe pinang as much as the Indians do; and by waſhing their teeth they preſerve them white. Some pretend that areca ſtrengthens the ſtomach, when the juice of it is ſwallowed, as moſt of the Indians do. Another property aſcribed to it is, its curing or carrying off all that might be unwholeſome or corrupt in the gums. When eaten by itſelf, as is ſometimes done by the Indians, it impoveriſhes the blood, and cauſes the jaundice; but is not attended with theſe inconveniences when mixed in the uſual way with betel. The Saimeſe call it *plou* in their language. The beſt areca of the Indies comes from the iſland of Ceylon The Dutch Eaſt-India company ſend a great deal of it in their ſhips into the kingdom of Bengal. There grows in Malabar a ſort of red areca, which is very proper for dyeing in that colour. The ſame company ſend

* Cornelius le Brun aſſerts, that they rub the leaves of betel with a red drug of Siam, or with white chalk.

ſome of it from time to time to Surat and Amadabat, for the uſe of the dyers in the dominions of the Grand Mogul.

2. The oleracea, or true cabage-palm, is the moſt beautiful, and perhaps the talleſt, of all trees. The trunk is perfectly ſtraight, and marked with rings at the veſtigiæ of the footſtalks of the leaves. Near the ground it is about ſeven feet in circumference; but tapers as it aſcends, and attains the height of 170 or 200 feet. The bark is of an aſh colour till within 25 or 30 feet of the extremity of the tree; when it alters at once to a deep ſea-green, which continues to the top. About five feet from the beginning of the green part upwards, the trunk is ſurrounded with its numerous branches in a circular manner; all the lowermoſt ſpreading horizontally with great regularity; and the extremities of many of the higher branches bend wavingly downwards, like ſo many plumes of feathers. Theſe branches, when full grown, are 20 feet long, more or leſs; and are thickly ſet on the trunk alternately, riſing gradually ſuperior one to another: Their broad curved ſockets ſo ſurround the trunk, that the ſight of it, whilſt among theſe, is loſt, which again appears among the very uppermoſt branches, and is there inveloped in an upright green conic ſpire, which beautifully terminates its great height. The above-mentioned branches are ſomewhat round underneath, and ſlightly grooved on the upper ſide: They are likewiſe decorated with a very great number of green pennated leaves: Some of theſe are near three feet long, and an inch and an half broad, growing narrower towards their points, as well as gradually decreaſing in length towards the extremities of the branches. As there are many thouſand leaves upon one tree: every branch bearing many ſcores upon it, and every leaf being ſet at a ſmall and equal diſtance from another, the beauty of ſuch a regular lofty group of waving foliage, ſuſceptible of motion by the moſt gentle gale of wind, is not to be deſcribed. The middle rib, in each leaf, is ſtrong and prominent, ſupporting it on the under ſide, the upper appearing ſmooth and ſhining. The pithy part of the leaf being ſcraped off, the inſide texture appears to be ſo many longitudinal thread-like filaments. Theſe, being ſpun in the ſame manner as they do hemp, or flax, are uſed in making cordage of every kind, as well as fiſhing-nets, which are eſteemed ſtronger than thoſe uſually made from any other material of the like nature.

Upon removing the large leaves, or branches, which ſurround the top of the trunk a little way above the beginning of the green bark juſt mentioned, what is called the *cabbage* is diſcovered lying in many thin, ſnow-white, brittle flakes, in taſte reſembling an almond, but ſweeter. This ſubſtance, which cannot be procured without deſtroying the tree, is boiled, and eaten with mutton by the inhabitants of the Weſt Indies, in the ſame manner as turnips and cabbage are with us; though it muſt appear the height of extravagancy and luxury to fell ſo ſtately a tree, which would be an ornament to the moſt magnificent palace in Europe, to gratify the taſte of an epicure, eſpecially as there is but a very ſmall part of it eatable. What is called the *cabbage-flower*, grows from that part of the tree where the aſh-coloured trunk joins the green part already deſcribed. Its firſt appearance is a green huſky ſpatha, growing to above 20 inches long and about four broad; the inſide being full of ſmall white ſtringy filaments, full of alternate protuberant knobs, the ſmalleſt of theſe reſembling a fringe of coarſe white thread knotted: theſe are very numerous, and take their riſe from larger footſtalks: and theſe footſtalks likewiſe are all united to different parts of the large parent-ſtalk of all. As this huſky ſpatha is opened while thus young, the farinaceous yellow ſeed in embryo, reſembling fine ſaw-duſt, is very plentifully diſperſed among theſe ſtringy filaments, which anſwer the uſe of apices in other more regular flowers: theſe filaments being cleared of this duſt, are pickled, and eſteemed among the beſt pickles either in the Weſt Indies or in Europe. But if this ſpatha is not cut down and opened whilſt thus young; if it be ſuffered to continue on the tree till it grows ripe and burſts; then the incloſed part, which whilſt young and tender is fit for pickling, will by that time have acquired an additional hardneſs, become ſoon after ligneous, grow buſhy, conſiſting of very many ſmall leaves, and in time produce a great number of ſmall oval thin-ſhelled nuts, about the bigneſs of unhuſked coffee-berries: Theſe being planted, produce young cabbage-trees.

The ſockets or grooves, formed by the broad part of the footſtalks of the branches, are uſed by the negroes as cradles for their children. On the inner ſide of the very young footſtalks are tender pellicles, which when dried, it is ſaid, make a writing paper The trunks ſerve as gutterings; the pith makes a ſort of ſago; and the nuts yield oil by decoction. In the pith alſo, after the trees are felled, there breeds a kind of worms, or grubs, which are eaten and eſteemed a great delicacy by the French of Martinico, St Domingo, and the adjacent iſlands. Theſe worms, ſays father Labat, are about two inches long, and of the thickneſs of one's finger; the head is black, and attached to the body without any diſtinction of neck. Their preparation for the table is as follows: They are ſtrung on wooden ſkewers before a fire; and as ſoon as heated, are rubbed over with raſpings of cruſt, ſalt, pepper, and nutmeg: this powder abſorbs all the fat, which during the cookery would otherwiſe eſcape; when properly roaſted, they are ſerved up with orange or citron ſauce. Theſe worms being expoſed for ſome time to the ſun, are ſaid to yield an oil which is of great efficacy in the piles. The oil in queſtion, ſays Labat, is never to be heated before its application to the part affected; as repeated experiments have evinced that its ſpirit is totally diſſipated by the fire.

ARELATE, or ARELATUM, is a town of Gallia Narbonenſis, ſituated on the Rhone, denoting a town on, or beyond, a marſh, according to the particular ſituation of the ſpeaker; called *Arelate Sextanorum*, (Pliny, Mela, Coin), becauſe it had a colony of the ſixth legion. Writers of the lower age call it *Arelas, atis*, (Prudentius, Auſonius). There was a double Arelas, one on each ſide of the river and joined by a bridge, (Auſonius); that on the left ſide is thought to have been built by Conſtantine. Tiberius's father was ſent by Julius Cæſar at the head of the colony, (Suetonius); and hence the appellation *Julia Paterna*, as appears from an inſcription. It was the favourite place of the Romans, and greatly ornamented; and hence called *Gallula Roma.* (Auſonius). It is now called *Arles.* E. Long. 5. 5. Lat. 43. 40.

AREMBERG, a ſmall town of Germany, in the circle of Weſtphalia, defended by a caſtle. It is the capital of a county of the ſame name, and was erected into a principality by the Emperor Maximilian II. in favour of John de Ligne, lord of Barbazon, who took the name of *Aremberg.* It is ſeated on the river Ayr. E. Long. 7. 3. N. Lat. 50. 27.

AREMORICA, or ARMORICA, a part of Gaul, between the Sequana and Ligeris, (Cæſar, Hirtius); denoting a country on, or beyond the ſea, *ar moer,* or *are moer,* Celtic. Pliny indeed ſays, that *Aquitania* was formerly called *Aremorica;* but in this he ſtands alone. In the lower age, the term *Armorica* was confined to Bretagne in France.

ARENA, in Roman antiquity, a place where the gladiators fought; ſo called from its being always ſtrewed with ſand, to conceal from the view of the people the blood ſpilt in the combat. Nero is ſaid to have ſtrewed the Arena with gold duſt.

ARENARIA, or SANDWORT, in botany: A genus of the decandria trigynia claſs; and in the natural method ranking under the 22d order, *Caryophyllæ.* The calyx has five open leaves; the petals are five, and entire; the capſule is unilocular, and contains many ſeeds. There are 17 ſpecies of arenaria, only ſeven of which are natives of Britain, viz. the peploides, or ſea-ſandwort; the trinervis, or plantain-leaved ſandwort; the ſerpylli-folia, or leaſt ſandwort; the ſaxatilis, or mountain-ſandwort; the laricifolia, or larchleaved ſandwort; the tenuifolia, or fine-leaved ſandwort; and the rubra, or purple-flowered ſandwort.

ARENACUM, or ARENACUS, one of the four towns or larger villages in the iſland of the Batavi, (Tacitus). Now *Arnheim,* in Guelderland. E. Long. 5. 20. N. Lat. 52. 2.

ARENARII, in antiquity, gladiators who combated with beaſts in the arena, or amphitheatre. The arenarii were ſlaves of the loweſt rank; ſo that, tho' manumitted, they were not capable of being Roman citizens. They were the ſame with what were otherwiſe called *Beſtiarii.*

ARENARIUM, in eccleſiaſtical writers, denotes a cemetery or burying-ground. The arenaria were properly a kind of pits, or holes under ground, wherein the ancient Chriſtians not only buried their dead, but held their religious aſſemblies in times of perſecution.

ARENSBERG, a ſmall town of Germany, in the circle of Weſtphalia, upon the river Roer. E. Long. 8. 20. N. Lat. 51. 25.

ARENSBOURG, an epiſcopal and maritime town of Livonia in Sweden, ſeated in the iſle of Oſel, in the Baltic Sea. E. Long. 22. 40. N. Lat. 58. 15.

AREOLA, among anatomiſts, the coloured circle ſurrounding the nipple of the breaſt.

AREOPAGUS, a ſovereign tribunal at Athens, famous for the juſtice and impartiality of its decrees, to which the gods themſelves are ſaid to have ſubmitted their differences. It was in the town, on a rock or hill oppoſite to the citadel. The word ſignifies ſtrictly, *rock of Mars.*

Plutarch attributes the eſtabliſhment of the Areopagus to Solon. Other authors think differently: and with good reaſon; for it appears undeniable, that this tribunal was inſtituted before Solon. But the beſt authorities allow him the honour of its reſtoration. The city of Athens, governed till this time by tribunals of a circumſcribed juriſdiction, which were multiplied by the moſt trifling accidents and circumſtances, took no fixed political or civil form, however cloſely united the members of thoſe tribunals were by their general views towards the public good, and by the common love of their country. As each of thoſe tribunals could only act in proportion to the power delegated to it, it was impoſſible that ſo many different and unequal impreſſions ſhould give to the great machine of the ſtate that uniform and regular movement which, by an impulſe always the ſame, would keep each part in the ſituation it ſhould maintain with relation to the whole.

To effect this univerſal and harmonious power, it was neceſſary to unite the different channels of public authority, which, by being too much diſtributed, loſt its force. This authority Solon collected, and placed it all in the court of Areopagus, which conſequently became the main ſpring of the government. The judges of this court, who, under Draco, decided only in caſes of murder, now took cognizance of crimes of every kind; and the ſame tribunal which inflicted capital puniſhment on murder, poiſoning, burning of houſes, theft, &c. ſtruck at the roots of thoſe crimes, by arraigning idleneſs, luxury, and debauchery. Equally attentive to ſtimulate the indolence of the young, and the languor of the old, theſe ſage judges rouſed in the one the laudable ambition to ſerve the ſtate, and reſtored to the others their former activity. Satisfied that extremes produce the ſame effects, they thought the republic had as much to fear from the exceſs of wealth as from the gripe of poverty. Hence they exacted a minute account of the effects of every individual. Hence their great ſeverity to thoſe idle citizens, who, inſtead of being uſeful members in a ſtate, are its bane and its diſhonour. Iſocrates draws a moſt beautiful and ſtriking picture of thoſe venerable and aſtoniſhing men, and of the order and harmony which flouriſhed in Athens by their wiſe adminiſtration.

The judges of the Areopagus, ſays that author, were more induſtrious to prevent crimes, by repreſenting them in an odious light, than to eſtabliſh modes of puniſhment. It was their opinion, that the enemies of the ſtate were the inſtruments deſtined by the gods to puniſh the wicked; but that it was their province to correct and reform public and private manners. They were vigilantly attentive to the conduct of all the citizens, but particularly to that of the youth. They well knew that the impetuoſity of juvenile paſſion gave the moſt violent ſhocks to health and growing virtue; that it was the duty of inſpectors of education to ſoften the auſterity of moral diſcipline with innocent pleaſure; and that no recreations were more eligible than bodily exerciſes, which enable a young man to give a good education its full play, which improve health, give a pleaſurable and agreeable vivacity, and even fortify the mind. The fortunes of the Athenians were too unequal to admit the ſame mode of education; and therefore the youth were trained in a manner ſuitable to the rank and circumſtances of their reſpective families. Thoſe of the inferior claſs were taught agriculture and commerce; from this principle, that idleneſs is followed by indigence, and that indigence excites to the moſt daring and attrocious crimes. Having thus endeavoured by wiſe precautions, to preclude the entrance of moral evil, they thought they had little to fear.

Exerciſes of the body, ſuch as horſemanſhip and hunting, were objects of education to the youth of liberal fortune. In this ſage diſtribution, their great aim was to prevent the poor from committing crimes, and to facilitate to the rich the acquiſition of virtue. Not ſatisfied with having eſtabliſhed good laws, they were extremely careful to ſee that they were obſerved. With this view, they had divided the city into quarters, and the country into cantons. Thus every thing paſſed under their eyes; nothing eſcaped them; they were acquainted with the private conduct of every citizen. Thoſe who had been guilty of any irregularity were cited before the magiſtrates, and were reprehended, or punſhed in proportion to their miſdemeanour.

The ſame Areopagites obliged the rich to relieve the poor. They repreſſed the intemperance of the youth by a ſevere diſcipline. Corruption in magiſtrates was ſuppreſſed by the puniſhments denounced againſt it; and the old men, at the ſight of the employments of the young, felt themſelves animated with a degree of juvenile vigour and activity.

Religion came likewiſe under the cognizance of the Areopagites. Plato durſt never, as we are told by Juſtin Martyr, divulge his private opinion concerning the Deity. He had learned from the Egyptians the docrine of Moſes. It appeared to him the beſt, and he embraced it with ardour. But his dread of the Areopagites, who were attached to the prevailing ſyſtem, would not permit him even to name the author of ſentiments which oppoſed the common tradition.

The public edifices, the cleanneſs of the ſtreets, the pay of the ſoldiers, the diſtribution of the public money; in a word, whatever intereſted the republic, was under the direction of the Areopagus. The people themſelves, jealous as they were of their power, did nothing without conſulting this aſſembly, and ſuffered it, without a murmur, to amend their precipitate decrees. Yet this authority, however great it may ſeem, was ſubject to the laws; by them rewards and puniſhments were determined; and thoſe reſpectable judges gave an account of the exerciſe of their truſt to public cenſors, who were placed betwixt them and the people, to prevent the ariſtocracy from growing too powerful.

The moſt important qualifications were required in thoſe who entered into the Areopagus. Solon made a law, by which they who had not been archons for a year ſhould not be admitted members of the Areopagus. To give more force to his law, he ſubjected himſelf to it, and was only admitted on that title. This was but the firſt ſtep; thoſe annual magiſtrates, after having given law to the republic, were interrogated on their adminiſtration. If their conduct was found irreproachable, they were admitted Areopagites with eulogiums; but the ſmalleſt miſconduct excluded them from that honour for ever. What adminiſtration was not to be expected from a tribunal ſo well compoſed? what veneration was not due to men of ſuch rare talents and virtue? Such reſpect was paid them, that people preſumed not to laugh in their preſence; and ſo well eſtabliſhed was their reputation for equity, that thoſe whom they condemned, or diſmiſſed without granting their petition, never complained that they had been unjuſtly treated.

The edifice of the Areopagus was extremely ſimple; and its roof, which was at firſt of the moſt common materials, remained in that ſtate till the time of Auguſtus. This we learn from Vitruvius. Oreſtes was the firſt who thought of embelliſhing it. He raiſed in it an altar to Minerva. He likewiſe adorned it with two ſeats of ſolid ſilver; on one of which the *accuſer* ſat, and the *accuſed* on the other. The one ſeat was conſecrated to *Injury*, and the other to *Impudence*. This religious ſketch was brought to perfection by Epimenides, who erected altars to thoſe allegorical deities, and ſoon after a temple, which Cicero mentions in his ſecond book of laws. This temple correſponded with that which Oreſtes had built to the Furies, who brought him to Athens, and procured him the protection of Minerva. Epimenides dedicated it a ſecond time to the Furies, or *ſevere Godeſſes*, as they were termed by the Athenians. A man was thought loſt without reſource, and a victim to every human ill, if he enforced a perjury by invoking the ſacred name of thoſe tremendous divinities.

Thoſe who employed their thoughts in ſolving the myſteries of Paganiſm, imagined that the Eumenides had their temple ſo near the court Areopagus, that they might enlighten the judges by their inſpiration, and, by their continual aſſiſtance, prevent them from committing thoſe errors to which human weakneſs is liable. To propitiate thoſe terrible deities, and to procure their favour for the Areopagus, they were worſhipped with great punctuality and devotion; and the ſenate itſelf appointed their prieſts. Demoſthenes had been nominated to preſide over their ſacrifices; and he thought it very extraordinary, that he, to whom the republic had confided ſo important an office, ſhould be publicly impeached.

It was natural to aſſociate with the Eumenides the other deities who ſhared with them the ſovereign empire over the dead. Epimenides placed in their temples the ſtatues of Pluto, of Mercury, and of Tellus. They were all, according to Pauſanias, of an agreeable form. Each of them was placed upon an altar, on which the citizens, or ſtrangers, who had been acquitted by the Areopagus made their grateful offerings. But it was not to gratitude alone that theſe ſeveral deities owed all the incenſe that ſmoked upon their altars. They who had been accuſed before the ſenate, haraſſed with ſuperſtition, and uncertain how theſe deities would be affected towards them, were laviſh of ſacrifices to obtain their clemency, by which they hoped their judges would likewiſe be influenced.

The tomb of Oedipus was another of the ornaments of the Areopagus. It was in the outward court of the Areopagus, where a barge was likewiſe placed, which made part of the pomp at the public games.

Whatever homage and implicit obedience the court of Areopagus might derive from all this religious parade, the public good was always dearer to them

Areopagus.

than any lower advantages they might have drawn from the altars and temples with which they were ſurrounded.

The ſenate aſſembled in a hall built on the ſummit of a hill, which was aſcended with difficuly by the old men bent with age. However, as for ſome time they only aſſembled on the three laſt days of each month, they bore with patience this inconvenient ſituation. But public affairs multiplied to ſuch a degree, that they were obliged to add to the three former ſittings a fourth, which was held on the ſeventh day of the month, and which was ſoon ſucceeded by an aſſembly every day. Their meetings were ſo regular, that they were not interrupted by the moſt ſolemn feſtivals, till Cephiſodorus was archon, who, in the third year of the 105th Olympiad, made a decree, which obliged the Areopagites to celebrate, after the example of the other courts, the Apaturian feaſts, which laſted five days.

This aſſiduous and painful exerciſe of their office made the Areopagites feel all the inconvenience of the ſituation of their tribunal, and determined them to remove it to a part of the city called the *Royal Portico*. It was a ſquare expoſed to all the inclemencies of the weather. When the judges, who aſſembled there in profound ſilence, had taken their places, they were incloſed by a thread, or rather a cord, drawn around them.

They held their aſſemblies in the night, that their attention to public affairs might not be diverted by external objects,—and (adds Lucian) that they might only be influenced by the arguments, and not by the preſence and action, of the ſpeakers. This circumſtance explains a paſſage in Athenæus, who tells us, that none knew the numbers nor faces of the Areopagites. The cuſtom of adminiſtering juſtice in the open air was not peculiar to them. It was followed by all the other tribunals when they tried for murder; for two reaſons:—1ſt, That the judges, the ſworn protectors of innocence, might not be hurt by being under cover with criminals, whoſe hands were polluted with blood. 2dly, that the accuſer and the accuſed might not be under the ſame roof.

When all the members of the ſenate were convened, a heral enjoined ſilence, and ordered the people to retire. As ſoon as they had departed, the Aſſembly proceeded to buſineſs; and as they deemed the leaſt preference a flagrant injuſtice, the cauſes which they were to determine were drawn by a kind of lottery; and the ſame chance which brought them up, diſtributed them to different numbers of judges, ſmall or great, according to the importance of the ſeveral cauſes.

In early times, the parties themſelves ſtated their cauſe in a ſimple manner. The eloquence of advocates was thought a dangerous talent, fit only to varniſh crimes. But afterwards the Areopagus, on this point, relaxed from their ſeverity;—at firſt the accuſed, and ſoon after the accuſers, were permitted to engage thoſe to make the attack and the defence, whoſe profeſſion it was to exert the art of ſpeaking, for others, with accuracy and elegance.

Sextus Empiricus ſeems not to have ſufficiently diſtinguiſhed times, where he ſays, that the court of Areopagus did not ſuffer thoſe who are to be tried at their bar to avail themſelves of the abilities of others. What undoubedly led him into that miſtake, was an inviolable cuſtom of that tribunal, which prohibited, in pleadings, all that warm and pictureſque oratory which ſeduces the judgment and inflames the paſſions. When the ſuffrages were collected, each perſon gave his in ſilence. They voted with a ſmall flint, which they held betwixt the thumb and the two next fingers, and which they put into one of the two urns that ſtood in a corner of the hall. One ſtood before the other. The firſt was called the *urn of death*; the ſecond, the *urn of compaſſion*. That of death was of braſs, and was termed *proper*; that of compaſſion was of wood, and was termed *improper*. The judges commonly brought their flint to the aſſembly, and put it into the urn; but, that all the ſuffrages might be collected, the herald took the two urns, and preſented them, one after another, to every ſenator, commanding him, in the name of the republic, no longer to defer his acquittal or condemnation.

Areopagus.

For this method of giving ſentence, which was called κρυϐδην ψηφος, becauſe it kept the vote of each perſon undiſcovered, the Thirty Tyrants, to make themſelves maſters of the deciſions of the Areopagus, ſubſtituted another, by means of which they knew exactly the opinion of each of the judges; for they obliged them to bring their flints publicly, and lay them upon two tables placed before them, the ſituation of which was quite oppoſite to that of the urns; for the firſt of thoſe tables was that of *life*, and the ſecond that of *death*.

The firſt ſubſtances with which they gave their ſuffrages were not ſmall pieces of the bones of a hog, as ſome authors aſſert, but ſea-ſhells, for which pieces of braſs of the ſame form, termed *ſpondyla*, were afterwards ſubſtituted. The ſubſtances with which they voted were diſtinguiſhed by their form and colour. Thoſe which condemned were black, and perforated in the middle; the others were white, and not perforated. The precaution of piercing the black ones tends to prove, what we have already obſerved, that the court of Areopagus ſat in the night: for what end did it ſerve to pierce the black ſhells, or flints, if the judges could have ſeen them and the white ones, and conſequently have diſtinguiſhed their colours by the aſſiſtance of the light? But as they paſſed ſentence in the dark, it is evident that a difference beſides that of colour was neceſſary, to know the black ones from the white. The judges were likewiſe permitted to multiply at pleaſure the diſtinctions between ſigns, which eſſentially diſtinguiſhed the fates of men.

After the ſuffrages were collected, they were taken out of the two urns, and put into a third vaſe of braſs. They were then counted; and as the number of white or of black flints was higher or inferior, one of the judges drew with his nail a ſhorter or a longer line on a tablet with a waxen ſurface, on which the reſult of each cauſe was marked. The ſhort line expreſſed acquittal; the long, condemnation.

With regard to the emoluments of the judges, they were as moderate as thoſe of the advocates. The length of the proceſs did not enhance its expence; and when the deciſion of a cauſe was poſtponed till the next day, the committee were only paid an obolus on that day. Hence Mercury, in Lucian, is ſurpriſed that ſuch ſenſible old men as the ſenators of Areopagus were ſhould ſell at ſo low a price the trouble of aſcending ſo high.

As to the number of the judges which compoſed the Areopagus, ſome authors, attentive only to a part of Solon's regulations, by which he enacted, that for the future, none but the nine archons ſhould be admitted members of the Areopagus, have imagined, that this tribunal was filled anew every year, and that it never conſiſted of more than nine magiſtrates. This opinion, and ſome others, are refuted by the circumſtantial account which Diogenes Laertius gives us of the condemnation of Socrates. This great man had wiſhed to ſubſtitute a rational hypotheſis for the fabulous and extravagant ſyſtem of religion which prevailed in his time. His project, however laudable, appeared impious in the eye of ſuperſtition. Information was laid againſt him before the Areopagus, and he had as many accuſers as fellow-citizens. After the charges and the anſwers were heard, they proceeded to ſuffrages. The opinions were divided, but not equally, for the number of thoſe who condemned him exceeded by 281 the number of thoſe who declared him innocent. He made an ironical reply to this iniquitous ſentence, by telling his judges, that he took it for granted, they would admit him to a maintenance in the Prytanæum. On this ſarcaſm, 80 of thoſe who had voted in his favour forſook him, went over to the oppoſite party, and condemned him to die. Here then we have 361 judges who condemn; to whom if we add thoſe who perſiſt in aquitting him, the number muſt be very conſiderable.

Of all the judgments of the Areopagus, the moſt famous one, excepting that of Mars, was the ſentence which they paſſed on Oreſtes. His trial, which happened under Demophon the 12th king of Athens, in 375 of the Attic æra, owed all its fame to a remarkable circumſtance, that gave riſe to a cuſtom which was obſerved ever afterwards. Oreſtes had killed his mother. He was accuſed before the Areopagus, and cited to appear in that court. He would have loſt his life in conſequence of the equal diviſion of the votes, had not Minerva, moved with his misfortunes, declared herſelf for thoſe who had abſolved him, and joined her ſuffrage to theirs. Thus Oreſtes was ſaved. In veneration to this miracle, the Areopagites, whenever the ſuffrages were equally divided, decided in favour of the accuſed, by granting him what they termed *the ſhell of Minerva*. Cephalus and Dædalus were condemned by the Areopagus long before the time of Oreſtes.

We find in ancient authors ſome deciſions of this tribunal, which bear the ſtrongeſt marks of juſtice, though their objects are not intereſting. We ſhall here quote an anecdote from Aulus Gellius, and Valerius Maximus, of a woman who was accuſed of having poiſoned her huſband and her ſon. She was taken and brought before Dolabella, who was then proconſul of Aſia. She was no ſooner in his preſence than ſhe owned the fact; and added, that ſhe had very good reaſons for putting her huſband and her ſon to death.—"I had (ſaid ſhe) to my firſt huſband, a ſon whom I tenderly loved, and whoſe virtues rendered him worthy of my affection. My ſecond huſband, and the ſon whom I bare to him, murdered my favourite child. I thought it would have been unjuſt to have ſuffered thoſe two monſters of barbarity to live. If you think, Sir, that I have committed a crime, it is your province to puniſh it: I certainly ſhall never repent of it." This affair embarraſſed Dolabella. She was afterwards ſent to the Areopagus; and that court, when they had examined her a long time, ordered her and her accuſer to appear before them again a hundred years after, from the firſt day of her trial.

We muſt not, however, ſuppoſe that the Areopagus always preſerved its old reputation; for ſuch is the conſtitution of human affairs, that perfection, with regard to them, is a violent, and conſequently a tranſitory, ſtate. Pericles, who lived about 100 years after Solon, to flatter the people and win them to his party, uſed his utmoſt efforts to weaken the authority of the Areopagus, which was then diſliked by the multitude. He took from it the cognizance of many affairs which had before come under its juriſdiction; and, to forward his deſign of humbling it, employed the eloquence of Ephialtes, whoſe talents were formidable, and who was an avowed enemy to the great men of Athens.

The Areopagus itſelf ſeemed to ſecond the endeavours of a man who projected its ruin, and by its miſconduct haſtened its fall. The old rules of the court, by which none were admitted its members but thoſe whoſe unexceptionable conduct would ſupport its majeſty, ſeemed too ſevere. They grew leſs delicate in their choice, and preſuming that the faults with which they diſpenſed, would ſoon be reformed in the ſociety of ſo many good examples, vice imperceptibly crept among them: corruption, at firſt ſecret and timid, grew inſenſibly open and daring, and made ſuch progreſs, that the moſt ſhameful crimes were ſoon exhibited on the ſtage; and they were not copied from the low and abandoned multitude, but from thoſe ſenators, once the venerable and auſtere cenſors of idleneſs and of vice. Demetrius, the comic poet, wrote a piece which he intitled *The Areopagite*, where he ſtrips the maſk off thoſe hypocritical legiſlators, who were now equally apt to be ſeduced by wealth and by beauty. So much had the Athenian ſenate degenerated in the days of Iſocrates, cir. 340 years before the Chriſtian æra.

Before this tribunal St Paul was called to give an account of his doctrine, and converted Dionyſius one of their number.

The end of this court of judicature is as obſcure as its origin, which was derived from very remote antiquity. It exiſted, with the other magiſtracies, in the time of Pauſanias, i. e. in the 2d century. The term of its ſubſequent duration is not aſcertained; but a writer, who lived under the emperors Theodoſius the Elder and Younger, in the 5th century, mentions it as extinct.

AREQUIBA, a city of Peru in South America, ſituated in W. Long. 73°. S. Lat. 17°. It is one of the moſt beautiful cities in all Peru, being delightfully ſituated in the valley of Quilca, 100 leagues from Lima, and 20 from the ſea, with which it communicates by a fine river. The entrance into the harbour is rather ſhallow for ſhips of great burden; but when once they are entered, they may ride ſecurely in 18 fathoms water. This city was founded in 1539, by order of Don Franciſco Pizarro, in a place known likewiſe by the name of *Arequiba*; but its ſituation being found diſadvantageous, the inhabitants obtained leave to remove to the place where the city now ſtands. The houſes are built with ſtone, and vaulted; and, contrary to what is uſual in warm countries, they are lofty, neatly furniſhed within, and finely decorated on the outſide. The inhabitants alſo are exempt from many diſeaſes common in other parts of Peru; which perhaps is owing to their keeping the ſtreets clean by means of canals which extend to the river. The temperature of the air is extremely good; and though ſometimes a ſlight froſt is perceivable, the cold is never exceſſive, nor the heat troubleſome, ſo that the ſurrounding fields are clothed with perpetual verdure. Theſe natural advantages however, are conſiderably allayed by its being very ſubject to earthquakes, by which it has already been five times laid in ruins; notwithſtanding, which, it is populous, and has amongſt its inhabitants ſome of the nobleſt families in America.

ARES, a word of Paracelſus's, by which he would expreſs that power of nature in the whole material world, by which ſpecies are divided into individuals.

ARETÆUS of Cappadocia, a Greek phyſician, of the ſect of the Pneumatiſts, lived in the reign of Auguſtus, according to ſome; according to others, under Trajan or Adrian. He wrote ſeveral treatiſes in the Ionian dialect, on acute diſeaſes, and other medicinal ſubjects; ſome of which are ſtill extant. The beſt edition of his works is that of Boerhaave, in Greek and Latin, with notes, printed in 1731; that of Wigan, printed at Oxford in 1723, in folio, is alſo much eſteemed.

ARETHUSA, in fabulous hiſtory, the daughter of Nereus and Coris, and the companion of Diana, who changed her into a fountain to deliver her from the purſuit of her lover Alpheus.

ARETHUSA, a celebrated fountain near the city of Syracuſe in Sicily, famous for the quantity of its waters, and the number of fiſhes it contained. Many fables were invented by the ancients concerning this fountain. They had alſo a notion that the river ALPHEUS run under or through the waters of the ſea, without mixing with them, from Peloponneſus to Sicily. Mr Brydone informs us, that it ſtill continues to ſend forth an immenſe quantity of water, riſing at once to the ſize of a river, but is entirely abandoned by the fiſhes it formerly contained in ſuch plenty. At ſome diſtance from Arethuſa is a fountain of freſh water which boils up very ſtrongly in the ſea, inſomuch that, after piercing the ſalt water, it may be ſometimes taken up very little affected by it. This fountain Mr Brydone thinks the ancients were ignorant of, or they would not have failed to uſe it as an argument for the ſubmarine journey of Alpheus.

Mr Swinburn deſcribes this once famous fountain as a large pool of water near the quay, defended from the ſea by a wall, and almoſt hidden by houſes on every other ſide. The water is not ſalt, but brackiſh, and fit for no purpoſe but waſhing linen. "This (ſays he) is the celebrated fountain of Arethuſa, whoſe ſoft poetical name is known to every reader. The fable of the nymph and her conſtant lover Alpheus, the excellence of the ſpring, and the charms of its ſituation, are themes on which ancient and modern poets have indulged their fancy, and exerciſed their pens. Alas, how altered! rubbiſh chokes up its wholeſome ſources; the waves have found a paſſage through the rocks, which repeated earthquakes have ſplit; and not a fiſh to be ſeen in it. Sometimes, after an earthquake, it has been left dry; and, at other times, the whole maſs of its waters have been tainted by ſubterraneous effluvia. Its fountain-head probably lies among the neighbouring hills."

ARETHUSA, in botany: A genus of the gynandria diandria claſs; and in the natural method ranking under the 7th order, *Orchideæ*. The generic character is taken from the nectarium, which is tubular, ſituated at the bottom of the corolla, and the inferior labium fixed to the ſtylus. There are four ſpecies; all natives of America except the carpenſis, which is only found at the Cape of Good Hope.

ARETIA, in botany: A genus of the pentandria monogynia claſs; and in the natural method ranking under the 21ſt order, *Pretiæ*. The corolla is divided into five parts; the tube of the corolla is ovated; and the capſule is globular, and conſiſts of but one cell. There is only one ſpecies, viz. the alphina.

ARETIN (Guido), famous for his muſical improvements, lived in the 13th century. He was a native of Arezzo, a city in Tuſcany; and having been taught the practice of muſic in his youth, and probably retained as a choriſter in the ſervice of the Benedictine monaſtery founded in that city, he became a monk profeſſed, and a brother of the order of St Benedict.

In this retirement he ſeems to have devoted himſelf to the ſtudy of muſic, particularly the ſyſtem of the ancients, and, above all, to reform their method of notation. The difficulties that attended the inſtruction of youth in the church-offices were ſo great, that as he himſelf ſays, ten years were generally conſumed barely in acquiring the knowledge of the plain-ſong; and this conſideration induced him to labour after ſome amendment, ſome method that might facilitate inſtruction, and enable thoſe employed in the choral office to perform the duties of it in a correct and decent manner. If we may credit thoſe legendary accounts that are extant in old monkiſh manuſcripts, we ſhould believe he was aſſiſted in his pious intention by immediate communications from heaven: ſome ſpeak of the invention of the ſyllables as the effect of inſpiration; and Guido himſelf ſeems to have been of the ſame opinion, by his ſaying it was revealed to him by the Lord; or, as ſome interpret his words, in a dream: but graver hiſtorians ſay, that being at veſpers in the chapel of his monaſtery, it happened that one of the offices appointed for that day was the hymn[†] to St John,

UT *queant laxis* RE*ſonare fibris*
MI*ra geſtorum* FA*muli tuorum*
SOL*ve pollutis* LA*biis reatum,*
Sancte Joannes.

During the performance of the hymn, he remarked the iteration of the words, and the frequent returns of UT, RE, MI, FA, SOL, LA: he obſerved likewiſe a diſſimilarity between the cloſeneſs of the ſyllable MI and the broad open ſound of FA, which he thought could not fail to impreſs upon the mind a laſting idea of their congruity; and immediately conceived a thought of applying the ſix ſyllables to perfect an improvement either then actually made by him, or under conſideration, viz. that of converting the ancient tetrachords into hexachords.

[†] Compoſed by Paul, a deacon of the church of Aquileia, about the year 770.

Struck with the diſcovery, he retired to his ſtudy; and having perfected his ſyſtem, began to introduce it into practice: the perſons to whom he communicated it were the brethren of his own monaſtery, from whom it met with but a cold reception, which, in the epiſtle to his friend, he aſcribes undoubtedly to its true cauſe, envy: however, his intereſt with the abbot, and his employment in the chapel, gave him an opportunity of trying the efficacy of his method on the boys who were training up for the choral ſervice, and it exceeded the moſt ſanguine expectation. "To the admiration of all (ſays cardinal Baronius), a boy thereby learnt, in a few months, what no man, though of great ingenuity, could before that attain in ſeveral years."

The fame of Guido's invention ſoon ſpread abroad, and his method of inſtruction was adopted by the clergy of other countries. We are told by Kircher, that Hermannus biſhop of Hamburg, and Elviricus biſhop of Oſnaburg, made uſe of it; and by the authors of the *Hiſtoire Litteraire de la France*, that it was received in that country, and taught in all the monaſteries in the kingdom. It is certain that the reputation of his great ſkill in muſic had excited in the pope a deſire to ſee and converſe with him; of which, and of his going to Rome for that purpoſe, and the reception he met with from the pontiff, he himſelf has given a circumſtantial account of in the epiſtle hereafter mentioned.

The particulars of this relation are very curious; and as we have his own authority, there is no room to doubt the truth of it. It ſeems that John XX. or, as ſome writers compute, the 19th pope of that name, having heard of the fame of Guido's ſchool, and conceiving a deſire to ſee him, ſent three meſſengers to invite him to Rome; upon their arrival, it was reſolved by the brethren of the monaſtery that he ſhould go thither attended by Grimaldo the abbot, and Peter the chief of the canons of the church of Arezzo. Arriving at Rome, he was preſented to the holy father, and by him received with great kindneſs. The pope had ſeveral converſations with him, in all which he interrogated him as to his knowledge in muſic; and upon ſight of an antiphonary which Guido had brought with him, marked with the ſyllables agreeable to his new invention, the pope looked on it as a kind of prodigy; and ruminating on the doctrines delivered by Guido, would not ſtir from his ſeat till he had learned perfectly to ſing off a verſe: upon which he declared, that he could not have believed the efficacy of the method, if he had not been convinced by the experiment he had himſelf made of it. The pope would have detained him at Rome; but labouring under a bodily diſorder, and fearing an injury to his health from the air of the place, and the heats of the ſummer, which was then approaching, Guido left that city upon a promiſe to reviſit it, and explain to his holineſs the principles of his new ſyſtem. On his return homewards, he made a viſit to the abbot of Pompoſa, a town in the duchy of Ferrara, who was very earneſt to have Guido ſettle in the monaſtery of that place: to which invitation it ſeems he yielded, being, as he ſays, deſirous of rendering ſo great a monaſtery ſtill more famous by his ſtudies there.

Here it was that he compoſed a tract on muſic, intitled *Micrologus*, i. e. "a ſhort diſcourſe;" which he dedicated to Theodald biſhop of Arezzo; and finiſhed, as he himſelf at the end of it tells us, under the pontificate of John XX. and in the 34th year of his age. Voſſius ſpeaks alſo of another muſical treatiſe written by him, and dedicated to the ſame perſon.

Moſt of the authors who have taken occaſion to mention Guido, ſpeak of the Micrologus as containing the ſum of his doctrine: but it is in a ſmall tract, intitled *Argumentum novi Cantus inveniendi*, that his declaration of his uſe of the ſyllables, with their ſeveral mutations, and in ſhort his whole doctrine of ſolmiſation, is to be found. This tract makes part of an epiſtle to a very dear and intimate friend of Guido, whom he addreſſes thus, "Beatiſſimo atque dulciſſimo fratri Michaëli;" at whoſe requeſt the tract itſelf ſeems to have been compoſed.

Whether Guido was the author of any other tracts, is not eaſy to determine. It no where appears that any of his works were ever printed, except that Baronius, in his *Annales Eccleſiaſtici*, tom. xi. p. 73, has given at length the epiſtle from him to his friend Michael of Pompoſa, and that to Theodald biſhop of Arezzo, prefixed to the Micrologus; and yet the writers on muſic ſpeak of the Micrologus as of a book in the hands of every one. Martini cites ſeveral manuſcrips of Guido; namely, two in the Ambroſian library at Milan, the one written about the 12th century, the other leſs ancient; another among the archives of the chapter of Piſtoja, a city in Tuſcany; and a third in the Mediceo-Laurenziano library at Florence, of the 15th century: theſe are clearly the Micrologus. Of the epiſtle to Michael of Pompoſa, together with the *Argumentum novi Cantus inveniendi*, he mentions only one, which he ſays is ſomewhere at Ratiſbon. Of the ſeveral tracts abovementioned, the laſt excepted, a manuſcript is extant in the library of Baliol-college in Oxford. Several fragments of the two firſt, in one volume, are alſo among the Harleian manuſcripts now in the Britiſh Muſeum, N° 3199; but ſo very much mutilated, that they afford but ſmall ſatisfaction to a curious inquirer.

ARETIN (Leonard), one of the moſt learned men of the 15th century, was ſecretary to the republic of Florence, and tranſlated from the Greek into Latin ſome of the Lives of Plutarch, and Ariſtotle's Ethics: he alſo compoſed three books of the Punic war, that may ſerve as a ſupplement to thoſe wanting in Livy; the hiſtory of the tranſactions in Italy during his time; that of ancient Greece; that of the Goths; that of the republic of Florence; and many other books. He died in 1443, aged 74.

ARETIN (Francis), a man of great reading, and well acquainted with the Greek language. He tranſlated into Latin the Commentaries of St Chryſoſtom upon St John, and about 20 Homilies of the ſame father: he alſo tranſlated the Letters of Phalaris into Latin, and wrote a treatiſe *De balneis Puteolanis*. He ſtudied at Sienna, about the year 1443; and afterwards taught law there with ſuch reputation, that they called him the *Prince of Subtleties*, and his wit became a proverb. He diſplayed his talents chiefly in diſputes, in which nobody could withſtand him. He gave his opinions in law with ſo much confidence, as to aſſure thoſe who conſulted him that they ſhould carry their cauſe: nor did experience contradict him; for it was a common ſaying at the bar, ſuch a cauſe has been condemned by Aretin, it muſt therefore be loſt. He taught alſo in the univerſity of Piſa, and in that of Ferrara. He was at Rome under the Pontificate of Sixtus IV. but did not ſtay here long; for he ſoon perceived that the great hopes which he had built upon his reputation would come to nothing. This pope, however, declared he would have given him a cardinal's hat, had he not thought he ſhould have done a public injury by depriving the youth of ſuch an excellent profeſſor. When old age would not permit him to go through the duties of his office, they diſpenſed with his reading of lectures, and his ſalary was continued. He continued, however, ſometimes to mount the chair; and although his lectures had now but little ſpirit in them, yet he had ſtill many hearers on account of his reputation. One day when the ſtudents were gone to ſome public ſhows, there were but 40 perſons in his auditory: which ſo mortified him, that he threw away his book; and crying out, "Aretin ſhall never explain law to a few perſons," retired in a paſſion, and would teach no more. He was ſevere in his temper, and never kept a ſervant longer than a month or two; for it was a maxim of his, "that new hired ſervants always ſerve beſt." He was honoured with the title of *knight*, and ſpent all his life in celibacy; and his way of living was ſo parſimonious, that he was thereby enabled to amaſs a great deal of wealth. He had deſigned this wealth for the maintenance of a college; but he altered his reſolution, and left it to his relations.

ARETIN (Peter), a native of Arezzo, who lived in the 16th century. He was famous for his ſatirical writings: and was ſo bold as to carry his invectives even againſt ſovereigns, and from thence got the title of the *Scourge of Princes*. Francis I. the emperor Charles V. moſt of the princes of Italy, ſeveral cardinals, and many noblemen courted his friendſhip by preſents, either becauſe they liked his compoſitions, or perhaps from an apprehenſion of falling under the laſh of his ſatire. Aretin became thereupon ſo inſolent, that he is ſaid to have got a medal ſtruck, on one ſide of which he is repreſented by theſe words, IL DIVINO ARETINO; and on the reverſe, ſitting upon a throne, receiving the preſents of Princes, with theſe words, I PRINCIPI TRIBUTATI DA POPOLI, TRIBUTANO IL SERVIDOR LORO. Some imagine that he gave himſelf the title of *Divine*, ſignifying thereby that he performed the functions of a god upon earth, by the thunderbolts with which he ſtruck the heads of the higheſt perſonages. He uſed to boaſt, that his lampoons did more ſervice to the world than ſermons; and it was ſaid of him, that he had ſubjected more princes by his pen than the greateſt had ever done by their arms. Aretin wrote many irreligious and obſcene pieces; ſuch are his dialogues, which were called *Ragionamenti*. There is likewiſe imputed to him another very obſcene performance, *De omnibus Veneris ſchematibus*. "It was about the year 1525 (ſays Mr Chevillier*) that Julio Romano, the moſt famous painter of Italy, inſtigated by the enemy of the ſalvation of mankind, invented drawings to engrave 20 plates: the ſubjects are ſo immodeſt that I dare only name them. Peter Aretin compoſed ſonnets for each figure. George Vaſari, who relates this in his Lives of the Painters, ſays, he does not know which would be the greateſt impurity, to caſt one's eyes upon the drawings of Julio, or to dip into the verſes of Aretin." Some ſay that Aretin changed his libertine principles; but however this may be, it is certain that he compoſed ſeveral pieces of devotion. He wrote a Paraphraſe on the penitential Pſalms, and another on Geneſis; he wrote alſo the Life of the Virgin Mary, and that of St Catherine of Sienna, and of St Thomas Aquinas. He was author likewiſe of ſome comedies. He died in the year 1556, being about 65 years old.

ARETOLOGI, in antiquity, a ſort of philoſophers, chiefly of the Cynic or Stoic tribe, who, having no ſchool or diſciples of their own, haunted the tables of great men, and entertained them in their banquets with diſputations on virtue, vice, and other popular topics. Theſe are ſometimes alſo denominated *Circulatores Philoſophi*. In this ſenſe, the word is derived from the Greek αρετη, *virtue*, and λογος, *diſcourſe*. Some authors chooſe to derive the word from αρετος, *gratus*, "agreeable;" and define Aretologi, by perſons who ſtrive to divert and entertain their audiences with jokes and pleaſant tales; which latter ſeems the more natural explication.

AREZZO, a city of Italy, in Tuſcany, ſeated in the territory of Florence, on the declivity of a hill that overlooks the neighbouring plain, between the Citta di Caſtelli and Florence. It is an ancient city, and a biſhop's ſee; and was famous for a kind of earthen ware much eſteemed by the Romans. It was greatly fallen to decay when Coſmo de Medicis took it under his protection; ſince which it has been recovering gradually. It is famed for being the birth-place of Mecænas. E. Long. 12. 2. N. Lat. 43. 27.

ARGEA, or ARGEI, in Roman antiquity, thirty human figures, made of ruſhes, thrown annually by the prieſts or veſtals into the Tiber, on the day of the ides of May.—Plutarch in his Roman Queſtions, inquires why they were called *Argea*. There are two reaſons aſſigned. The firſt, that the barbarous nation who firſt inhabited theſe parts caſt all the Greeks they could meet with into the Tiber: for Argians was a common name for all Grecians: but that Hercules perſuaded them to quit ſo inhuman a practice, and to purge themſelves of the crime by inſtituting this ſolemnity. The ſecond, that Evander, an Arcadian, and a ſworn enemy of the Argians, to perpetuate that enmity to his poſterity, ordered the figures of Argians to be thus caſt into the river.

ARGEIA, or ARGOLIS, a diſtrict of Peloponneſus, ſituated between Arcadia to the weſt, the Egean Sea to the eaſt, Laconica and the Sinus Argolicus to the ſouth, and to the north the territory of Corinth and the Sinus Saronicus (Livy, Ptolemy); ſo called from ARGOS, the capital: Now *Romania di Morea*.

By the Greeks the people were called *Argeii*, from *Argi* or *Argos*; by the Romans, *Argivi*, Argives They were a colony who migrated, it is ſaid, from Egypt, under the command of Inachus. Polemon and Ptolemy Mendeſius, ancient Greek writers, inform us, that Inachus was contemporary with Amoſis, who demoliſhed Avaris, and expelled the ſhepherds out of Egypt. If, with ſome learned chronologers, we ſuppoſe Inachus to have begun to reform the Argives B. C. 1856, and to have died B. C. 1808, he muſt have been coeval with Amoſis who reigned in Upper Egypt 15 years before the expulſion of the ſhepherds, and 10 years after that event, which happened B.C. 1806. Inachus was ſtyled the *Son of the Ocean*, becauſe his origin was not known, or becauſe he had come by ſea into Greece. Before his arrival the inhabitants were rude and barbarous. Theſe he united and civilized, and inſtructed in various arts. His ſon Phoroneus inſtituted the laws of government; and, on that account, has been called the *firſt king in Argos*, the *firſt of men*, and the *father of mortals*. The family of Inachus, after having kept poſſeſſion of the throne 347 years, were expelled by Danaus, who arrived B. C. 1509 with a colony from Canaan. Acriſius, the laſt king of Argos, died B. C. 1313; and was ſucceeded by Perſeus, his grandſon, who transferred the ſeat of government to Mycenæ, 544 years from the firſt year of Inachus, in the reign of Cecrops II. king of Athens, and about the time when Pelops the ſon of Tantalus king of Phrygia, having been compelled by Ilus to leave his native country, came into Greece with great wealth, and acquired ſupreme power in the region afterwards called by his name. In the 37th year of Euryſtheus, grandſon of Perſeus, the Argonautic expedition happened, i. e. B. C. 1224. This unjuſt and tyrannical prince had aſſigned to Hercules his taſk; and, after the death of that hero, he baniſhed all his children. Theſe were the Heraclidæ who fled to Athens for protection, and who returned to Peloponneſus 40 years after the deſtruction of Troy. In the reign of Agamemnon, the Trojan war commenced; and it was carried on with vigour during the ſpace of ten years. In the year B. C. 1184, Troy was taken, and the war was concluded. Scarcely had the Grecians ſettled in their own country after their return from this dangerous expedition, when the poſterity of Hercules invaded Peloponneſus, took poſſeſſion of it, and divided it among themſelves. Here the kingdom of Mycenæ ended, and that of Sparta was eſtabliſhed on its ruins. See SPARTA.

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* *Origin de l'imprimerie de Paris*, p. 224.

ARGEMONE, PRICKLY POPPY: A genus of the monogynia order, belonging to the polyandria claſs of plants; and in the natural method ranking under the 27th order, *Rhœadeæ*. The corolla conſiſts of ſix petals; the calyx is triphyllous; and the capſule is ſemivalved. Of this genus there are three ſpecies, which are common in many parts of the Weſt-Indies, and called by the Spaniards the *devil's fig*; but they are of no uſe, and have very little beauty.

ARGENCES, a town of France, in Lower Normandy, on the river Meance. W. Long. 0. 10. N. Lat. 49. 15.

ARGENT, the common French word for *ſilver*, of which metal all white fields or charges are ſuppoſed to conſiſt. Argent of itſelf is uſed in heraldry to ſignify purity, innocence, beauty, and gentleneſs; and, according to G. Leigh, if it is compounded with

Gul.	it ſignifies	boldneſs;
Azu.		courteſy;
Ver.		virtue;
Pur.		favour;
Sab.		religion;

ARGENTAC, a town of France, in the Limoſin, on the river Dordogne. E. Long. 2. 3. N. Lat. 45. 5.

ARGENTAN, a town of France in Lower Normandy, and in the dioceſe of the Seez, with the title of marquiſate. It is ſeated on an eminence, in the middle of a fertile plain, on the banks of the river Orne, and carries on a conſiderable trade. E. Long. 0. 5. N. Lat. 48. 54.

ARGENTARIA, a town of ancient Gaul, thought to ſtand in the place where the city Colmar now ſtands. It is remarkable for a great victory gained by the emperor Gratian over the Lentienſes, in the month of May, A. D. 378. The Romans being but few in number, were at firſt overpowered, and obliged to give ground; but ſoon returning to the charge, they gained in the end a complete victory. Thirty thouſand of the barbarians, and among the reſt their king Triarius were killed on the ſpot; and all the reſt, except 5000, taken priſoners.

ARGENTARIA Creta, pure white earth, found in Pruſſia, and much eſteemed for cleaning plate.

ARGENTARIUS is frequently uſed in Roman writers, for a money changer or banker. The argentarii were monied people, who made a profit either by the changing, or lending money at intereſt. Theſe had their *tabernæ*, or offices, in the *forum Romanum*, built there as early as the reign of L. Tarquinius Priſcus. The argentarii and fœneratores were much hated on account of their covetouſneſs and extortion.

ARGENTATI MILITES, in antiquity. Livy, lib. vi. ſpeaks of *argentati milites*, as diſtinguiſhed from *aurati*. Aquinas ſuppoſes theſe to have been ſimilar to the argyraſpides and chryſaſpides; but the deſcriptions do not quadrate. Livy only repreſents the argentati as cloathed in white linen coats.

ARGNTEUIL, a town of the Iſle of France, ſeated on the river Seine, five miles north-weſt of Paris. It is a very beautiful place, with fine vineyards. In the environs are quarries of ſtucco. In the Benedictine priory they pretended to have the ſeamleſs coat of Chriſt. E. Lon. 2. 28. N. Lat. 48. 52.

ARGENTIERE, a ſmall iſland in the Archipelago, near Milo. It is about 18 miles in compaſs; and is full of barren mountains, producing nothing but barley, cotton, and a few grapes fit only for eating. The barley and cotton are ſown round the only village there is in the iſland. The ladies are handſome enough, have no other employment but making cotton ſtockings, and take up with the ſailors who put into the port. The men all uſe the ſea, and in time become good pilots. They have very little religion, are very ignorant, and of very bad morals. Juſtice is adminiſtered by an itinerant cadi, who is ſometimes the only muſſulman in the whole iſland. The only article relating to natural hiſtory is the Terra Cimolia ſo highly eſteemed by the ancients; it is a kind of white chalk, which is very heavy without taſte, and crumbles eaſily: they uſe it in waſhing linen. E. Long. 23. 10. N. Lat. 36. 50.

ARGENTINA, in ichthyology, a genus of fiſhes belonging to the order of abdominales. The generic characters are theſe: The teeth are in the tongue as well as the jaws; the branchioſtege membrane has eight radii or rays; the anus is near the tail; and the belly-fins conſiſt of many rays. There are two ſpecies of argentina, viz. The ſphyræna has 15 rays in the fin at the anus; the air-bladder of this ſpecies is conical on both ſides, and ſhines like ſilver: according to Mr Ray, falſe pearls are ſometimes made of it. 2. The carolina has likewiſe 15 rays in the fin near the anus;

the tail is forked, and the lateral lines are ſtraight. It inhabits the freſh waters of Carolina.

ARGENTINUS, a deity worſhipped by the ancients, as the god of ſilver coin; as Æſculanus, whom they made his father, was the god of braſs money, which was in uſe before ſilver.

ARGENTON, a town and county of France, in the duchy of Berry, divided into two by the river Creuſe. Here was formerly a caſtle; but it was demoliſhed by Lewis XIV. E. Long. 1. 38. N. Lat. 40. 30.

ARGENTORA, *Argentina*, (Notitiæ); *Argentoratum*, (Ptolemy); *Argentoratus*, (Ammian); a city of the Tribocci; one of the fifty forts built by Druſus on the Rhine, (Florus): an appellation formed by the Romans from the German, *Argen Straſſen*, or *Straten*, "unſafe roads for travellers," from the maroding parties of the garriſons that infeſted the roads. Now *Straſburg*†, in the lower Alſace, on the rivulet Ill, near the Rhine. E. Long. 7. 35. Lat 48. 38.

† See *Straſburg*.

ARGENTUM. See SILVER.

ARGENTUM Album, in our old cuſtoms, ſilver coin, or pieces of bullion that anciently paſſed for money. By Doomſday tenure, ſome rents to the king were paid in *argento albo*, common ſilver pieces of money; other rents in *libris urſis et penſatis*, in metal of full weight and purity: in the next age, that rent which was paid in money, was called *blanch fearm*, and afterwards *white rent*; and what was paid in proviſions, was termed *black mail*.

ARGENTUM Dei, God's penny, anciently ſignified earneſt-money, or money given to bind a bargain; in ſome places called *erles*, or *arles*, and by the civilians and canoniſts, *arrhæ*. *Et cepit de prædicto Henrico tres denarios de argenti Dei præ manibus.*

ARGENTUM Muſivum is a maſs conſiſting of ſilver-like flakes, uſed for the colouring of plaſter-figures, and for other purpoſes, as pigment. It conſiſts of an amalgam of equal parts of tin, biſmuth, and mercury. It is to be mixed with white of eggs, or ſpirit varniſh, and then applied to the intended work, which is afterwards to be burniſhed.

ARGENTUM Vivum, Mercury or *Quickſilver*. See MERCURY and CHEMISTRY-*Index*.

ARGESTES, is uſed by Vitruvius for the wind which blows from that quarter of the horizon, which is 75° from the ſouth, and weſtward. Ricciolus uſes the term to denote the wind which blows at 22° 30′, from the weſt towards the north, coinciding with that which is otherwiſe called *weſt-north-weſt*.

ARGIL, in ornithology, a ſpecies of ardea. See ARDEA.

ARGILLA, clay in natural hiſtory. See CLAY.

ARGIVI, or ARGEII, the people of Argeia or Argolis. See ARGEIA.

ARGO, in antiquity, a ſhip or veſſel celebrated among the poets; being that wherein the Argonauts, of whom Jaſon was the chief, made their expedition in queſt of the golden fleece. Jaſon having happily accompliſhed his enterpriſe, conſecrated the ſhip Argo to Neptune; or, as others ſay, to Minerva, in the Iſthmus of Corinth; where, they add, it did not remain long before it was tranſlated into heaven, and made a conſtellation. The generality of authors repreſent the ſhip Argo as of a long make, reſembling the modern galleys; and furniſhed with thirty benches of rowers. It could not, however, be of any great bulk, ſince the Argonauts were able to carry it on their backs from the Danube to the Adriatic ſea.

ARGO Navis, the *Ship Argo*, in aſtronomy, is a conſtellation in the ſouthern hemiſphere, whoſe ſtars, in Ptolemy's catalogue, are 45; in Tycho's, 11; in the Britannic catalogue, and Sharp's appendix, 64.

ARGOB, (anc. geog.), a canton lying beyond Jordan, in the half tribe of Manaſſeh, and in the country of Baſhan, one of the moſt fruitful on the other ſide of Jordan. In the region of Argob there were ſixty cities, called *Baſhan-havoth-jair*, which had very high walls and ſtrong gates, without reckoning many villages and hamlets which were not incloſed, Deut. iii. 4. 14, and 1 Kings iv. 13. But Argob was more particularly the name of the capital city of the region of Argob, which Euſebius ſays was fifteen miles weſt from Geraſa.

ARGONAUTA, the name of a genus of ſhell-fiſh belonging to the order of vermes teſtacea. The ſhell conſiſts of one ſpiral involuted valve. There are two ſpecies of argonauta, viz. The argo, with a ſubdented carina, which is found in the Mediterranean and Indian oceans. This is the famous nautilus of authors. The ſhell ſeems no thicker nor ſtronger than a piece of paper; and the fiſh that inhabits it is a ſepia. It has been imagined that men firſt learned the method of ſailing in veſſels from what they ſaw practiſed by this creature. When it is to ſail, it extends two of its arms on high; and between theſe ſupports a membrane, which it throws out on this occaſion: this ſerves for its ſail; and the two other arms it hangs out of the ſhell, to ſerve occaſionally either as oars or as a ſteerage; but this laſt office is generally ſerved by the tail. When the ſea is calm, it is common to ſee numbers of theſe creatures diverting themſelves with ſailing about in this manner; but as ſoon as a ſtorm riſes, or any thing gives them diſturbance, they draw in their legs, and take in as much water as makes them ſomewhat heavier than the ſea-water in which they ſwim, and they then ſink to the bottom. The manner of their voiding this abundant water, when they would riſe again, is by a number of holes, of which their legs are full. 2. The cymbium, with a blunt plaited carina. This ſpecies is very ſmall, and is found in the Mediterranean.

See Plate LVIII.

ARGONAUTIC, ſomething belonging to the Argonauts.

The argonautic expedition is one of the greateſt epochas or periods of hiſtory which Sir Iſaac Newton endeavours to ſettle, and from thence to rectify the ancient chronology. This he ſhows, by ſeveral authorities, to have been one generation or about thirty years earlier than the taking of Troy, and 43 years later than the death of Solomon. See CHRONOLOGY.

Dr Bryant, however, rejects the hiſtory of the Argonautic expedition as a Grecian fable, founded indeed on a tradition derived from Egypt, and ultimately referring to Noah's preſervation, &c. in the ark. But although we are not to believe all the romantic ſtories which poets, and even ſome grave hiſtorians, have told us of thoſe famous adventurers, yet it ſeems unreaſonable to diſcredit enterely the Argonautic expedition. See ARGONAUTS.

ARGONAUTICA, in literary hiſtory, denotes poems on the ſubject and expeditions of the Argonauts. We have the *Argonautics* of Orpheus in epic verſe, publiſhed by H. Stephens; the *Argonauticon* of Valerius Flaccus, in eight books of Latin heroics, in imitation of Apollonius, with reſpect to which Burman obſerves that the imitator has often ſurpaſſed the original; the *Argonautics* of Apollonius Rhodius, an heroic poem, conſiſting of four books, *opus*, as Quintilian calls it, *non contemnendum*.

ARGONAUTS, in antiquity, a company of illuſtrious Greeks, who embarked along with Jaſon, in the ſhip Argo, from Colchis, with a deſign to obtain the golden fleece.

The occaſion of this expedition is thus repreſented by Greek writers. Phryxus, flying with his ſiſter Helle from the rage of their ſtep-mother Ino, the daughter of Cadmus, went on board a ſhip, whoſe enſign was a golden ram and ſailed to Colchis (now Mingrelia, part of Georgia). Helle was drowned by the way, in that ſea which from her was called the *Helleſpont*, now the *Dardanelles*. This, according to ſome, was the ground of the poetical fable, that a ram with a golden fleece ſwam away with them to Colchis; and that the Argonauts undertook their famed expedition, in order to find that fleece. But Strabo and Arrian inform us, that it was a practice of the Colchians to collect gold on mount Caucaſſus by extending fleeces acroſs the beds of the torrents; and as the water paſſed, the metallic particles remained entangled in the wool: hence, according to thoſe hiſtorians, the adventure was named the *expedition of the golden fleece*. Sir Iſaac Newtown thinks that this expedition was really an embaſſy ſent by the Greeks, during the inteſtine diviſions of Egypt in the reign of Amenophis, to perſuade the nations upon the coaſt of the Euxine and Mediterranean ſeas, to take that opportunity of ſhaking off the yoke of Egypt, which Seſoſtris had laid upon them; and that fetching the golden fleece, was only a pretence to cover their true deſign.

But the moſt judicious and ſatisfactory account of the Argonautic expedition ſeems to be that given by Dr Gillies in his hiſtory of Greece. "The northern diſtricts of Theſſaly being peculiarly expoſed to the dangerous fury of invaders, the petty princes of that province entered into a confederacy for their mutual defence. They aſſembled in ſpring and autumn at Thermopylæ, a place afterwards ſo illuſtrious, and then governed by Amphictyon, a deſcendant of Deucalion, whoſe name is immortalized in the Amphictyonic council. The advantages which the confederates derived from this meaſure, were ſoon perceived by their neighbours. The central ſtates gradually acceded to their alliance; and about the middle of the fourteenth century before Chriſt, Acriſius king of Argos, and other princes of the Peloponneſus, were allowed to ſhare the benefits and ſecurity of this uſeful aſſociation. See AMPHICTYONS.

"After this event, the Amphictyons appear to have long confined themſelves to the original purpoſe of their inſtitution. The ſtates, whoſe meaſures were directed by this aſſembly, found ſufficient occupation in defending their own territories; and near a century elapſed, before they undertook, by common conſent, any diſtant expedition. But it was not to be expected that their reſtleſs activity could be always exhauſted in defenſive war. The eſtabliſhment of the Amphictyons brought together the chiefs moſt diſtinguiſhed by birth and bravery. Glory and emulation prompted them to arms, and revenge directed thoſe arms againſt the barbarians. Jaſon, Admetus, and other chieftans of Theſſaly, having equipped a ſmall fleet in the neighbouring harbour of Iolcus, and particularly the ſhip Argo, of ſuperior ſize and conſtruction to any before known, were animated with a deſire to viſit foreign lands, to plant colonies in thoſe parts of them that appeared moſt delightful, and to retort on their inhabitants the injuries which Greece had ſuffered from ſtrangers. The princes of the north having proclaimed this ſpirited deſign over the central and ſouthern provinces, the ſtandard of enterprize and glory was ſpeedily ſurrounded by the flower of the Grecian youth, who eagerly embraced this honourable opportunity to ſignalize their manly valour. Peleus, Tydeus, Telamon, and in general the fathers of thoſe heroic chiefs who in the ſucceeding age ſhone with diſtinguiſhed luſtre in the plains of Troy, are numbered among the leaders of the Argonauts. They were accompanied by the choſen warriors, and by the venerable prophets, of their reſpective tribes; by an Eſculapius, the admired father of the healing art; and by the divine Orpheus, whoſe ſublime genius was worthy to celebrate the amazing ſeries of their adventures.

"Theſe adventures, however, have been too much adorned by the graces of poetry, to be the proper ſubjects of hiſtorical compoſition. The deſigns of the Argonauts are vieled under the allegorical, or at leaſt doubtful, phraſe, *of carrying off the golden fleece*; which, though eaſily explained, if we admit the report that the inhabitants of the eaſtern banks of the Euxine extended fleeces of wool, in order to collect the golden particles which were carried down by the torrents from Mount Caucaſus, is yet deſcribed in ſuch various language by ancient writers, that almoſt every modern who examines the ſubject, thinks himſelf intitled to offer, by way of explanation, ſome new conjecture of his own. But in oppoſition to the moſt approved of theſe conjectures, we may venture to affirm, that the voyage to Colchis was not undertaken with a view to eſtabliſh extenſive plans of commerce, or to ſearch for mines of gold, far leſs to learn the imaginary art of converting other ſubſtances into that precious metal; all ſuch motives ſuppoſing a degree of ſpeculation and refinement unknown in that age to the gallant but uninſtructed youth of Theſſaly. The real object of the expedition may be diſcovered by its conſequences. The Argonauts fought, conquered, and plundered; they ſettled a colony on the ſhores of the Euxine; and carried into Greece a daughter of the king of Colchis, the celebrated Medea, a princeſs of Egyptian extraction, whoſe crimes and enchantments are condemned to eternal infamy in the immortal lines of Euripides."

ARGONAUTS of St Nicholas, was the name of a military order inſtituted by Charles III. king of Naples, in the year 1382, for the advancement of navigation, or, as ſome ſay, merely for preſerving amity among the nobles. They wore a collar of ſhells, incloſed in a ſilver creſcent, whence hung a ſhip with this device, *Non credo tempori*, "I do not truſt time." Hence theſe

Argonaut knights came to be called *knights of the ſhell*. They received the order of St Baſil, archbiſhop of Naples; and held their aſſemblies in the church of St Nicholas, their patron.

ARGOPHYLLUM, White-leaf (*Forſt. Nov. Gen.*): A genus of the monogynia order, belonging to the pentandria claſs of plants. The capſule is trilocular; the nectarium is pyramidal, pentagonous, and the length of the corolla. There is but one ſpecies, the netidum or gloſſy, a native of New Caledonia. This genus has great affinity with the ivy; but differs in the nectarium, and perhaps in the fruit.

ARGOS. an ancient name of Peloponneſus; from Argos, one of the kings, (Homer, Strabo).

Argos, the capital, and an inland town, of Argolis or Argeia. It had different ſurnames; as *Achaicum*, from the country, or an ancient people, (Homer); *Hippium*, from its breed of horſes; and *Inachium*, from the river Inachus, which runs by, or from Inachus the founder of the kingdom, whoſe name was alſo given to the river. The Argives related, that this was one of the river-gods who adjudged the country to Juno, when ſhe contended for it with Neptune, which deity in return made their water to vaniſh; the reaſon why the Inachus flowed only after rain, and was dry in ſummer. The ſource was a ſpring, not copious, on a mountain in Arcadia, and the river ſerved there as a boundary between the Argives and Mantineans.

Ancient Argos ſtood chiefly on a flat. The ſprings were near the ſurface; and it abounded in wells, which were ſaid to have been invented by the daughters of Danaus. This early perſonage lived in the acropolis or citadel, which was named *Lariſſa*, and accounted moderately ſtrong. On the aſcent was a temple of Apollo on the ridge, which in the ſecond century continued the ſeat of an oracle. The woman who propheſied was debarred from commerce with the male ſex. A lamb was ſacrificed in the night, monthly; when, on taſting of the blood, ſhe became poſſeſſed with the divinity. Farther on was a ſtadium, where the Argives celebrated games in honour of Neméan Jupiter and of Juno. On the top was a temple of Jupiter, without a roof, the ſtatue off the pedeſtal. In the temple of Minerva there, among other curious articles, was a wooden Jupiter, with an eye more than common, having one in the forehead. This ſtatue, it was ſaid, was once placed in a court of the palace of Priam, who fled as a ſuppliant to the altar before it, when Troy was ſacked. In this city was alſo the brazen tower in which Danäe, being confined there by her father, was deflowered by Jupiter.

Argos retains its original name and ſituation, ſtanding near the mountains which are the boundary of the plain, with Napoli and the ſea in view of it. The ſhining houſes are whitened with lime or plaſter. Churches, mud-built cottages and walls, with gardens and open areas, are interſperſed, and the town is of conſiderable extent. Above the other buildings towers a very handſome moſque ſhaded with ſolemn cypreſſes; and behind is a lofty hill, brown and naked, of a conical form, the ſummit crowned with a neglected caſtle. The devaſtations of time and war have effaced the old city. We look in vain (ſays Mr Chandler) for veſtiges of its numerous edifices, the theatre, the gymnaſium, the temples, and monuments, which it once boaſted, contending even with Athens in antiquity and in favours conferred by the gods.

Argos Amphilochicum, (Thucydides, a city of Acarnania, (Scylax, Pliny); its territory Amphilochia: ſituate on the eaſt ſide of the Sinus Ambracius, (Thucydides); diſtant one hundred and eighty ſtadia to the ſouth-eaſt of Ambracia, (Polybius). Alſo called *Argia Amphilochis*, (Mela); *Amphiloci*, and *Amphilochici*, the people, (Stephanus). The name is from Amphilochus, ſon of Amphiaraus; and from Argos, the name of his country, in Peloponneſus, (Thucydides).

Argos Hippium. See Argos in Peloponneſus, *ſupra*.

Argos Hippium, the ancient name of Arpi; but Lampe is a ſtill more ancient; afterwards called *Argyrippa*, and *Argippa*; built by, and the reſidence of, Diomedes, on the Cerbalus, (Virgil); afterwards a large and populous city, (Livy): a town of Apulia; now in ruins, and the place called *Arpi*.

Argos Pelaſgicum, (Homer); an appellation denoting Theſſaly; ſo called from the Pelaſgi.

Argos Portus, a port of Tuſcany, (Strabo): now Porto Ferraro, in the north of the iſland of Elba. E. Long. 11. 30. Lat. 42. 35.

ARGUIM, an iſland on the coaſt of Africa, about ſixteen miles diſtant from Cape Blanco, ſituated in W. Long. 16. 30. N. Lat. 20. 20. It is ſcarce two miles in length; notwithſtanding which, it was a bone of contention for 87 years between the Portugueſe, Dutch, Engliſh, and French; and, after a variety of fortune, has at laſt been totally abandoned.

This iſland was firſt diſcovered by the Portugueſe in 1444, when a fleet bound to the Eaſt touched at Arguim, and from ſome little trade carried on with the natives, it was imagined that a ſettlement there might be of ſome advantage to Portugal. In conſequence of this opinion, a fort was erected on the iſland, and the Portugueſe enjoyed the peaceable poſſeſſion of it till 1638. At this time the Dutch having received a minute account of the condition of the iſland, reſolved to attack it; and accordingly landed without moleſtation from the garriſon, which was too weak to oppoſe them. The Portugueſe, however, defended themſelves with great intrepidity, and at laſt ſurrendered upon honourable terms. The Dutch immediately ſet about repairing the fortifications, and ſecuring it in the beſt manner they could: however, in 1665, the fort was reduced almoſt to an heap of rubbiſh by an Engliſh ſquadron; but as the fortifications were totally deſtroyed, and only a ſmall garriſon left there, it was eaſily retaken by the Dutch the next year. They now redoubled their diligence in ſtrengthening the iſland, entering into alliance with Mooriſh chiefs, procuring a number of families to ſettle under protection of the fort, and giving extravagant prices for gums, in order to monopolize the gum-trade. By this means the gum-trade of the French Senegal company was almoſt entirely deſtroyed; upon which they fitted out a ſquadron, diſpoſſeſſed the Dutch, and had the iſland finally ceded to them by the treaty of Nimeguen.

Though the Dutch now ſeemed to be totally expelled, they reſolved not to part ſo eaſily with ſuch a valuable ſettlement. Under pretence of being ſubjects of the Elector of Brandenburg, therefore, they erected one of the forts which had been demoliſhed, and there maintained themſelves in ſpite of the utmoſt endeavours of the French company to diſpoſſeſs them. Numberleſs were the memorials, proteſts, reſcripts, &c. which were publiſhed upon this occaſion, till a new war in 1701 put an end to them. In 1717, however, the French company having found all their remonſtrances ineffectual, fitted out a new ſquadron; but this armament did not arrive at Arguim before Feb. 26th, 1721. The Dutch defended themſelves with ſuch intrepidity and conduct as had almoſt baffled the utmoſt efforts of the French; but the latter having found means to draw off a Mooriſh chief from his allegiance, the Dutch were obliged to evacuate Arguim, and retire to Portendic, where they fortified themſelves, determining to watch a favourable opportunity for recovering their ſettlement at Arguim. This was not long wanting, by means of the weakneſs of the garriſon and the imprudence of Duval the French director; who having quarrelled with the Moors, was ſurpriſed, defeated, and killed by them; in conſequence of which, the ſettlement fell again into the hands of the Dutch on the 11th of Jan. 1722. In 1723, the Dutch were attacked by another French ſquadron under the command of the Sieur Riguadiere. This gentleman boaſted that the fort could not hold out one day; but though he prevailed ſo far as to get poſſeſſion of the ciſterns which contained the water of the beſieged, he was at laſt ſhamefully repulſed, and forced to raiſe the ſiege with precipitation. The Dutch, however, did not long enjoy the poſſeſſion which they had ſo bravely defended; for, in 1725, their fort was entirely demoliſhed by the French under Du Caſſe, and has never ſince been rebuilt by any European nation.

ARGUMENT, in rhetoric and logic, an inference drawn from premiſes, the truth of which is indiſputable, or at leaſt highly probable. See LOGIC.

ARGUMENT, in matters of literature, denotes alſo the abridgment or heads of a book, hiſtory, comedy, chapter, &c. See SYLLABUS.

ARGUMENTATION, the act of inventing or framing arguments, of making inductions, and drawing concluſions. See INDUCTION, &c.

Argumentation, according to Cicero, is the delivering or unfolding of an argument.—The matter of argumentation is propoſitions; the form, their due diſpoſition, with regard to one another, ſo as a concluſion may be drawn from them. See ENTHYMEME, PROPOSITION, RATIOCINATION, SORITES, SYLLOGISM, &c.

ARGUS, in fabulous hiſtory, was the ſon of Ariſtor, and had 100 eyes, 50 of which were always open. Juno made choice of him to guard Io, whom Jupiter had transformed into a white heifer; but Jupiter, pitying Io for being ſo cloſely confined, ſent Mercury, who, with his flute, charmed Argus to ſleep, ſealed up his eyes with his caduceus, and then cut off his head; when Juno, to reward his fidelity, turned him into a peacock, and placed his eyes in his tail.

ARGUS-Shell, a ſpecies of porcelain-ſhell, beautifully variegated with ſpots, reſembling in ſome meaſure thoſe in a peacock's tail.

ARGUTIÆ, witty and acute ſayings, which commonly ſignify ſomething further than what their mere words at firſt ſight ſeem to import.—Writers on rhetoric ſpeak of divers ſpecies of argutiæ, viz.

ARGUTIÆ ab alieno, when ſomething is ſaid, which ſeems repugnant either to the nature and property of a thing, or to common cuſtom, the laws, &c. which yet in reality is conſiſtent therewith; or when ſomething is given as a reaſon of another, which yet is not the reaſon of it. For inſtance, *Si Caius nihil didiciſſet, erraſſet minus:* again, *Aureum hoc ſæculum eſt, quia plurimus jam auro honos venit.*

ARGUTIÆ ab illuſione, thoſe wherein alluſion is made to ſome hiſtory, fable, ſentence, proverb, or the like; e. gr. *Multi umbram captant & carnem amittunt.*

ARGUTIÆ a comparatis, when two things are compared together, which yet at firſt ſight appear very different from each other, but ſo as to make a pretty kind of ſimile or diſſimile; e. gr. *Par eſt pauper nil cupiens principi omnia habenti.*

ARGUTIÆ a repugnantibus, when two things meet in a ſubject, which yet regularly cannot be therein; or when two things are oppoſed to each other, yet the epithet of the one is attributed to the other; e. gr. *Dum tacent clamant.*

ARGYLE (dukes of). See CAMPBELL.

ARGYLESHIRE, or ARGATHILIA, in Scotland, which together with Perthſhire and the Weſtern Iſlands, is ſaid to have conſtituted the ancient kingdom of the Scots, while the reſt of Caledonia was ſubject to the Picts and Romans, comprehends Kintyre, Knapdale, Argyle proper, Cowal, and Lorn. It is bounded on the ſouth by the Iriſh ſea and the Frith of Clyde; on the eaſt, by Perthſhire; on the north-eaſt, by Lochaber; and on the north-weſt, by ſeveral Iſlands. The extent of it from ſouth to north, between the Mull of Kintyre and the point of Ardnamurchan where it joins the ſhire of Inverneſs, is about 114 miles; and the breadth in ſome places, including the iſles, to 70. This country, like all other parts of the Highlands, affords a very wild and horrid proſpect of hills, rocks, and huge mountains, piled upon each other in a ſtupendous and dreadful diſorder; bare, bleak, and barren to the view; or at beſt covered with ſhagged heath, which appears black and diſmal to the eye, except in the ſummer, when it is variegated with an agreeable bloom of a purple colour. The coaſt of Argyle is rocky: yet indented with bays and inlets, that afford good harbours for ſhipping. The country is well watered by rivers, brooks, and lakes, abounding with fiſh; the vales and flat parts of it are cultivated for corn; the mountains feed an innumerable quantity of black cattle, which run wild among the hills in winter as well as ſummer; the heath and woods, of which there is a conſiderable number, afford ſhelter to deer, roebucks, and all ſorts of game in great plenty: the circumambient ſea, with its locks, bays, and harbours, pours forth myriads of fiſh; but the innate wealth of the country is dug from the bowels of the mountains in iron, copper, lead, and other metals and minerals.

Argyle is the ſeat of a provincial ſynod, conſiſting of five preſbyteries and 49 pariſhes; and gives the titles of *duke* and *earl* to the noble family of Campbell, the moſt powerful of all the Scottiſh nobility. The duke of Argyle is, by hereditary right, great maſter of the king's houſehold in Scotland; admiral of the Weſtern iſles; general of Denoon caſtle; keeper of Dunſtaffnage and Carrick: and, before the juriſdictions were aboliſhed, enjoyed other hereditary offices, which rendered him too powerful as the ſubject of a limited monarchy. He ſtill poſſeſſes many royalties; his vaſſals, even of the name of *Campbell*, are ſo numerous, and his influence extends ſo far, that he could, on occaſion, bring 3000 or 4000 fighting men into the field. Argyleſhire is in general peopled by this clan; and affords a great number of caſtles and ſeats belonging to gentlemen who hold of the duke, and boaſt themſelves deſcended from his family.

Argyle Proper is bounded by Knapdale and Cowal on the ſouth; Lochaber on the north; Lennox and the Grampian hills on the eaſt; and Lorne on the weſt. It lies between Lochfyn and Lochow; which laſt is a freſh-water lake, about a mile broad, but extending 24 in length, including 12 iſlands, on two of which there are the caſtles of Enconel and Glenurquhart. This lake which gives the title of *viſcount* to the duke of Argyle, iſſues in the river Aw, which, after a courſe of ſix or ſeven miles, enters Loch Ettiff, and this falls into the weſt ſea, oppoſite to the iſle of Mull: all theſe abound with excellent trout and ſalmon. Argyleſhire ſends one member to parliament.

When the projected canal ſhall be completed, and ſome villages and harbours erected, the populous county of Argyle (Mr Knox affirms) will become one of the moſt valuable provinces in the Britiſh empire. It abounds in black cattle, ſheep, and fiſh, though the latter are leſs numerous than thoſe on the more northern ſhores. Waſhed on both ſides by the ſea, deeply indented by navigable lakes and bays; having an eaſy communication with the fiſhing grounds on the North Highlands; with Glaſgow, and the trading towns on the Clyde; with Ireland, Wales, Whitehaven, Liverpool, Briſtol, and other marts on the weſt coaſt of England, we may eaſily conceive, that the period is at no great diſtance, when Argyleſhire will become a great commercial county. To corroborate this opinion, he obſerves, that after a veſſel gets under ſail from this coaſt, ſhe enters at once into the Atlantic, where ſhe meets with no interruption till ſhe makes the coaſt of America or the Weſt-Indies. The line, therefore, which nature points out for the inhabitants, is, that of ſalt-making, fiſhing, ſhip-building, freights or the carrying trade; ſoap and glaſs-making, by means of the kelp upon their ſhores, and ſand found upon Gia iſland, which is adapted for the latter.

ARGYRASPIDES, or ARGYROASPIDES, in antiquity, perſons armed with ſilver bucklers, or bucklers ſilvered.

The argyraſpides, according to Quintus Curtius, made the ſecond corps of Alexander's army; the firſt was the phalanx.—According to Juſtin's account, lib. xii. chap. 7. Alexander having penetrated into India, and extended his empire as far as the ocean; for a monument of his glory, ordered the armour of his ſoldiers, and the houſings of his horſes, to be adorned with ſilver. And hence commanded them to be called *argyraſpides*, from the Greek *αργυρος*, *ſilver*, and *ασπις*, *buckler*.

By this author it ſhould ſeem, that Alexander's whole army were called *argyraſpides*.—After that prince's death, the agyraſpides deſpiſed all other chiefs of the army, diſdaining to obey any other, having borne arms under Alexander.

ARGYRIPÆ. See *ARGOS Hippium*.

ARGYRUNTUM, a maritime town of Illyria, (Ptolemy, Pliny). Now Novigrad, a town of Dalmatia. E. Long. 17. 30. Lat. 44. 30.

ARHUSEN, a dioceſe of North Jutland in Denmark, to the ſouth of Wilburg, about 60 miles in length and 30 in breadth. It contains two capital cities, called *Arhuſen* and *Rander*; beſides ſeveral market-towns of leſs note, and upwards of 300 villages. Arhuſen, one of the capitals, is advantageouſly ſituated on the coaſt of the Baltic Sea, at the mouth of the river Guda, which runs through it; and it is ſurrounded with foreſts full of game. E. Long. 10. 0. N. Lat. 56. 10.

ARIA, one of the ancient names of Thrace, (Stephanus); that is *martial*, from the character of the people, whoſe country Euripides calls the reſidence of Mars and Sophocles his place of nativity.

ARIA, and *Ariana* (anc. geog.) whether the ſame or diſtinct countries authors are not agreed. Ptolemy has only Aria, and knows nothing about Ariana. Pliny mentions only Ariana, and ſays nothing about Aria; but diſtinguiſhes between the Arii and Ariani: Parthia, he ſays, has the Arii to the eaſt, Carmania and the Ariani to the ſouth; from which it is conjectured, the Ariani extended farther than the Arii, and compriſed the Gedroſii and the Drangae. Arrian has only Aria and Arii, and is ſilent about Ariana. But Strabo gives more extenſive bounds to Ariana than to Aria, without particularly defining them: only in general he ſays, that Ariana begins from India, and quotes Eratoſthenes; according to whom, Ariana is bounded by the Indus on the eaſt; on the ſouth, by the Great Sea; by Paropamiſus on the north, and by the mountains, quite to Portæ Caſpiæ; on the weſt, by the ſame boundaries by which Parthia is ſeparated from Media, Carmania from Parætacene and Perſia: and thus Ariana is extremely extenſive.—Aria has its limits thus deſcribed by Ptolemy: On the north, ſome parts of Margiana and Bactriana; on the eaſt, the Paropamiſidæ; on the ſouth, the Drangiana: and Strabo ſays, the Arii adjoin to the the Paropamiſidæ on the weſt.

ARIA, called *Ariapolis*, (Strabo): Now Herat, in Choraſan, ſet down in an ancient map as ſituated on the river Arias, which probably gave name to the country Aria. Arrian calls the river *Areios*; Pliny, *Arius*; Ammian, *Arias*; now Heri, which runs by Alexandria, alſo called *Alexandria Arion* or *Ariorum*.

ARIADNÆA, in Grecian antiquity, two feſtivals at Naxos, in honour of two women named *Ariadne*. One of them being the daughter of king Minos, they had, in the ſolemnity dedicated to her, a ſhew of ſorrow and mourning; and, in memory of her being left by Theſeus near the time of child-birth, it was uſual for a young man to lie down and counterfeit all the agonies of a woman in labour. This feſtival is ſaid to be firſt inſtituted by Theſeus, to atone for his ingratitude to that princeſs.—The other Ariadne was thought to be of a gay and ſprightly temper; and therefore her feſtival was obſerved with muſic and other expreſſions of mirth and joy.

ARIADNE, daughter of Minos king of Crete. Theſeus being ſent to deſtroy the Minotaur, Ariadne was ſo taken with him, that, as a teſtimony of her love, ſhe gave Theſeus a clue of thread to guide him out of the labyrinth. Theſeus, having killed the Minotaur, carried off the Athenians he had relieved, together with Ariadne; whom, however, he afterward forſook.

ARIADNIA, in antiquity. See ARIADNÆA.

ARIANA (anc. geog.), an extenſive country, compriſing Paropamiſus, Arachoſia, Drangiana, and Gedroſia, if we ſuppoſe it to reach the ſea. See ARIA.

ARIANNA, a ſmall village ſix miles N. E. from the city of Tunis. Here is a beautiful range of the ancient Carthaginian aqueduct, 74 feet high, ſupported by columns 16 feet ſquare, and which ſtill increaſed in grandeur the nearer it approached Carthage. The ſtones are all diamond-cut. Near this ſpot ſeveral ancient mattamones, or ſubterraneous magazines for corn, have been diſcovered within theſe few years, capable of containing 100 buſhels, ſtrongly arched with large ſquare ſtones. The Moors have already begun to demoliſh them, it being their cuſtom to do ſo with every thing beautiful as ſoon as it comes to light.

ARIANO, a town of Italy, in the kingdom of Naples, in the Ulterior Principality, with a biſhop's ſee. Mr Swinburne deſcribes it as an ugly city, built upon the uneven ſummit of a mountain, with an extenſive look-out on all ſides, but expoſed to every blaſt that blows. It does not appear to be ſo old as the time of the Romans; therefore ſuppoſed to owe its riſe to the demolition of ſome neighbouring town, and to the advantages its ſituation afforded for diſcovery and defence. It is but a poor place, without trade or manufactures; having declined ever ſince the deſolation cauſed by an earthquake in 1456. It reckons about 14,000 inhabitants, and no leſs than 20 pariſhes and convents, beſides an ill-endowed cathedral. The wine made here is pale, like red Champagne, which it alſo reſembles in a certain tartneſs, exceedingly refreſhing in hot weather. The ſoil lies upon a ſoft agrillaceous ſtone. At a ſmall diſtance to the eaſt is a bank conſiſting of layers of volcanical earths, interſperſed with thick ſtrata of oyſter-ſhells.

Below the town is a convent of Dominicans, whoſe houſe, within theſe laſt hundred years, has been thrice rebuilt, having been as often thrown to the ground by earthquakes. The laſt and moſt deſtructive happened in 1732, fatal to all the country that lies along the eaſtern verge of the Appenine. In order to ſecure a retreat in caſe of future accidents, which from their ſituation they have every reaſon to expect, theſe fathers have conſtructed a ſmall building of wood, the parts of which being joined together with ſtrong iron chains, are contrived ſo as to have a proper play, and by yielding to the oſcillatory motion of the earth, return eaſily to their equilibrium. E. Long. 15. 19. N. Lat. 41. 8.

ARIANS, followers of Arius, a preſbyter of the church of Alexandria about the year 315; who maintained, that the Son of God was totally and eſſentially diſtinct from the Father; that he was the firſt and nobleſt of thoſe beings whom God had created, the inſtrument by whoſe ſubordinate operation he formed the univerſe; and therefore inferior to the father both in nature and dignity: alſo, that the Holy Ghoſt was not God, but created by the power of the Son.

The Arians owned that the Son was the word, but denied that word to have been eternal. They held, that Chriſt had nothing of man in him but the fleſh, to which the λογος or Word was joined, which was the ſame as the ſoul in us. See *Lardner's Credibility*, &c. Vol. IX. b. i. c. 69.

The Arians were firſt condemned and anathematized by a council at Alexandria in 320, under Alexander, biſhop of that city; who accuſed Arius of impiety, and cauſed him to be expelled from the communion of the church: and afterwards by 380 fathers in the general council of Nice, aſſembled by Conſtantine in the year 325. But notwithſtanding that, it was not extinguiſhed; on the contrary, it became the reigning religion, eſpecially in the Eaſt, where it obtained much more than in the Weſt. Arius was recalled from baniſhment by the emperor Conſtantine in two or three years after the council of Nice, and the laws that had been enacted againſt him were repealed. In the year 335, Athanaſius, his zealous opponent, was depoſed and baniſhed into Gaul, and Arius and his followers were reinſtated in their privileges, and received into the communion of the church. In little more than a year after this, he fell a victim to the reſentment of his enemies, and died a tragical death, occaſioned probably by poiſon, or ſome other violence. The Arian party found a protector in Conſtantinus, who ſucceeded his father in the empire of the Eaſt; and the zeal with which he abetted them produced many animoſities and tumults to the time of his death in the year 362. They underwent various revolutions, perſecuting and oppreſſed, under ſucceeding emperors, according to the degree of intereſt they had in the civil power, till at length Theodoſius the Great exerted every poſſible effort to ſuppreſs and diſperſe them.

The Arians were divided into various ſects, of which ancient writers give an account under the names of *Semi-Arians*, *Euſebeans*, *Aetians*, *Eunomians*, *Acacians*, *Pſathyrians*, and others. But they have been commonly diſtributed into three claſſes, viz. the *Genuine Arians*, *Semi-Arians*, and *Eunomians*.

Arianiſm was carried in the fifth century into Africa under the Vandals; and into Aſia under the Goths: Italy, the Gauls, and Spain, were alſo deeply infected with it; and towards the commencement of the ſixth century, it was triumphant in many parts of Aſia, Africa, and Europe. But it ſunk almoſt all at once, when the Vandals were driven out of Africa, and the Goths out of Italy, by the arms of Juſtinian. However, it revived again in Italy under the protection of the Lombards in the ſeventh century.

Eraſmus ſeems to have aimed in ſome meaſure to reſtore Arianiſm at the beginning of the ſixteenth century, in his Commentaries on the New Teſtament. Accordingly, he was reproached by his adverſaries with Arian interpretations and gloſſes, Arian tenets, &c. To which he made little anſwer, ſave that there was no hereſy more thoroughly extinct than that of the Arians: *Nulla hereſis magis extincta quam Arianorum.* But the face of things was ſoon changed. Servetus, a Spaniard by nation, publiſhed in 1531 a little treatiſe againſt the Trinity, which once more revived the opinions of the Arians in the Weſt. Indeed he rather ſhowed himſelf a Photinian than an Arian; only that he made uſe of the ſame paſſages of Scripture, and the ſame arguments againſt the divinity of our Saviour, with the proper Arians.

It is true, Servetus had not, properly ſpeaking, any diſciples; but he gave occaſion after his death to the forming of a new ſyſtem of Arianiſm in Geneva, much more ſubtle and artful than his own, and which did not a little perplex Calvin. From Geneva the new Arians removed to Poland, where they gained conſiderable ground; but at length became Socinians.

The appellation *Arian* has been indiſcriminately applied, in more modern times, to all thoſe who conſider Jeſus Chriſt as inferior and ſubordinate to the Father; and whoſe ſentiments cannot be ſuppoſed to coincide exactly with thoſe of the ancient Arians. Mr Whiſton was one of the firſt divines who revived this controverſy, in the beginning of the 16th century. He was followed by Dr. Clarke, who publiſhed his famous book intitled *The Scripture Doctrine of the Trinity*, &c. In conſequence of which he was reproached with the title of *Semi-Arian.* He was alſo threatened by the convocation, and combated by argument. Dr Waterland, who has been charged with verging towards Tritheiſm, was one of his principal adverſaries. The hiſtory of this controverſy during the preſent century may be found in a pamphlet, intitled *An account of all the conſiderable books and Pamphlets that have been wrote on either ſide, in the Controverſy concerning the Trinity, from the year* 1712; *in which is alſo contained an account of the Pamphlets written this laſt Year, on each ſide, by the Diſſenters to the end of the Year* 1719. Publiſhed at London, 1720.

ARICINA, in mythology, a ſurname of Diana; under which appellation ſhe was honoured in the foreſt Aricine, ſo called from Aricia a princeſs of the blood-royal of Athens. Hippolytus, to whom this princeſs was married, is ſaid to have erected a temple to Diana in this foreſt, where he was concealed after his reſurrection by Eſculapius, and to have eſtabliſhed a prieſt and feſtivals.

ARIAS MONTANUS, a learned Spaniſh divine, employed by Philip II. of Spain, to publiſh another edition of the Bible, after that of Cardinal Ximenes; which he finiſhed with applauſe, and died at Seville, in 1598.

ARICA, a port town of South-America, in the province of Los Charaes, in Peru. It was formerly a conſiderable place: but the earthquakes, which are frequent here, have almoſt entirely ruined it; for there are no more than 150 families, which are moſt of them blacks, mulattoes, and Indians. Moſt of the houſes are made with canes or reeds, ſet upright, and bound together with cords or thongs; and as it never rains here, they are covered only with mats, which makes the place look at a diſtance like a heap of ruins.

The vale of Arica is about a league wide, and ſix leagues long, next the ſea, and is all a barren country, except the ſpot where the old town ſtood, which is divided into little meadows of clover graſs and plots for ſugar canes, with a few olive and cotton trees intermixt. This vale grows narrower as it runs eaſtward: and a league up there is a village, where they begin to cultivate pimento or Jamaica pepper, which is planted throughout all the reſt of the vale; and there are ſeveral farms, which produce nothing elſe, that bring in the value of 80,000 crowns yearly. The Spaniards of Peru are ſo uſed to this pepper, that they dreſs no proviſion without it. W. Long. 70. 15. S. Lat. 18. 26.

ARICONIUM, a town of the Silures, (Antonine); now Hereford, (Camden). W. Long. 2. 42. Lat. 52. 6.

ARIDAS, a kind of taffety, manufactured in the Eaſt Indies from a ſhining thread which is got from certain herbs, whence they are ſtyled *aridas of herbs.*

ARIDULLAM, in natural hiſtory, a kind of zarnich found in the Eaſt Indies. See Zarnich.

ARIES, in zoology. See Ovis.

Aries, the battering-ram. See *Battering-Ram.*

Aries, in aſtronomy, a conſtellation of fixed ſtars, drawn on the globe, in the figure of a ram. It is the firſt of the twelve ſigns of the zodiac, from which a twelf part of the ecliptic takes its denomination.

ARILLUS, an improper term invented by Linnæus, and defined to be the proper exterior coat or covering of the ſeed, which falls off ſpontaneouſly.

All ſeeds are not furniſhed with an arillus; in many, a dry covering, or ſcarf-ſkin, ſupplies its place. In Jeſſamy; hound's tongue, *cynogloſſum;* cucumber; fraxinella, *dictamnus;* ſtaff-tree, *celaſtrus;* ſpindle-tree, *euonymus;* African ſpiræa, *dioſma;* and the coffee-tree, *coffea;* it is very conſpicuous.

In the genus hound's tongue, four of theſe arilli, or proper coats, each unfolding a ſingle ſeed, are affixed to the ſtylus; and in this circumſtance, ſays Linnæus, does the eſſence of the genus conſiſt. In fraxinella, the arillus is common to two ſeeds. The ſtaff-tree has its ſeeds only half involved with this cover.

The arillus is either *baccatus,* ſucculent, and of the nature of a berry; as in the ſpindle-tree, *euonymus. Cartilagineus,* cartilaginous, or griſtly; as in the African ſpiræa, *dioſma. Coloratus,* coloured; as in the ſtaff-tree. *Elaſticus,* endued with elaſticity, for diſperſing the ſeeds; as is remarkable in the African ſpiræa, *dioſma,* and fraxinella. *Sebar,* rough and knotty; as in hound's tongue.

Although covered with an arillus or other dry coat, ſeeds are ſaid to be naked (*ſemina nuda*) when they are not incloſed in any ſpecies of pericarpium or fruit-veſſel; as in the graſſes, and the *labiati* or lipped flowers of Tournefort, which correſpond to the *didynamia gymnoſpermia* of Linnæus. Seeds are ſaid to be covered (*ſeminu tecta*) when they are contained in a fruit-veſſel, whether capſule pod, or pulpy pericarpium, of the apple, berry, or cherry kind: See Semen). This exterior coat of the ſeed is, by ſome former writers, ſtyled *calyptra.* See Calyptra.

The different ſkins or coverings of the ſeed, are adapted, ſay naturaliſts, for receiving the nutritive juices, and tranſmitting them within.

ARIMANIUS, the evil god of the ancient Perſians. The Perſian Magi held two principles: a good dæmon, or god, and an evil one: the firſt the author of all good, and the other of all evil; the former they ſuppoſed to be repreſented by light, and the latter by darkneſs, as their trueſt ſymbols. The good principle they named *Yezad* or *Yezdan,* and *Ormozd* or *Hormizda,* which the Greeks wrote *Oromaſdes*; and the evil dæmon they called *Abriman,* and the Greeks *Arimanius.* Some of the Magians held both theſe principles to have been from all eternity; but this ſect was reputed heterodox: the original doctrine being, that the good principle only was eternal, and the other created. —Plutarch (*De Iſide et Oſiride,* p. 369.) gives the following account of the Magian traditions in relation to theſe gods and the introduction of evil into the world, viz. That Oromazes conſiſted of moſt pure light, and Arimanius of darkneſs; and that they were at war with each other: that Oromazes created ſix gods; the firſt, the author of benevolence: the ſecond, of truth; the third, of juſtice, riches, and the pleaſure which attends good actions; and that Arimanius made as many, who were the authors of the oppoſite evils or vices: that then Oromazes, triplicating himſelf, removed as far from the ſun as the ſun is from the earth, and adorned the heaven with ſtars, appointing the dog-ſtar for their guardian and leader: that he alſo created 24 other gods, and incloſed them in an egg; but Arimanius having alſo made an equal number, theſe laſt perforated the egg, by which means evil and good became mixed together. However, the fatal time will come, when Arimanius, the introducer of plagues and famine, muſt be of neceſſity utterly deſtroyed by the former, and annihilated; then the earth being made plain and even, mankind ſhall live in a happy ſtate, in the ſame manner, in the ſame political ſociety, and uſing one and the ſame language. Theopompus writes, that, according to the Magians, the ſaid two gods, during the ſpace of 3000 years, alternately conquer, and are conquered; that for other 3000 years, they will wage mutual war, fight, and deſtroy the works of each other, till at laſt Hades (or the evil ſpirit) ſhall periſh, and men become perfectly happy, their bodies needing no food, nor caſting any ſhadow, i. e. being perfectly tranſparent.

ARIMASPI, (Pliny), a people of Sarmatia Europea, to the ſouth of the Montes Riphæi, ſaid by Mela to have but one eye; a fable broached by Ariſteas Proconneſius, according to Herodotus.

ARIMATHEA, a town of Judea, (Evangeliſts); thought to be the ſame with *Ramatha*, 1 Sam. i. and thus in the tribe of Ephraim, (Wells).—This place is now called *Ramla*; and is in a very ruinous ſtate, containing nothing but rubbiſh within its boundaries. The Aga of Gaza reſides here in a Serai, the floors and walls of which are tumbling down. He maintains about one hundred horſemen, and as many Barbary ſoldiers, who (ſays Mr Volney) are lodged in an old Chriſtian Church, the nave of which is uſed as a ſtable, and in an ancient kan, which is diſputed with them by the ſcorpions. The adjacent country is planted with lofty olive trees, diſpoſed in quincunces. The greateſt part of them are as large as the walnut trees of France; but they are daily periſhing through age, the ravages of contending factions, and even from ſecret miſchief; for, in theſe countries, when a peaſant would revenge himſelf of his enemy, he comes by night, and ſaws or cuts his trees cloſe to the ground, and the wound, which he takes care to cover, draining of the ſap like an iſſue, the olive tree languiſhes and dies. Amid theſe plantations, we meet, at every ſtep, with dry wells, ciſterns fallen in, and vaſt vaulted reſervoirs, which prove that, in ancient times, this town muſt have been upwards of a league and a half in circumference. At preſent it ſcarcely contains two hundred families. The little land which is cultivated, by a few of them, belongs to the Mufti, and two or three perſons related to him. The reſt content themſelves with ſpinning cotton, which is chiefly purchaſed by two French houſes eſtabliſhed there. The only remarkable antiquity at Ramla is the minoret of a ruined moſque on the road to Yafa, which is very lofty; and by an Arabic inſcription appears to have been built by the ſultan Saladin.

ARIMINUM, a town of Umbria, or Romagna, at the mouth of the Ariminus, on the Gulph of Venice. The ſeizing on it by Cæſar gave riſe to the civil war. Now called *Rimini*, E. Long. 13. 30. Lat. 44. 8.

ARIOLI, in antiquity, a kind of prophets, or religious conjurers, who by abominable prayers, and horrible ſacrifices at the altars of idols, procured anſwers to their queſtions concerning future events. *Iſid. Orig.* lib. viii. cap. 9. Theſe are alſo called *harioli*, and their operation *hariolation*. Sometimes they were denominated *aruſpices* or *haruſpices*. The *arioli* were diſtinguiſhed by a ſlovenly dreſs, diſorderly and matted beards, hair, &c.

ARION, an excellent muſician and poet, inventor of dithyrambics. Periander entertained him at his court, where getting an eſtate, and returning to Corinth, the ſailors, for lucre of his money, threw him into the ſea; when, according to the poets, a dolphin, charmed with his muſic, took him on her back and carried him ſafe to ſhore.

Arion, an admirable horſe, much more famous in poetic hiſtory than Bucephalus in that of Alexander. Authors ſpeak variouſly of his origin, though they agree in giving him a divine one His production is moſt commonly aſcribed to Neptune. This god, according to ſome, raiſed him out of the ground by a ſtroke of his trident: according to others, he begot him upon the body of the fury Erynnys; according to others, upon that of Ceres, whom he raviſhed in the form of a horſe, ſhe having previouſly aſſumed the form of a mare to elude his purſuit. This horſe was nurſed by the Nereids; and being ſometimes yoked with the ſea-horſes of Neptune to the chariot of this god, he drew him with incredible ſwiftneſs through the ſea. He had this ſingularity in him, that his right feet reſembled thoſe of a man. Neptune gave him to Capreus king of Haliartus. Capreus made a preſent of him to Hercules; who mounted him when he took the city of Elis, gained the prize with him in the race againſt Cygnus the ſon of Mars near Træcena, and at laſt made a preſent of him to Adraſtus. It is under this laſt maſter that Arion has ſignalized himſelf the moſt: he won the prize for racing at the Memean games, which the princes who went to beſiege Thebes inſtituted in the honour of Archemorus; and was the cauſe that Adraſtus did not periſh in this famous expedition, as all the other chiefs did.

ARIOSTO (Lodovico), the famous Italian poet, and author of Orlando Furioſo, was born at the caſtle of Reggio in Lombardy in 1474. His father, who was major-domo to Duke Hercules, lived to the extent of his fortune, ſo left but little at his death. Arioſto, from his childhood ſhewed great marks of genius, eſpecially in poetry; and wrote a comedy in verſe on the ſtory of Pyramus and Thiſbe, which his brothers and ſiſters played. His father being utterly unlearned, and rather regarding profit than his ſon's inclination, compelled him to ſtudy the civil law in which having plodded ſome years to no purpoſe, he quitted it for more pleaſing ſtudies; yet often lamented, as Ovid and

Arioſto.

Arioſto, Aripo.

and Petrarch did before him, and our own Milton ſince*, that his father baniſhed him from the muſes. At the age of 24, Arioſto loſt his father, and found himſelf perplexed with family-affairs. However, in about ſix years he was, for his good parts, taken into the ſervice of Don Hippolito, cardinal of Eſte. At this time he had written nothing but a few ſonnets; but now he reſolved to make a poem, and choſe Bayardo's *Orlando Inamorato* for a ground-work. However, he was prevented writing for a great many years, and was choſen as a fit perſon to go on an embaſſy to Pope Julio II. where he gave ſuch ſatisfaction, that he was ſent again, underwent many dangers and difficulties, and at his return was highly favoured. Then, at his leiſure, he again applied himſelf to his poem: but, ſoon after, he incurred the cardinal's diſpleaſure for refuſing to accompany him into Hungary; by which he was ſo diſcouraged, that he deferred writing for 14 years, even till the cardinal's death. After that, he finiſhed by degrees, in great perfection, that which he began with great expectation. Duke Aſtolfo offered him great promotions if he would ſerve him; but, preferring liberty to grandeur, he refuſed this and other great offers from princes and cardinals, particularly from Leo X. from all whom he received notwithſtanding great preſents. The Duke of Ferrara delighted ſo much in his comedies, of which he wrote five, that he built a ſtage on purpoſe to have them played in his court, and enabled our poet to build himſelf a houſe in Ferrara, with a pleaſant garden, where he uſed to compoſe his poems, which were highly eſteemed by all the princes of Italy, who ſent him many preſents; but he ſaid, "he would not ſell his liberty for the beſt cardinal's hat in Rome." It was but a ſmall, though convenient houſe: being aſked, why he had not built it in a more magnificent manner, ſince he had given ſuch noble deſcriptions of ſumptuous palaces, beautiful porticos, and pleaſant fountains, in his Orlando Furioſo? He replied, That words were cheaper laid together than ſtones. Upon the door was the following inſcription:

Parva ſed apta mibi, ſed nulli obnoxia, ſed non
Sordida, parta meo ſed tamen ære, domus.

Which Mr Harrington thus tranſlates:

This houſe is ſmall, but fit for me, but hurtful unto none;
But yet not ſluttiſh, as you ſee, yet paid for with mine own.

In his diet he was temperate, and ſo careleſs of dainties, that he was fit to have lived in the world when they fed upon acorns. Whether he was ever married, is uncertain. He kept company with one Alexandria, to whom, it was reported, he was married privately, and a lady Genevera, whom he ſlily mentions in the 24th book of his Orlando, as poets are apt to intermix with their fictions ſome real amours of their own. He was urged to go ambaſſador to pope Clement, but would by no means accept this embaſſy. He tranſlated the *Menecmi* of Plautus: and all his own comedies were ſo eſteemed, that they were frequently acted by perſons of the firſt quality; and when his Lena was firſt repreſented, Ferdinand of Eſte, afterwards Marquis of Maſſa, ſo far honoured the piece as to ſpeak the prologue. He began one of his comedies in his father's lifetime, when the following incident ſhows the remarkable talent he had for poetry. His father one day rebuked him ſharply, charging him with ſome great fault; but all the while he returned him no anſwer. Soon after, his brother began on the ſame ſubject; but he eaſily refuted him, and, with ſtrong arguments, juſtified his own behaviour. "Why then (ſaid his brother) did you not ſatisfy my father?" "In truth (ſaid Ludovico) I was thinking of a part in my comedy; and methought my father's ſpeech to me was ſo ſuited to the part of an old man's chiding his ſon, that I forgot I was concerned in it myſelf, and conſidered it only to make it a part of my play." It is alſo reported of Arioſto, that, coming by a potter's ſhop, he heard him ſinging a ſtave out of his Orlando, with ſo bad a grace, that, out of all patience, he broke with his ſtick ſeveral of his pots. The potter, in a pitiful tone, aſking what he meant by wronging a poor man that had never injured him? "You raſcal (he replied), I have not done thee half the wrong thou haſt done me: for I have broken but two or three pots of thine, not worth ſo many halfpence; whereas thou haſt broken and mangled a ſtanza of mine worth a mark of gold."

Arioſto was tall, of a melancholly complexion, and ſo abſorbed in ſtudy and meditation, that he often forgot himſelf. His picture was drawn by Titian in a maſterly manner. He was honoured with the laurel by the hands of the emperor Charles V. He was naturally affable, always aſſuming leſs than was his due, yet never putting up a known injury even from his ſuperiors. He was ſo fearful on the water, that, whenever he went out of a ſhip, he would ſee others go before him; and, on land, he would alight from his horſe on the leaſt apprehenſion of danger. He was of an amorous diſpoſition, and left two natural ſons. He enjoyed the friendſhip of the moſt eminent men of learning of his time, moſt of whom he mentions with great reſpect in the laſt canto of his Orlando Furioſo. His conſtitution was but weakly, ſo that he was obliged to have recourſe to phyſicians the greateſt part of his life. He bore his laſt ſickneſs with great reſolution and ſerenity; and died at Ferrara the 8th of July, 1533, according to Sir John Harrington, being then 59 years of age. He was interred in the church of the Benedictine monks, who, contrary to their cuſtom, attended his funeral. He had a buſt erected to him, and the following epitaph, written by himſelf, inſcribed upon his tomb:

Ludovici Arioſti humantur oſſa
Sub hoc marmore, ſeu ſub hac humo, ſeu
Sub quidquid voluit benignus hæres,
Sive hærede benignior comes, ſeu
Opportunius incidens viator:
Nam ſcire haud potuit futura: ſed nec
Tanti erat, vacuam ſibi cadaver
Ut urnam cuperet parare.
Vivens iſta tamen ſibi paravit,
Quæ ſcribi voluit ſuo ſepulchro,
Olim ſi quod haberet id ſepulchrum:
Ne cum ſpiritus hoc brevi peracto
Præſcripto ſpatio miſellos artus,
Quos ægre ante reliquerat, repoſcet,
Hac et hac cinerem huc et huc revellem
Dum noſcat proprium, diu vagetur.

ARIPO, a ſtrong town of Aſia, on the weſtern coaſt of the iſland of Ceylon, at the mouth of the river Sarunda. It belongs to the Dutch; and to the eaſt

* See his Latin Poem. *Ad Patrem.*

of it is a bank, where they fiſh for pearls. E. Long. 80. 25. N. Lat. 8. 42.

ARISBA (anc. geog.), a town of the iſland of Leſbos (Herodot.)—Another of Troas on the continent, in the territory and to the ſouth-eaſt of Abydos (Polyb.): the rendezvous of Alexander's army after the paſſage of the Helleſpont (Arrian); a colony of the Mitylenians (Stephanus); taken and plundered by Achilles (Virgil). The reſidence of Axylus, celebrated by Homer, for his hoſpitality, which gained him the character of a friend to mankind.

ARISH, a Perſian long meaſure, containing about 38 Engliſh inches.

ARISI, the Indian name for the plant which produces the rice. See ORYZA.

ARISTA, or AWN, among botaniſts, a long needle-like beard, which ſtands out from the huſk of a grain of corn, graſs, &c.

ARISTÆUS, ſon of Apollo and Cyrene, whom, for the many ſervices he had rendered to mankind by his knowledge of all profitable arts, the gods placed amongſt the ſtars; ſo that he is the Aquarius in the zodiac. The reſemblance of his hiſtory to that of Moſes has been curiouſly diſcuſſed by Huetius.

ARISTANDER, a famous ſoothſayer under Alexander the Great, over whom he gained a wonderful influence by the good ſucceſs of his art. He had already had the ſame employment at the court of king Philip; and it was he who explained better than his brethren the dream that this Prince had after having married Olympias.

ARISTARCHUS, a Grecian Philoſopher of Samos, one of the firſt that maintained that the earth turns upon its own centre. We are not ſure of the age in which he lived; and have none of his works but a *Treatiſe of the greatneſs and diſtance of the Sun and Moon*, tranſlated into Latin by Frederic Commandine, and publiſhed with Pappus's explanations in 1572.

ARISTARCHUS, a celebrated grammarian, much eſteemed by Ptolemy Philometor, who committed to him the education of his ſon. He applied himſelf chiefly to criticiſm, and made a reviſal of Homer's poems, but in too magiſterial a way; for ſuch verſes as he did not like he treated as ſpurious. He commented on other poets; Cicero and Horace made uſe his name to expreſs a very rigid critic.

ARISTIDA, in botany: A genus of the triandria digynia claſs; and, in the natural method, ranking under the 4th order, *Gramina*. The calyx has a double valve; the corolla has one valve, and three awns at the points. There are three ſpecies of Ariſtida, viz. the adſcenſionis, a native of the iſland of Aſcenſion; the Americana, a native of Jamaica; and the plumoſa, a native of America.

ARISTIDES, ſurnamed the *Juſt*, flouriſhed at Athens at the ſame time with Themiſtocles, who triumphed over him by his boiſterous eloquence, and got him baniſhed, 483 years before Chriſt (See OSTRACISM): but Ariſtides being recalled a ſhort time after, would never join with the enemies of Themiſtocles to get him baniſhed; for nothing could make him deviate from the ſtricteſt rules of moderation and juſtice. Ariſtides brought the Greeks to unite againſt the Perſians; diſtinguiſhed himſelf at the famous battle of Marathon, and that of Salamine and Platea; and eſtabliſhed an annual income of 460 talents for a fund to ſupply the expences of war. This great man died ſo poor, though he had the management of the revenues of Greece, that the ſtate was obliged to pay his funeral expences, to give fortunes to his daughters in marriage, and a maintenance to his ſon Lyſimachus.

ARISTIDES of Miletus, a famous Greek author, often cited by the ancients.

ARISTIDES, a very eloquent Athenian orator, who became a convert to the Chriſtian religion, and about the year 124 preſented to the emperor Adrian an apology for the Chriſtians.

ARISTIDES (Ælius), a celebrated orator, born in Myſia, about 129 years before the Chriſtian æra. The beſt edition of his works is that of Oxford, printed in Greek and Latin, in two volumes quarto.

ARISTIDES, a painter cotemporary with Apelles, flouriſhed at Thebes about the 122d Olympiad. He was the firſt, according to Pliny, who expreſſed character and paſſion, the human mind, and its ſeveral emotions; but he was not remarkable for ſoftneſs of colouring. "His moſt celebrated picture was of an infant (on the taking of a town) at the mother's breaſt, who is wounded and expiring. The ſenſations of the mother were clearly marked, and her fear leſt the child, upon failure of the milk, ſhould ſuck her blood." "Alexander the Great (continues the ſame author) took this picture with him to Pella."

Junius (in his Treatiſe *de Picturâ Veterum*(conjectures that the following beautiful epigram of Emilianus was written on this exquiſite picture:

Ελκε, ταλαν παρα μητρος ον ȣκ ετι μαζον αμελξεις
  Ελκυσον υϛατιον ναμα κατα φθιμενης.
Η δη γαρ ξιφεεσσι λιποπνοος αλλα τα μητρος
  Φιλτρα και ειν αιδη παιδοκομειν εμαθον

Elegantly tranſlated thus;

Suck, little wretch, while yet thy mother lives,
  Suck the laſt drop her fainting boſſom gives!
She dies! her tenderneſs ſurvives her breath,
  And her fond love is provident in death..

Webb's Inquiry, dial. vii. p. 161.

ARISTIPPUS, the founder of the Cyrenaic ſect of philoſophy, was the ſon of Aretades, and born at Cyrene in Libya. He flouriſhed about the 96th Olympiad. The great reputation of Socrates induced him to leave his own country, and remove to Athens, that he might have the ſatisfaction of hearing his diſcourſes. He was chiefly delighted with thoſe diſcourſes of Socrates that related the moſt to pleaſure: which he aſſerted to be the ultimate end in which all happineſs conſiſts. His manner of life was agreeable to his opinion; for he indulged himſelf extremely in all the luxuries of dreſs, wine, and women. Though he had a good eſtate, and three country ſeats, yet he was the only one of the diſciples of Socrates who took money for teaching; which being obſerved by the philoſopher, he aſked Ariſtippus, How he came to have ſo much? Who in reply aſked him, How he came to have ſo little? Upon his leaving Socrates, he went to Ægina, as Athenæus informs us, where he lived with more freedom and luxury than before. Socrates ſent frequent exhortations to him, in order to reclaim him; but all in vain: and with the ſame view he publiſhed that diſcourſe which we find in Xenophon. Here Ariſtippus became acquainted with Lais, the famous courtezan of Corinth; for whoſe ſake he took a voyage to that city. He continued at Ægina till the death of Socrates, as appears from Plato's *Phædo*, and the epiſtle which he wrote upon that occaſion. He returned at laſt into his own country Cyrene, where he profeſſed philoſophy, and inſtituted a ſect, which, as we obſerved above, was called the *Cyrenaic*, from the place, and by ſome writers the *Hedonic* or voluptuous, from its doctrines. During the height of the grandeur of Dionyſius the Sicilian tyrant, a great many philoſophers reſorted to him; and among the reſt Ariſtippus, who was tempted thither by the magnificence of that court. Dionyſius aſking him the reaſon of his coming, he replied, "That it was in order to give what he had, and to receive what he had not:" or, as others repreſent it, "That when he wanted wiſdom, he went to Socrates; but now as he wanted money, he was come to him." He very ſoon inſinuated himſelf into the favour of Dionyſius; for, being a man of a ſoft eaſy temper, he conformed himſelf exactly to every place, time, and perſon, and was a complete maſter of the moſt refined complaiſance.

We have ſeveral remarkable paſſages concerning him during his reſidence at that court mentioned by Diogenes Laertius. Dionyſius, at a feaſt, commanded that all ſhould put on womens purple habits, and dance in them. But Plato refuſed, repeating theſe lines:

I cannot in this gay effeminate dreſs
Diſgrace my manhood, or my ſex betray.

But Ariſtippus readily ſubmitted to the command, and made this reply immediately:

——At feaſts, where mirth is free,
A ſober mind can never be corrupted.

At another time, interceding with Dionyſius in behalf of a friend, but not prevailing, he caſt himſelf at his feet; being reproved by one for that exceſs of humility, he replied, "That it was not he who was the cauſe of that ſubmiſſion; but Dionyſius, whoſe ears were in his feet." Dionyſius ſhewed him three beautiful courtezans, and ordered him to take his choice. Upon which he took them all three away with him, alleging that Paris was puniſhed for preferring one to the other two: but when he had brought them to his door, he diſmiſſed them, in order to ſhew that he could either enjoy or reject with the ſame indifference. Having deſired money of Dionyſius, the latter obſerved to him, that he had aſſured him a wiſe man wanted nothing. "Give me (ſays he) what I aſk, and we will talk of that afterwards." When Dionyſius had given it him, "Now (ſays he), you ſee I do not want." By this complaiſance he gained ſo much upon Dionyſius, that he had a greater regard for him than for all the reſt of the philoſophers, though he ſometimes ſpoke with ſuch freedom to that king, that he incurred his diſpleaſure. When Dionyſius aſked, Why philoſophers haunted the gates of rich men, but not rich men thoſe of philoſophers? he replied, "Becauſe the latter know what they want, and the others not." Another time, Dionyſius repeating (out of Sophocles, as Plutarch affirms, who aſcribes this to Zeno) theſe verſes:

He that with tyrants ſeeks for bare ſupport,
Enſlaves himſelf, though free he came to court;

he immediately anſwered,

He is no ſlave if he be free to come.

Diocles, as Laertius informs us, related this in his *Lives of the Philoſophers*; though others aſcribe this ſaying to Plato. Ariſtippus had a conteſt with Antiſthenes the Cynic philoſopher; notwithſtanding which, he was very ready to employ his intereſt at court for ſome friends of Antiſthenes, to preſerve them from death, as we find by a letter of his to that philoſopher. Diogenes followed the example of his maſter Antiſthenes in ridiculing Ariſtippus, and called him the *court-ſpaniel*.

We have many apohthegms of his preſerved. Suidas obſerves, that he ſurpaſſed all the philoſophers in the acuteneſs of his apohthegms. Being once railed at, he left the room; and the perſon who abuſed him, following him, and aſking him why he went away, he anſwered, "Becauſe it is in your power to rail, but it is not in my power not to hear you." A perſon obſerving, that the philoſophers frequented the houſes of rich men: "Why (ſays he), the phyſicians frequent the chambers of the ſick, yet that is no reaſon why a man ſhould rather chooſe to lie ſick than be cured." To one who boaſted of his great reading, he ſaid, "That as they who feed and exerciſe moſt are not always more healthy than any who only eat and exerciſe to ſatisfy nature; ſo neither they who read much, but they who read no more than is uſeful, are truly learned." Among other inſtructions which he gave to his daughter Arete, he adviſed her particularly to deſpiſe ſuperfluity. To one who aſked him what his ſon would be the better for being a ſcholar? "If for nothing elſe (ſaid he), yet for this alone, that when he comes into the theatre, one ſtone will not ſit upon another." When a certain perſon recommended his ſon to him, he demanded 500 drachmas; and upon the father's replying, that he could buy a ſlave for that ſum, "Do ſo (ſaid he), and then you'll be maſter of a couple." Being reproached, becauſe, having a ſuit of law depending, he fee'd a lawyer to plead for him, "Juſt ſo (ſaid he), when I have a great ſupper to make, I always hire a cook." Being aſked what was the difference between a wiſe man and a fool, he replied, "Send both of them together naked to thoſe who are acquainted with neither of them, and then you'll know." Being reproved by a certain perſon (who, according to Mr Stanley, was Plato) for his coſtly and voluptuous feaſts, "I warrant you (ſaid he), that you would not have beſtowed three farthings upon ſuch a dinner;" which the other confeſſing, "Why, then (ſaid he), I find myſelf leſs indulgent to my palate than you are to your covetous humour;" or, as it is otherwiſe repreſented, "I find, that I love my belly, and you love your money." When Simus, treaſurer to Dionyſius, ſhewed him his houſe magnificently furniſhed, and paved with coſtly marble, (for he was a Phrygian, and conſequently profuſe); Ariſtippus ſpit in his face: upon which the other growing angry, "Why, truly (ſaid he), I could not find a fitter place." His ſervant carrying after him a great weight of money, and being ready to ſink upon the road under his burden, he bid him throw away all that was too much for him to carry. Horace mentions this fact in his third ſatire of the ſecond book :

> ————————Quid ſimile iſti
> Græcus Ariſtippus ? qui ſervos projicere aurum
> In media juſſit Libya, quia tardius irent
> Propter onus ſegnes.

Being aſked, what things were moſt proper for children to be inſtructed in ? he anſwered, "Thoſe which might prove of the greateſt advantage to them when they came to be men." Being reproached for going from Socrates to Dionyſius, he replied, "That he went to Socrates when he wanted ſerious inſtruction, and to Dionyſius for diverſion." Having received money of Dionyſius at the ſame time that Plato accepted a book only, and being reproached for it, "The reaſon is plain (ſays he), I want money, and Plato wants books." Having loſt a conſiderable farm, he ſaid to one who ſeemed exceſſively to compaſſionate his loſs, "You have but one field ; I have three left: why ſhould not I rather grieve for you ?" Plutarch, who relates this in his book *De Tranquillitate Animi*, obſerves upon it, that it is very abſurd to lament for what is loſt, and not to rejoice for what is left. When a perſon told him, "That the land for his ſake was loſt," he replied, "That it was better ſo, than that he ſhould be loſt for the land." Being caſt by ſhipwreck aſhore on the iſland of Rhodes, and perceiving mathematical ſchemes and diagrams drawn upon the ground, he ſaid, "Courage, friends ; for I ſee the footſteps of men."

After he had lived a long time with Dionyſius, his daughter Arete ſent to him, to deſire his preſence at Cyrene, in order to take care of her affairs, ſince ſhe was in danger of being oppreſſed by the magiſtrates. But he fell ſick in his return home, and died at Lipara, an Æolian iſland. With regard to his principal opinions ; like Socrates, he rejected the ſciences as they were then taught, and pretended that logic alone was ſufficient to teach truth and fix its bounds. He aſſerted, that pleaſure and pain were the criterions by which we were to be determined ; that theſe alone made up all our paſſions ; that the firſt produced all the ſoft emotions, and the latter all the violent ones. The aſſemblage of all pleaſure, he aſſerted, made true happineſs, and that the beſt way to attain this was to enjoy the preſent moments. He wrote a great many books: particularly the hiſtory of Libya, dedicated to Dionyſius ; ſeveral Dialogues ; and four books Of the Luxury of the Ancients. There are four epiſtles of his extant in the Socratic Collection publiſhed by Leo Allatius.

Beſides Arete his daughter, whom he educated in philoſophy. Ariſtippus had alſo a ſon, whom he diſinherited for his ſtupidity. Arete had a ſon, who was named *Ariſtippus* from his grandfather, and had the ſurname of Μητροδιδακτος from his mother's inſtructing him in philoſophy. Among his auditors, beſides his daughter Arete, we have an account of Æthiops of Ptolemias, and Antipater of Cyrene. Arete communicated the philoſophy which ſhe received from her father to her ſon Ariſtippus, who tranſmitted it to Theodorus *the atheiſt*, who inſtituted the ſect, called *Theodorean*. Antipater communicated the philoſophy of Ariſtippus to Epitimedes his diſciple ; Epitimedes to Paræbates ; Paræbates to Hegeſias and Anniceris ; and theſe two laſt, improving it by ſome additions of their own, obtained the honour each of them of giving a name to the *Hegeſiac* and *Annicerian* ſect.

Laertius mentions two other perſons of the name of Ariſtippus ; one, who wrote the Hiſtory of Arcadia ; the other, a philoſopher of the New Academy.

ARISTO, a Stoic philoſopher, the diſciple of Zeno the chief of the Stoics, flouriſhed about 290 years before the Chriſtian æra. He differed but little from his maſter Zeno. He rejected logic as of no uſe, and natural philoſophy as being above the reach of the human underſtanding. It is ſaid, that being bald, the ſun burnt his head ; and that this cauſed his death.—There is a ſaying of his recorded, which might render the doctrine of Ariſtippus leſs odious than it ordinarily is ; (ſee ARISTIPPUS). He uſed to ſay, "That a philoſopher might do thoſe of his hearers a prejudice who put a wrong interpretation upon good meanings ; as for example, that the ſchool of Ariſtippus might ſend out debauchees, and that of Zeno, Cynics :" which ſeems to imply, that the doctrine of this philoſopher never produced this effect but when it was miſunderſtood. He ſhould alſo have added, that every teacher is therefore obliged to forbear laying down ambiguous maxims, or to prevent falſe gloſſes being put upon them.

ARISTO (Titus), a Roman lawyer, perfect maſter of the public and civil law, of hiſtory and antiquity. The Pandects mention ſome books of his, as does Aulus Gellius.—He was cotemporary with Pliny the younger, who gives him a noble character, and had a moſt tender friendſhip for him. See *Plinii Epiſt.* lib. i. ep. 22.

ARISTOCRACY, a form of government where the ſupreme power is veſted in the principal perſons of the ſtate. The word is derived from αριςος, *optimus*, and κρατεω, *impero*, "I govern." The ancient writers of politics prefer the ariſtocratical form of government to all others. The republic of Venice is an ariſtocracy. Ariſtocracy ſeems to coincide with oligarchy ; which, however, is more ordinarily uſed to ſignify a corruption of an ariſtocratical ſtate, where the adminiſtration is in the hands of too few, or where ſome one or two uſurp the whole power.

ARISTOGITON, a famous Athenian, who, with Armodius, killed Hipparchus tyrant of Athens, about 513 years before the Chriſtian æra. The Athenians erected a ſtatue to him.

ARISTOLOCHIA, BIRTHWORT : A genus of the hexandria order, belonging the the gynandria claſs of plants ; and in the natural method ranking under the 11th order *Sarmentaceæ*. It has no calyx ; the corolla conſiſts of one entire petal ; and the capſule, which is below the flower, has ſix cells. The ſpecies are 21 ; but only the five following merit deſcription. 1. The rotunda, is a native of the ſouth of France, of Spain, and Italy, from whence the roots are brought for medicinal uſe. The roots are roundiſh, grow to the ſize of ſmall turnips, being in ſhape and colour like the roots of cyclamens, which are frequently ſold inſtead of them. This ſort hath three or four weak trailing branches, which lie on the ground when they are not ſupported, and extend two feet in length ; the leaves are heart-ſhaped and rounded at their extremity ; the flowers

Ariſtolochia.

flowers come out ſingly at every leaf, toward the upper part of the ſtalk. They are of a purpliſh black colour; and are frequently ſucceeded by oval ſeed-veſſels having ſix cells full of flat ſeeds. 2. The longa, is a native of the ſame countries. This ſpecies hath long tap-roots like carrots; the branches are weak and trailing, extending little more than a foot; the flowers come out from the wings of the leaves like the other, are of a pale purple colour, and are frequently ſucceeded by ſeed-veſſels like the other. 3. The ſerpentaria, is a native of Virginia and Carolina, from whence the *radix ſerpentariæ*, or ſnake-root, ſo much uſed in medicine, is brought over. The plant riſes out of the ground in one, two, and ſometimes three pliant ſtalks, which at every little diſtance are crooked or undulated. The leaves ſtand alternately, and are about three inches long, in form ſomewhat like the ſmilax aſpera. The leaves grow cloſe to the ground on footſtalks an inch long, of a ſingular ſhape, and of a dark purple colour. A round canulated capſule ſucceeds the flower. It is filled with ſeeds, which are ripe in May. The uſual price of the root when dried is 6d. per pound, both in Virginia and Carolina, which is money hardly earned; yet the negro ſlaves employ great part of the time allowed them by their maſters in ſearch for it, which is the reaſon that there are ſeldom found any but very ſmall plants of this ſpecies. When they are planted in gardens in thoſe countries where they are natives, the plants increaſe ſo much in two years time, that the hand can ſcarce graſp the ſtalks of a ſingle one. This ſpecies delights in woods, and is uſually found near the roots of great trees. 4. The indica, or contrayerva of Jamaica, is a native of that iſland, where its roots are uſed inſtead of the true contrayerva. It hath long trailing branches, which climb upon the neighbouring plants, and ſometimes riſe to a conſiderable height. The flowers are produced in ſmall cluſters towards the upper part of the ſtalks, which are of a dark purple colour. 5. The clematitis, with heart-ſhaped leaves, an upright ſtem, with the flowers crouded in the axillæ. The root is long and ſlender.

Culture. The firſt, ſecond, and third ſorts are propagated from ſeeds, which ſhould be ſown in the autumn, in pots filled with light freſh earth, and placed under a frame to preſerve them from the froſt. If they are plunged into a gentle hot-bed in the month of March, the plants will come up the ſooner. In ſummer, and in autumn when the ſtalks begin to decay, they muſt be watered. In winter they muſt be again ſheltered; and in March, before the roots begin to ſhoot, they muſt be tranſplanted into ſmall ſeparate pots filled with light earth, when they may be removed into the open air, and treated as before. The next ſpring they may be planted in the open air in a warm border; where, in the autumn, when their ſtalks decay, if the border is covered with old tanner's bark to keep out the froſt, the roots will be ſecured; but where this care is not taken, they will frequently be killed by the froſt. The fourth is tender: and therefore muſt be kept in a ſtove during the winter, or it will not live in England.

Medical Uſes. The roots of the long and round ſorts, on being firſt chewed, ſcarce diſcover any taſte, but in a little time prove nauſeouſly bitteriſh; the long ſomewhat the leaſt ſo. The root of the clematitis is long and ſlender, rarely exceeding the thickneſs of a gooſe-quill: it inſtantly fills the mouth with an aromatic bitterneſs, which is not ungrateful. Their medical virtues are, to heat, ſtimulate, attenuate viſcid phlegm, and promote the fluid ſecretions in general: they are principally celebrated in ſuppreſſions of female evacuations. The doſe in ſubſtance is from a ſcruple to two drams. The long ſort is recommended externally for cleanſing and drying wounds and ulcers, and in cutaneous diſeaſes.

The root of the ſerpentaria is ſmall, light, buſhy, and conſiſts of a number of ſtrings or fibres, matted together, iſſuing from one common head; of a browniſh colour on the outſide, and paler or yellowiſh within. It has an aromatic ſmell, like that of valerian, but more agreeable: and a warm, bitteriſh, pungent taſte. This root is a warm diaphoretic and diuretic; it has been greatly celebrated as an alexipharmic, and eſteemed one of the principal remedies in malignant fevers and epidemic diſeaſes. In theſe intentions, it is given in ſubſtance from 10 to 30 grains; and in infuſion, to a dram or two. Both watery and ſpirituous menſtrua extract its virtue by infuſion, and elevate ſome ſhare of its flavour in diſtillation; along with the water a ſmall portion of eſſential oil ariſes.

None of theſe articles, however, are now in ſo much eſteem as formerly; and while all of them are baniſhed from the Pharmacopœia of the London college, the clematitis is alone retained in that of Edinburgh.

Ariſtomenes. Ariſtophanes.

ARISTOMENES, a general of the Meſſenians, renowned for his valour and virtue. See Messenia.

ARISTOPHANES, a celebrated comic poet of Athens. He was cotemporary with Plato, Socrates, and Euripides; and moſt of his plays were written during the Peloponneſian war. His imagination was warm and lively, and his genius particularly turned to raillery. He had alſo great ſpirit and reſolution; and was a declared enemy to ſlavery, and to all thoſe who wanted to oppreſs their country. The Athenians ſuffered themſelves in his time to be governed by men who had no other views than make themſelves maſters of the commonwealth. Ariſtophanes expoſed the deſigns of theſe men, with great wit and ſeverity, upon the ſtage. Cleo was the firſt whom he attacked, in his comedy of the *Equites*; and as there was not one of the comedians who would venture to perſonate a man of his great authority, Ariſtophanes played the character himſelf, and with ſo much ſucceſs, that the Athenians obliged Cleo to pay a fine of five talents, which were given to the poet. He deſcribed the affairs of the Athenians in ſo exact a manner, that his comedies are a faithful hiſtory of that people. For this reaſon, when Dionyſius king of Syracuſe deſired to learn the ſtate and language of Athens, Plato ſent him the comedies of Ariſtophanes, telling him, theſe were the beſt repreſentations thereof. He wrote above 50 comedies; but there are only 11 extant which are perfect: theſe are, Plutus, the Clouds, the Frogs, Equites, the Acharnenſes, the Waſps, Peace, the Birds, the Eccleſiazuſæ or Female Orators, the Theſmophoſiazuſæ or Prieſteſſes of Ceres, and Lyſiſtrata. The Clouds, which he wrote in ridicule of Socrates*, is the moſt celebrated of all his comedies. Madam Dacier tells us, ſhe was ſo much charmed with this performance, that after ſhe had tranſlated it, and read it over 200 times, it did not become the leaſt tedious to her, which

* See the article *Socrates*.

which ſhe could not ſay of any other piece; and that the pleaſure which ſhe received from it was ſo exquiſite, that ſhe forgot all the contempt and indignation which Ariſtophanes deſerved for employing his wit to ruin a man, who was wiſdom itſelf, and the greateſt ornament of the city of Athens. Ariſtophanes having conceived ſome averſion to the poet Euripides, ſatirizes him in ſeveral of his plays, particularly in his Frogs and his Theſmophoſiazuſæ. He wrote his Peace in the 10th year of the Peloponneſian war, when a treaty for 50 years was concluded between the Athenians and the Lacedæmonians, though it continued but ſeven years. The Acharnenſes was written after the death of Pericles, and the loſs of the battle in Sicily, in order to diſſuade the people from intruſting the ſafety of the commonwealth to ſuch imprudent generals as Lamachus. Soon after, he repreſented his Aves or Birds; by which he admoniſhed the Athenians to fortify Decelæa, which he calls by a fictitious name *Nephelococcygia*. The Vaſpæ, or Waſps, was written after another loſs in Sicily, which the Athenians ſuffered from the miſconduct of Chares. He wrote the Lyſiſtrata when all Greece was involved in a war; in which comedy the women are introduced debating upon the affairs of the commonwealth; when they come to a reſolution, not to go to bed with their huſbands till a peace ſhould be concluded. His Plutus, and other comedies of that kind, were written after the magiſtrates had given orders that no perſon ſhould be expoſed by name upon the ſtage. He invented a peculiar kind of verſe, which was called by his name, and is mentioned by Cicero in his Brutus; and Suidas ſays, that he alſo was the inventor of the tetrameter and octameter verſe.

Ariſtophanes was greatly admired among the ancients, eſpecially for the true Attic elegance of his ſtyle. The time of his death is unknown; but it is certain he was living after the expulſion of the tyrants by Thraſybulus, whom he mentions in his Plutus and other comedies. There have been ſeveral editions and tranſlations of this poet. Nicodemus Friſchin, a German, famous for his claſſical knowledge, in the 16th century, tranſlated Plutus, the Clouds, the Frogs, the Equites, and the Acharnenſes, into Latin verſe. Quintus Septimus Florens rendered into Latin verſe the Waſps, the Peace, and Lyſiſtrata; but his tranſlation is full of obſolete words and phraſes. Madam Dacier publiſhed at Paris, in 1692, a French verſion of Plutus and the Clouds, with critical notes, and an examination of them according to the rules of the theatre. Mr Lewis Theobald likewiſe tranſlated theſe two comedies into Engliſh, and publiſhed them with remarks. The moſt noble edition of this author is that publiſhed by Ludolphus Kuſter, at Amſterdam, in folio, in 1710, and dedicated to Charles Montague Earl of Halifax.

ARISTOTELIA, in antiquity, annual feaſts celebrated by the citizens of Stagiris, in honour of Ariſtotle, who was born there; and in gratitude for his having procured from Alexander the rebuilding and repeopling of that city, which had been demoliſhed by king Philip.

ARISTOTELIAN, ſomething that relates to the philoſopher Ariſtotle.

ARISTOTELIAN Philoſophy, the philoſophy taught by Ariſtotle, and maintained by his followers. The Ariſtotelian is otherwiſe called the ***Peripatetic philoſophy***. See PERIPATETICS.

ARISTOTELIANS, a ſect of philoſophers, otherwiſe called *Peripatetics*.

The Ariſtotelians and their dogmata prevailed for a long while in the ſchools and univerſities; even in ſpite of all the efforts of the Carteſians, Newtonians, and other corpuſcularians. But the ſyſtems of the latter, have at length gained the pre-eminence; and the Newtonian philoſophy in particular is now very generally received. The principles of Ariſtotle's philoſophy, the learned agree, are chiefly laid down in the four books *de Cœlo*; the eight books of *Phyſical Auſcultation*, φυσικης ακροασεως, belonging rather to logics, or metaphyſics, than to phyſics. Inſtead of the more ancient ſyſtems, he introduced matter, form, and privation, as the principles of all things; but he does not ſeem to have derived much benefit from them in natural philoſophy. His doctrines are, for the moſt part, ſo obſcurely expreſſed, that it has not yet been ſatisfactorily aſcertained what were his ſentiments on ſome of the moſt important ſubjects. He attempted to refute the Pythagoræan doctrine concerning the twofold motion of the earth; and pretended to demonſtrate, that the matter of the heavens is ungenerated, incorruptible, and ſubject to no alteration: and he ſuppoſed that the ſtars were carried round the earth in ſolid orbs. The reader will find a diſtinct account of the logical part of his philoſophy by Dr Reid profeſſor of moral philoſophy in the univerſity of Glaſgow, in the ſecond volume of Lord Kames's Sketches of the Hiſtory of Man; and Mr Harris has publiſhed a ſenſible commentary on his Categories, under the title of ***Philoſophical Arrangements***.

ARISTOTLE, the chief of the Peripatetic philoſophers, born at Stagyra, a ſmall city in Macedon, in the 99th Olympiad, about 384 years before the birth of Chriſt. He was the ſon of Nicomachus, phyſician to Amyntas the grandfather of Alexander the Great. He loſt his parents in his infancy; and Proxenes, a friend of his father's, who had the care of his education, taking but little notice of him, he quitted his ſtudies, and gave himſelf up to the follies of youth. After he had ſpent moſt of his patrimony, he entered into the army; but not ſucceeding in this profeſſion, he went to Delphos to conſult the oracle what courſe of life he ſhould follow; when he was adviſed to go to Athens, and ſtudy philoſophy. He accordingly went thither about 18 years of age, and ſtudied under Plato till he was 37. By this time he had ſpent his whole fortune; and we are told that he got his living by ſelling powders, and ſome receipts in pharmacy. He followed his ſtudies with moſt extraordinary diligence, ſo that he ſoon ſurpaſſed all in Plato's ſchool. He eat little, and ſlept leſs; and, that he might not over-ſleep himſelf, Diogenes Laertius tells us, that he lay always with one hand out of the bed, having a ball of braſs in it, which, by its falling into a baſon of the ſame metal, awaked him. We are told, that Ariſtotle had ſeveral conferences with a learned Jew at Athens, and that by this means he inſtructed himſelf in the ſciences and religion of the Egyptians, and thereby ſaved himſelf the trouble of travelling into Egypt. When he had ſtudied about 15 years under Plato, he began to form different tenets from thoſe of his maſter, who became highly picked at his behaviour. Upon the death of Plato, he quitted Athens; and retired to Atarnya, a little city in Myſia, where his old friend Hermias reigned. Here he married Pythias, the ſiſter of this prince, whom he is ſaid to have loved ſo paſſionately, that he offered ſacrifice to her. Some time after, Hermias having been taken priſoner by Meranon the king of Perſia's general, Ariſtotle went to Mitylene the capital of Leſbos, where he remained till Philip king of Macedon having heard of his great reputation, ſent for him to be tutor to his ſon Alexander, then about 14 years of age: Ariſtotle accepted the offer; and in eight years taught him rhetoric, natural philoſophy, ethics, politics, and a certain ſort of philoſophy, according to Plutarch, which he taught nobody elſe. Philip erected ſtatues in honour of Ariſtotle; and for his ſake rebuilt Stagyra, which had been almoſt ruined by the wars.

The laſt fourteen years of his life he ſpent moſtly at Athens, ſurrounded with every aſſiſtance which men and books could afford him, for proſecuting his philoſophical inquiries. The glory of Alexander's name, which then filled the world, inſured tranquillity and reſpect to the man whom he diſtinguiſhed as his friend: but after the premature death of that illuſtrious protector, the invidious jealouſy of prieſts and ſophiſts inflamed the malignant and ſuperſtitious fury of the Athenian populace; and the ſame odious paſſions which proved fatal to the offenſive virtue of Socrates, fiercely aſſailed the fame and merit of Ariſtotle. To avoid the cruelty of perſecution, he ſecretly withdrew himſelf to Chalcis, in Eubœa. This meaſure was ſufficiently juſtified by a prudent regard to his perſonal ſafety; but leſt his conduct ſhould appear unmanly, when contraſted with the firmneſs of Socrates in a ſimilar ſituation, he condeſcended to apologize for his flight, by ſaying, that he was unwilling to afford the Athenians a ſecond opportunity "to ſin againſt philoſophy." He ſeems to have ſurvived his retreat from Athens only a few months, vexation and regret probably ended his days.

Beſides his treatiſes on philoſophy, he wrote alſo on poetry, rhetoric, law, &c. to the number of 400 treatiſes, according to Diogenes Laertius; or more, according to Francis Patricius of Venice. An account of ſuch as are extant, and of thoſe ſaid to be loſt, may be ſeen in Fabricius's *Bibliotheca Græca*. He left his writings with Theophraſtus, his beloved diſciple and ſucceſſor in the Lycæum, and forbad that they ſhould ever be publiſhed. Theophraſtus, at his death, truſted them to Neleus, his good friend and diſciple; whoſe heir buried them in the ground at Scepſis, a town of Troas, to ſecure them from the king of Pergamus, who made great ſearch every where for books to adorn his library. Here they lay concealed 160 years, until, being almoſt ſpoiled, they were ſold to one Apellicon, a rich citizen of Athens. Sylla found them at this man's houſe, and ordered them to be carried to Rome. They were ſome time after purchaſed by Tyrannion a grammarian; And Andronicus of Rhodes having bought them of his heirs, was in a manner the firſt reſtorer of the works of this great philoſopher; for he not only repaired what had been decayed by time and ill-keeping, but alſo put them in a better order, and got them copied. There were many who followed the doctrine of Ariſtotle in the reigns of the 12 Cæſars, and their numbers increaſed much under Adrian and Antoninus: Alexander Aphrodinus was the firſt profeſſor of the Peripatetic philoſophy at Rome, being appointed by the emperors Marcus Aurelius and Lucius Verus; and in ſucceeding ages the doctrine of Ariſtotle prevailed among almoſt all men of letters, and many commentaries were written upon his works.

The firſt doctors of the church diſapproved of the doctrine of Ariſtotle, as allowing too much to reaſon and ſenſe; but Anatolius biſhop of Laodicea, Didymus of Alexandria, St Jerome, St Auguſtine, and ſeveral others, at length wrote and ſpoke in favour of it. In the ſixth age, Boethius made him known in the weſt, and tranſlated ſome of his pieces into Latin. But from the time of Boethius to the eighth age, Joannes Damaſcenus was the only man who made an abridgement of his philoſophy, or wrote any thing concerning him. The Grecians, who took great pains to reſtore learning in the 11th and following ages, applied much to the works of this philoſopher, and many learned men wrote commentaries on his writings: amongſt theſe were Alfarabius, Algazel, Avicenna, and Averroes. They taught his doctrine in Africa, and afterwards at Cordova in Spain. The Spaniards introduced his doctrine into France, with the commentaries of Averroes and Avicenna; and it was taught in the univerſity of Paris, until Amauri, having ſupported ſome particular tenets on the principles of this philoſopher, was condemned of hereſy, in a council held there in 1210, when all the works of Ariſtotle that could be found were burnt, and the reading of them forbidden under pain of excommunication. This prohibition was confirmed, as to the phyſics and metaphyſics, in 1215, by the pope's legate; though at the ſame time he gave leave for his logic to be read, inſtead of St Auguſtine's uſed at that time in the univerſity. In the year 1265, Simon, cardinal of St Cecil, and legate from the holy ſee, prohibited the reading of the phyſics and metaphyſics of Ariſtotle. All theſe prohibitions, however, were taken off in 1366; for the cardinals of St Mark and St Martin, who were deputed by Pope Urban V. to reform the univerſity of Paris, permitted the reading of thoſe books which had been prohibited: and in the year 1448, Pope Stephen approved of all his works, and took care to have a new tranſlation of them into Latin.

ARISTOXENUS, the moſt ancient muſical writer, of whoſe works any tracts are come down to us. He was born at Tarentum, a city in that part of Italy called *Magna Græcia*, now Calabria. He was the ſon of a muſician, whom ſome call *Mneſias*, others *Spintharus*. He had his firſt education at Mantinæa, a city of Arcadia, under his father, and Lamprus of Erythræ; he next ſtudied under Xenophilus, the Pythagorean; and laſtly under Ariſtotle, in company with Theophraſtus. Suidas, from whom theſe particulars are tranſcribed, adds, that Ariſtoxenus, enraged at Ariſtotle having bequeathed his ſchool to Theophraſtus, traduced him ever after. But Ariſtocles the Peripatetic in Euſebius, exculpates Ariſtoxenus in this particular, and aſſures us that he always ſpoke with great reſpect of his maſter Ariſtotle. From the preceding account it appears that Ariſtoxenus lived under Alexander the Great and his firſt ſucceſſors. His *Harmo-*

Ariſtoxenus.

nics in three books, all that are come down to us, together with Ptolemy's Harmonic's, were firſt publiſhed by Gogavinus, but not very correctly, at Venice, 1562, in 4to, with a Latin verſion. John Meurſius next tranſlated the three books of Ariſtoxenus into Latin, from the MS. of Joſ. Scaliger; but according to Meibomius, very negligently. With theſe he printed at Leyden, 1616, 4to. Nicomachus and Alypius, two other Greek writers on muſic. After this, Meibomius collected theſe muſical writers together; to which he added Euclid, Bacchius ſenior, Ariſtides Quintilianus; and publiſhed the whole, with a Latin verſion, and notes, from the elegant preſs of Elzevir, Amſt. 1652. The learned editor dedicates theſe ancient muſical treatiſes to Chriſtina queen of Sweden. Ariſtoxenus is ſaid by Suidas to have written 452 different works, among which thoſe on muſic were the moſt eſteemed; yet his writings on other ſubjects are very frequently quoted by ancient authors, notwithſtanding Cicero and ſome others ſay that he was a bad philoſopher, and had nothing in his head but muſic. The titles of ſeveral of the loſt works of Ariſtoxenus, quoted by Athenæus and others, have been collected by Meurſius in his notes upon this author, by Tonſius and Menage, all which Fabricius has digeſted into alphabetical order.

ARITHMETIC

IS a ſcience which explains the properties of numbers, and ſhows the method or art of computing by them.

Hiſtory of Arithmetic.

AT what time this ſcience was firſt introduced into the world we can by no means determine. That ſome part of it, however, was coeval with the human race was abſolutely certain. We cannot conceive how any man endowed with reaſon can be without ſome knowledge of numbers. We are indeed told of nations in America who have no word in their language to expreſs a greater number than three; and this they call *pœtarrarorincouroac*: but that ſuch nations ſhould have no idea of a greater number than this, is abſolutely incredible. Perhaps they may compute by threes, as we compute by tens; and this may have occaſioned the notion that they have no greater number than three.

But though we cannot ſuppoſe any nation, or indeed any ſingle perſon, ever to have been without ſome knowledge of the difference between greater and ſmaller numbers, it is poſſible that mankind may have ſubſiſted for a conſiderable time without bringing this ſcience to any perfection, or computing by any regular ſcale, as 10, 60, &c. That this, however, was very early introduced in the world, even before the flood, we may gather from the following expreſſion in Enoch's prophecy, as mentioned by the apoſtle Jude: "Behold the Lord cometh with *ten thouſands* of his ſaints." This ſhows, that even at that time men had ideas of numbers as high as we have at this day, and computed them alſo in the ſame manner, namely by tens. The directions alſo given to Noah concerning the dimenſions of the ark, leave us no room to doubt that he had a knowledge of numbers, and of meaſures likewiſe. When Rebekah was ſent away to Iſaac, Abraham's ſon, her relations wiſhed ſhe might be the mother of *thouſands of millions*; and if they were totally unacquainted with the rule of multiplication, it is difficult to ſee how ſuch a wiſh could have been formed.

It is probable, therefore, that the four fundamental rules of Arithmetic have always been known to ſome nation or other. No doubt, as ſome nations, like the Europeans formerly, and the Africans and Americans now, have been immerſed in the moſt abject and deplorable ſtate of ignorance, they might remain for ſome time unacquainted with numbers, except ſuch as they had immediate occaſion for; and, when they came afterwards to improve, either from their own induſtry, or hints given by others, might fancy that they themſelves, or thoſe from whom they got the hints, had invented what was known long before. The Greeks were the firſt European nation among whom arithmetic arrived at any degree of perfection. M. Goguet is of opinion, that they firſt uſed pebbles in their calculations: a proof of which he imagines is, that the word ψηφιζω, which comes from ψεφος, a little ſtone, or flint, among other things, ſignifies *to calculate*. The ſame, he thinks, is probable of the Romans; and derives the word *calculation* from the uſe of little ſtones *(calculi)* in their firſt arithmetical operations.

If this method, however, was at all made uſe of, it muſt have been but for a ſhort time, ſince we find the Greeks very early made uſe of the letters of the alphabet to repreſent their numbers. The 24 letters of their alphabet, taken according to their order, at firſt denoted the numbers 1, 2, 3, 4, 5, 7, 8, 9, 10, 20, 30, 40, 50, 60, 70, 80, 100, 200, 300, 400, 500, 600, 700, and 800; to which they added the three following, ς, ϟ, ϡ, to repreſent 6, 90, 900. The difficulty of performing arithmetical operations by ſuch marks as theſe may eaſily be imagined, and is very conſpicuous from Archimedes's treatiſe concerning the dimenſions of a circle.

The Romans followed a like method; and beſides characters for each rank of claſſes, They introduced others for five, fifty, and five hundred. Their method is ſtill uſed for diſtinguiſhing the chapters of books, and ſome other purpoſes. Their numeral letters and values are the following:

I	V	X	L	C	D	M
One,	five,	ten,	fifty,	one hundred,	five hundred,	one thouſand.

Any number, however great, may be repreſented by repeating and combining theſe according to the following rules:

1ſt, When the ſame letter is repeated twice, or oftener, its value is repreſented as often. Thus II ſignifies two: XXX thirty, CC two hundred.

2d, When a numeral letter of leſſer value is placed after one of greater, their values are added: thus XI ſignifies eleven, LXV ſixty-five, MDCXXVIII one thouſand ſix hundred and twenty-eight.

3d. When a numeral letter of leſſer value is placed before one of greater, the value of the leſſer is taken from that of the greater; thus IV ſignifies four, XL forty, XC ninety, CD four hundred.

Sometimes IↃ is uſed inſtead of D for 500, and the value is increaſed ten times by annexing Ↄ to the right hand.

Thus IↃ ſignifies 500. Alſo CIↃ is uſed for 1000
IↃↃ 5000 CCIↃↃ for 10000
IↃↃↃ 50000 CCCIↃↃↃ for 100000

Sometimes thouſands are repreſented by drawing a line over the top of the numeral, $\overline{\text{V}}$ being uſed for five thouſand, $\overline{\text{L}}$ for fifty thouſand, $\overline{\text{CC}}$ two hundred thouſand.

4 Sexageſimal Arithmetic. About the year of Chriſt 200, a new kind of arithmetic, called *ſexageſimal*, was invented, as is ſuppoſed, by Claudius Ptolomæus. The deſign of it was to remedy the difficulties of the common method, eſpecially with regard to fractions. In this kind of arithmetic, every unit was ſuppoſed to be divided into 60 parts, and each of theſe into 60 others, and ſo on: hence any number of ſuch parts were called *ſexageſimal fractions*; and to make the computation in whole numbers more eaſy, he made the progreſſion in theſe alſo ſexageſimal. Thus from one to 59 were marked in the common way: then 60 was called a *ſexageſima prima*, or firſt ſexageſimal integer, and had one ſingle daſh over it; ſo 60 was expreſſed thus I′; and ſo on to 59 times 60, or 3540, which was thus expreſſed LIX′. He now proceeded to 60 times 60, which he called a *ſexageſima ſecunda*, and was thus expreſſed I″. In like manner, twice 60 times 60, or 7200, was expreſſed by II″; and ſo on till he came to 60 times 3600, which was a third ſexageſimal, and expreſſed thus, I‴. If any number leſs than 60 was joined with theſe ſexageſimals, it was added in its proper characters without any daſh; thus I′XV repreſented 60 and 15, or 75; I′VXXV is four times 60 and 25, or 265; X″II′XV, is ten times 3600, twice 60 and 15, or 36,135, &c. Sexageſimal fractions were marked by putting the daſh at the foot, or on the left hand of the letter: thus I, or ′I, denoted $\frac{1}{60}$; I,, or ″I, $\frac{1}{3600}$, &c.

5 Indian Characters when brought into uſe. The moſt perfect method of notation, which we now uſe, came into Europe from the Arabians, by the way of Spain. The Arabs however, do not pretend to be the inventors of them, but acknowledge that they received them from the Indians. Some there are indeed, who contend that neither the Arabs nor the Indians were the inventors, but that they were found out by the Greeks. But this is by no means probable; as Maximus Planudes, who lived towards the cloſe of the 13th century, is the firſt Geek who makes uſe of them: and he is plainly not the inventor; for Dr Wallis mentions an inſcription on a chimney in the parſonage-houſe of Helendon in Northamptonſhire, where the date is expreſſed by M° 133, inſtead of 1133. Mr Luffkin furniſhes a ſtill clearer inſtance of their uſe, in the window of a houſe, part of which is a Roman wall, near the market-place in Colcheſter; where between two carved lions ſtands an eſcutcheon with the figures 1090. Dr Wallis is of opinion that theſe characters muſt have been uſed in England at leaſt as long ago as the year 1050, if not in ordinary affairs, at leaſt in mathematical ones, and in aſtronomical tables. How theſe characters came to be originally invented by the Indians we are entirely ignorant.

The introduction of the Arabian characters in notation did not immediately put an end to the ſexageſimal arithmetic. As this had been uſed in all the aſtronomical tables, it was for their ſakes retained for a conſiderable time. The ſexageſimal integers went firſt out, but the fractions continued till the invention of decimals.

9 Treatiſes on Arithmetic. The oldeſt treatiſes extant upon the theory of arithmetic are the ſeventh, eighth, and ninth books of Euclid's elements, where he treats of proportion and of prime and compoſite numbers; both of which have received improvements ſince his time, eſpecially the former. The next of whom we know any thing is Nicomachus the Pythagorean, who wrote a treatiſe of the theory of arithmetic, conſiſting chiefly of the diſtinctions and diviſions of numbers into claſſes, as plain, ſolid, triangular, quadrangular, and the reſt of the figurate numbers as they are called, numbers odd and even, &c. with ſome of the more general properties of the ſeveral kinds. This author is, by ſome, ſaid to have lived before the time of Euclid; by others, not long after. His arithmetic was publiſhed at Paris in 1538. The next remarkable writer on this ſubject is Boethius, who lived at Rome in the time of Theodoric the Goth. He is ſuppoſed to have copied moſt of his work from Nicomachus.

From this time no remarkable writer on arithmetic appeared till about the year 1200, when Jordanus of Namur wrote a treatiſe on this ſubject, which was publiſhed and demonſtrated by Joannes Faber Stapulenſis in the 15 century, ſoon after the invention of printing. The ſame author alſo wrote upon the new art of computation by the Arabic figures, and called this book *Algoriſmus Demonſtratus*. Dr Wallis ſays this manuſcript is in the Savillian library at Oxford, but it hath never yet been printed. As learning advanced in Europe, ſo did the knowledge of numbers; and the writers on arithmetic ſoon became innumerable. About the year 1464, Regiomontanus, in his triangular tables, divided the Radius into 10,000 parts inſtead of 60,000; and thus tacitly expelled the ſexageſimal arithmetic. Part of it, however, ſtill remains in the diviſion of time, as of an hour into 60 minutes, a minute into 60 ſeconds, &c. Ramus in his arithmetic, written about the year 1550, and publiſhed by Lazarus Schonerus in 1586, uſes decimal periods in carrying on the ſquare and cube roots to fractions. The ſame had been done before by our countrymen Buckley and Record; but the firſt who publiſhed an expreſs treatiſe on decimals was Simon Stevinius, about the year 1582. As to the circulating decimals, Dr Wallis is the firſt who took much notice of them. He is alſo the author of the *arithmetic of infinites*, which has been very uſefully applied to geometry. The greateſt improvement, however, which the art of computation ever received, is the invention of logarithms. The honour of this invention is unqueſtionably due to Lord Napier, baron of Merchiſton in Scotland, about the end of the 16th or

Notation and Numeration.

beginning of the 17th century. By theſe means arithmetic has advanced to a degree of perfection which the ancients could never have imagined poſſible, much leſs hoped to attain; and we believe it may now be reckoned one of thoſe few ſciences which have arrived at their utmoſt height, and which is in its nature capable of little further improvement.

7 CHAP. I. NOTATION AND NUMERATION.

THE firſt elements of arithmetic are acquired during our infancy. The idea of one, though the ſimpleſt of any, and ſuggeſted by every ſingle object, is perhaps rather of the negative kind, and conſiſts partly in the excluſion of plurality, and is not attended to till that of a number be acquired. Two is formed by placing one object near another; three, four, and every higher number, by adding one continually to the former collection. As we thus advance from lower numbers to higher, we ſoon perceive that there is no limit to this increaſing operation; and that, whatever number of objects be collected together, more may be added, at leaſt in imagination; ſo that we can never reach the higheſt poſſible number, nor approach near it. As we are led to underſtand and add numbers by collecting objects, ſo we learn to diminiſh them by removing the objects collected; and if we remove them one by one, the number decreaſes through all the ſteps by which it advanced, till only one remain, or none at all. When a child gathers as many ſtones together as ſuits his fancy, and then throws them away, he acquires the firſt elements of the two capital operations in arithmetic. The idea of numbers, which is firſt acquired by the obſervation of ſenſible objects, is afterwards extended to meaſures of ſpace and time, affections of the mind, and other immaterial qualities.

Small numbers are moſt eaſily apprehended: a child ſoon knows what two and what three is; but has not any diſtinct notion of ſeventeen. Experience removes this difficulty in ſome degree; as we become accuſtomed to handle larger collections, we apprehend clearly the number of a dozen or a ſcore; but perhaps could hardly advance to an hundred without the aid of claſſical arrangement, which is the art of forming ſo many units into a claſs, and ſo many of theſe claſſes into one of a higher kind, and thus advancing through as many ranks of claſſes as occaſion requires. If a boy arrange an hundred ſtones in one row, he would be tired before he could reckon them; but if he place them in ten rows of ten ſtones each, he will reckon an hundred with eaſe; and if he collect ten ſuch parcels, he will reckon a thouſand. In this caſe, ten is the loweſt claſs, an hundred is a claſs of the ſecond rank, and a thouſand is a claſs of the third rank.

There does not ſeem to be any number naturally adapted for conſtituting a claſs of the loweſt, or any higher rank to the excluſion of others. However, as ten has been univerſally uſed for this purpoſe by the Hebrews, Greeks, Romans, and Arabians, and by all nations who have cultivated this ſcience, it is probably the moſt convenient for general uſe. Other ſcales, however, may be aſſumed, perhaps on ſome occaſions, with ſuperior advantage; and the principles of arithmetic will appear in their full extent, if the ſtudent can adapt them to any ſcale whatever: thus, if eight were the ſcale, 6 times 3 would be two claſſes and two units, and the number 18 would then be repreſented by 22. If 12 were the ſcale, 5 times 9 would be three claſſes and nine units, and 45 would be repreſented by 39, &c.

Numeration.

It is proper, whatever number of units conſtitutes a claſs of the lower rank, that the ſame number of each claſs ſhould make one of the next higher. This is obſerved in our arithmetic, ten being the univerſal ſcale: but is not regarded in the various kinds of monies, weights, and the like, which do not advance by any univerſal meaſure; and much of the difficulty in the practice of arithmetic ariſes from that irregularity.

As higher numbers are ſomewhat difficult to apprehend, we naturally fall on contrivances to fix them in our minds, and render them familiar: but notwithſtanding all the expedients we can fall upon, our ideas of high numbers are ſtill imperfect, and generally far ſhort of the reality; and though we can perform any computation with exactneſs, the anſwer we obtain is often incompletely apprehended.

It may not be amiſs to illuſtrate, by a few examples, the extent of numbers which are frequently named without being attended to. If a perſon employed in telling money reckon an hundred pieces in a minute, and continue at work ten hours each day, he will take ſeventeen days to reckon a million; a thouſand men would take 45 years to reckon a billion. If we ſuppoſe the whole earth to be as well peopled as Britain, and to have been ſo from the creation, and that the whole race of mankind had conſtantly ſpent their time in telling from a heap conſiſting of a quadrillion of pieces, they would hardly have yet reckoned the thouſandth part of that quantity.

All numbers are repreſented by the ten following characters.

1	2	3	4	5	6	7	8	9	0
One,	two,	three,	four,	five,	ſix,	ſeven,	eight,	nine,	cypher.

The nine firſt are called *ſignificant figures*, or *digits*; and ſometimes repreſent units, ſometimes tens, hundreds, or higher claſſes. When placed ſingly, they denote the ſimple numbers ſubjoined to the characters. When ſeveral are placed together, the firſt or right-hand figure only is to be taken for its ſimple value: the ſecond ſignifies ſo many tens, the third ſo many hundreds, and the others ſo many higher claſſes, according to the order they ſtand in. And as it may ſometimes be required to expreſs a number conſiſting of tens, hundreds, or higher claſſes, without any units or claſſes of a lower rank annexed; and as this can only be done by figures ſtanding in the ſecond, third, or higher place, while there are none to fill up the lower ones; therefore an additional character or cypher (0) is neceſſary, which has no ſignification when placed by itſelf, but ſerves to ſupply the vacant places, and bring the figures to their proper ſtation.

The following table ſhews the names and diviſions of the claſſes. 8.

Figure	Place
8.	TRILLIONS.
4	Hundred thouſand of billions
3	Ten thouſand of billions
7,	Thouſand billions
9	Hundred billions
8	Ten billions
2.	BILLIONS.
5	Hundred thouſand of millions
6	Ten thouſand of millions
4,	Thouſand millions
7	Hundred millions
3	Ten millions
8.	MILLIONS.
9	Hundred thouſands
7	Ten thouſands
2,	Thouſands
6	Hundreds
4	Tens
5	Units

The firſt ſix figures from the right hand are called the *unit period*, the next ſix the *million period*, after which the *trillion*, *quadrillion*, *quintillion*, *ſextillion*, *ſeptillion*, *octillion*, and *nonillion* periods follow in their order.

It is proper to divide any number, before we reckon it into periods and half periods, by different marks. We then begin at the left hand, and read the figures in their order, with the names of their places, from the table. In writing any number, we muſt be careful to mark the figures in their proper places, and ſupply the vacant places with cyphers.

As there are no poſſible ways of changing numbers, except by enlarging or diminiſhing them according to ſome given rule, it follows, that the whole art of arithmetic is comprehended in two operations, *Addition* and *Subtraction*. However, as it is frequently required to add ſeveral equal numbers together, or to ſubtract ſeveral equal ones from a greater, till it be exhauſted, proper methods have been invented for facilitating the operation in theſe caſes, and diſtinguiſhed by the names of *Multiplication* and *Diviſion*; and theſe four rules are the foundation of all arithmetical operations whatever.

As the idea of number is acquired by obſerving ſeveral objects collected, ſo is that of fractions by obſerving an object divided into ſeveral parts. As we ſometimes meet with objects broken into two, three, or more parts, we may conſider any or all of theſe diviſions promiſcuouſly, which is done in the doctrine of vulgar fractions, for which a chapter will be allotted. However, ſince the practice of collecting units into parcels of tens has prevailed univerſally, it has been found convenient to follow a like method in the conſideration of fractions, by dividing each unit into ten equal parts, and each of theſe into ten ſmaller parts; and ſo on. Numbers divided in this manner are called *Decimal Fractions*.

CHAP. II. ADDITION.

ADDITION is that operation by which we find the amount of two or more numbers. The method of doing this in ſimple caſes is obvious, as ſoon as the meaning of number is known, and admits of no illuſtration. A young learner will begin at one of the numbers, and reckon up as many units ſeparately as there are in the other, and practice will enable him to do it at once. It is impoſſible ſtrictly ſpeaking, to add more than two numbers at a time. We muſt firſt find the ſum of the firſt and ſecond; then we add the third to that number; and ſo on. However, as the ſeveral ſums obtained are eaſily retained in the memory, it is neither neceſſary nor uſual to mark them down. When the numbers conſiſt of more figures than one, we add the units together, the tens together, and ſo on. But if the ſum of the units exceed ten, or contain ten ſeveral times, we add the number of tens it contains to the next column, and only ſet down the number of units that are over. In like manner we carry the tens of every column to the next higher. And the reaſon of this is obvious from the value of the places; ſince an unit, in any higher place, ſignifies the ſame thing as ten in the place immediately lower.

Example.

RULE. "Write the numbers diſtinctly, "units under units, tens under tens; and "ſo on. Then reckon the amount of the "right-hand column. If it be under ten, "mark it down. If it exceed ten, mark "the units only, and carry the tens to the "next place. In like manner, carry the "tens of each column to the next, and mark "down the full ſum of the left hand co-"lumn."

346863
876734
123467
314213
712316
438987
279654
———
3092234
24438

As it is of great conſequence in buſineſs to perform addition readily and exactly, the learner ought to practiſe it till it become quite familiar. If the learner can readily add any two digits, he will ſoon add a digit to a higher number with equal eaſe. It is only to add the unit place of that number to the digit; and, if it exceed ten, it raiſes the amount accordingly. Thus, becauſe 8 and 6 is 14, 48 and 6 is 54. It will be proper to mark down under the ſums of each column, in a ſmall hand, the figure that is carried to the next column. This prevents the trouble of going over the whole operation again, in caſe of interruption or miſtake. If you want to keep the account clean, mark down the ſum and figure you carry on a ſeparate paper, and, after reviſing them, tranſcribe the ſum only. After ſome practice, we ought to acquire the habit of adding two or more figures at one glance. This is particularly uſeful when two figures which amount to 10, as 6 and 4, or 7 and 3, ſtand together in the column.

Every operation in arithmetic ought to be reviſed, to prevent miſtakes; and as one is apt to fall into the ſame miſtake, if he reviſe it in the ſame manner he performed it, it is proper either to alter the order, or elſe to trace back the ſteps by which the operation advanced, which will lead us at laſt to the number we began with. Every method of proving accounts may be referred to one or other of theſe heads.

1ſt, Addition may be proven by any of the following methods: repeat the operation, beginning at the top of the column, if you began at the foot when you wrought it.

2d, Divide the account into ſeveral parts; add theſe ſeparately, and then add the ſums together. If their amount correſpond with the ſum of the account, when added at once, it may be preſumed right. This method is particularly proper when you want to know the ſums of the parts, as well as that of the whole.

3d, Subtract the numbers ſucceſſively from the ſum; if the account be right, you will exhauſt it exactly, and find no remainder.

When the given number conſiſts of articles of different value, as pounds, ſhillings, and pence, or the like, which are called *different denominations*, the operations in arithmetic muſt be regulated by the value of the articles. We ſhall give here a few of the moſt uſeful tables for the learner's information.

I. *Sterling Money.*

4 Farthings=1 penny, *marked* d.
12 Pence=1 Shilling, s.
20 Shillings=1 Pound, L.
Alſo, 6 s. 8 d.=1 noble
10 s.=1 angel
13 s. 4 d. or two-thirds of a pound=1 merk.

II. *Averdupoiſe Weight.*

16 Drams=1 ounce, oz.
16 Ounces=1 pound, lb.
28 Pound=1 quarter, qr.
4 Quart=1 hun. wght, C.
20 Hun. weight=1 ton, T.

Scots money is divided in the ſame manner as Sterling, and has one-twelfth of its value. A pound Scots is equal to 1 s. 8 d. Sterling, a ſhilling Scots to a penny Sterling, and a penny Scots to a twelfth-part of a penny Sterling; a mark Scots is two-thirds of a pound Scots, or $13\frac{1}{3}$ d. Sterling.

III. *Troy Weight.*

20 Mites=1 grain, gr.
24 Grain=1 pen. wt. dwt.
20 Pen. wts.=1 ounce, oz.
12 Ounces=1 pound, lb.

IV. *Apothecaries Weight.*

20 Grains=1 ſcruple, ℈
3 Scruples=1 dram, ʒ
8 Drams=1 ounce, ℥
12 Ounces=1 pound, ℔

V. *Engliſh Dry Meaſure.*

2 Pints=1 quart
4 Quarts=1 gallon
2 Gallons=1 peck
4 Pecks=1 buſhel
8 Buſhels=1 quarter

VI. *Scotch Dry Meaſure.*

4 Lippies=1 peck
4 Pecks=1 firlot
4 Firlots=1 boll
16 Bolls=1 chalder

VII. *Engliſh Land Meaſure.*

$30\frac{1}{4}$ Square yards=1 pole or perch
40 Poles=1 rood
4 Roods=1 acre

VIII. *Scots Land Meaſure.*

36 Square ells=1 fall
40 Falls=1 rood
4 Roods=1 acre

IX. *Long Meaſure.*

12 Inches=1 foot
3 Feet=1 yard
$5\frac{1}{2}$ Yards=1 pole
40 Poles=1 furlong
8 Furlongs=1 mile
3 Miles=1 league.

X. *Time.*

60 Seconds=1 minute
60 Minutes=1 hour
24 Hours=1 day
7 Days=1 week
365 Days=1 year
52 Weeks & 1 day=1 year.

RULE *for compound Addition.* "Arrange like "quantities under like, and carry according to the "value of the higher place."

Note 1. When you add a denomination, which contains more columns than one, and from which you carry to the higher by 20, 30, or any even number of tens, firſt add the units of that column, and mark down their ſum, carrying the tens to the next column; then add the tens, and carry to the higher denomination, by the number of tens that it contains of the lower. For example, in adding ſhillings, carry by ten from the units to the tens, and by two from the tens to the pounds.

Note 2. If you do not carry by an even number of tens, firſt find the complete ſum of the lower denomination, then enquire how many of the higher that ſum contains, and carry accordingly, and mark the remainder, if any, under the column. For example, if the ſum of a column of pence by 43, which is three ſhillings and ſeven pence, mark 7 under the pence-column, and carry 3 to that of the ſhillings.

Note 3. Some add the lower denominations after the following method: when they have reckoned as many as amounts to one of the higher denomination, or upwards, they mark a dot, and begin again with the exceſs of the number reckoned above the value of the denomination. The number of dots ſhows how many are carried, and the laſt reckoned number is placed under the column.

Examples in Sterling Money.

L	145	6	8
	215	3	9
	172	18	4
	645	7	7
	737	2	3
	35	3	9
	9	—	7
	1764	12	3
	780	—	—
	99	9	9
	150	10	—
	844	8	7

L	16	9	$11\frac{1}{4}$
	169	16	10
	36	12	$9\frac{3}{4}$
	54	7	6
	30	—	$1\frac{1}{4}$
	7	19	6
	707	19	11
	14	14	4
	84	18	$8\frac{3}{4}$
	125	3	7
	16	16	$8\frac{3}{4}$
	62	5	3

In Averdupoiſe Weight.

T.	*C.*	*qr.*	*lb.*
1	19	3	26
—	14	1	16
2	18	1	16
—	1	2	27
3	9	—	10
—	17	2	24
—	15	3	18
4	6	—	5
—	6	3	9
6	4	—	4
5	5	—	5

T.	*C.*	*qr.*	*lb.*
3	15	[illegible]	[illegible]
6	3	—	19
5	7	3	26
3	2	2	—
4	3	1	10
—	18	1	12
1	1	1	1
5	3	—	7
6	4	—	9
4	6	—	5
2	1	3	4

When one page will not contain the whole account, we add the articles it contains, and write againſt their ſum, *Carried forward*; and we begin the next page with the ſum of the foreging, writing againſt it, *Brought forward*.

When the articles fill ſeveral pages, and their whole ſum is known, which is the caſe in tranſcribing accounts, it is beſt to proceed in the following manner: Add the pages, placing the ſums on a ſeparate paper; then add the ſums, and if the amount of the whole be right, it only remains to find what numbers ſhould be placed at the foot and top of the pages. For this purpoſe, repeat the ſum of the firſt page on the ſame line; add the ſums of the firſt and ſecond, placing the amount in a line with the ſecond; to this add the ſum of the third, placing the amount in a line with the third. Proceed in like manner with the others; and if the laſt ſum correſponds with the amount of the pages, it is right. Theſe ſums are tranſcribed at the foot of the reſpective pages, and tops of the following ones.

Ex-

Subtraction.

Examples.

L 134 6 8	L	L	L
42 3 9	170 5 4	70 4 2	15 3 9
175 4 9	66 9 8	18 6 8	12 2 6
42 5 7	73 8 6	12 13 2	7 5 4
163 7 4	45 3 2	15 3 9	8 — —
148 5 8	78 7 9	17 5 4	— 9 6
73 2 3	12 — —	18 6 8	— 5 10
L	L	L	L

1ſt Page,	L778	16	—	L 778	16	—
2d	445	14	5	1224	10	5
3d	151	19	9	1376	10	2
2th	43	6	11	1419	17	1

L1419 17 1

Then we tranſcribe L778, 16s. at the foot of the firſt and top of the ſecond pages, L1224 : 10 : 5 at the foot of the ſecond and top of the third; and ſo on.

CHAP. III. SUBTRACTION.

SUBTRACTION is the operation by which we take a leſſer number from a greater, and find their differences. It is exactly oppoſite to addition, and is performed by learners in a like manner, beginning at the greater and reckoning downwards the units of the leſſer. The greater is called the *minuend*, and the leſſer the *ſubtrahend*.

If any figure of the ſubtrahend be greater than the correſponding figure of the minuend, we add ten to that of the minuend, and, having found and marked the difference, we add one to the next place of the ſubtrahend. This is called *borrowing ten*. The reaſon will appear, if we conſider that, when two numbers are equally increaſed by adding the ſame to both, their difference will not be altered. When we proceed as directed above, we add ten to the minuend, and we likewiſe add one to the higher place of the ſubtrahend, which is equal to ten of the lower place.

RULE. "Subtract units from units, tens from tens, "and ſo on. If any figure of the ſubtrahend be "greater than the correſponding one of the minuend, "borrow ten."

Example.			
	Minuend	173694	738641
	Subtrahend	21453	379235
	Remainder	152241	359406

To prove ſubtraction, add the ſubtrahend and remainder together; if their ſum be equal to the minuend, the account is right.

Or ſubtract the remainder from the minuend. If the difference be equal to the ſubtrahend, the account is right.

RULE *for compound ſubtraction.* "Place like denominations under like, and borrow, when neceſſary, "according to the value of the higher place."

Examples.

			C.	*qr.*	*lb.*	*A.*	*R.*	*F.*	*E.*
L 146	3	3	12	3	19	15	2	24	18
58	7	6	4	3	24	12	2	36	7
L 87	15	9	7	3	23	2	3	28	11

Note 1. The reaſon for borrowing is the ſame as in ſimple ſubtraction. Thus, in ſubtracting pence, we add 12 pence when neceſſary to the minuend, and at the next ſtep, we add one ſhilling to the ſubtrahend.

Note 2. When there are two places in the ſame denomination, if the next higher contain exactly ſo many tens, it is beſt to ſubtract the units firſt, borrowing ten when neceſſary; and then ſubtract the tens, borrowing, if there is occaſion, according to the number of tens in the higher denomination.

Note 3. If the value of the higher denomination be not an even number of tens, ſubtract the units and tens at once, borrowing according to the value of the higher denomination.

Note 4. Some chuſe to ſubtract the place in the ſubtrahend, when it exceeds that of the minuend, from the value of the higher denomination, and add the minued to the difference. This is only a different order of proceeding, and gives the ſame anſwer.

Note 5. As cuſtom has eſtabliſhed the method of placing the ſubtrahend under the minuend, we follow it when there is no reaſon for doing otherwiſe; but the minuend may be placed under the ſubtrahend with equal propriety; and the learner ſhould be able to work it either way, with equal readineſs, as this laſt is ſometimes more convenient; of which inſtances will occur afterwards.

Note 6. The learner ſhould alſo acquire the habit, when two numbers are marked down, of placing ſuch a number under the leſſer, that, when added together, the ſum may be equal to the greater. The operation is the ſame as ſubtraction, though conceived in a different manner, and is uſeful in balancing accounts, and on other occaſions.

It is often neceſſary to place the ſums in different columns, in order to exhibit a clear view of what is required. For inſtance, if the values of ſeveral parcels of goods are to be added, and each parcel conſiſts of ſeveral articles, the particular articles ſhould be placed in an inner column, and the ſum of each parcel extended to the outer column, and the total added there.

If any perſon be owing an account, and has made ſome partial payments, the payments muſt be placed in an inner column, and their ſum extended under that of the account in the outer column, and ſubtracted there.

An example or two will make this plain.

1ſt.] 30 yards linen at 2s.	L. 3	
45 ditto at 1s. 6d.	3 7 6	
		L. 6 7 6
120 lb thread at 4s.	L. 24	
40 ditto at 3s.	6	
30 ditto at 2s. 6d.	3 15	
		33 15
		L. 40 2 6

[2d. 1773.

Jan. 15. Lent James Smith		L. 50	
22. Lent him further		70	
			L. 120
Feb. 3. Received in part		L. 62	
5. Received further			
In gold	L. 10 10		
In ſilver	13		
		23 10	
			85 10
Balance due me			L. 34 10

Chap. IV. MULTIPLICATION.

In Multiplication, two numbers are given, and it is required to find how much the firſt amounts to, when reckoned as many times as there are units in the ſecond. Thus, 8 multiplied by 5, or 5 times 8, is 40. The given numbers (8 and 5) are called *factors;* the firſt (8) the *multiplicand;* the ſecond (5) the *multiplier;* and the amount (40) the *product.*

This operation is nothing elſe than addition of the ſame number ſeveral times repeated. If we mark 8 five times under each other, and add them, the ſum is 40: But, as this kind of addition is of frequent and extenſive uſe, in order to ſhorten the operation, we mark down the number only once, and conceive it to be repeated as often as there are units in the multiplier.

For this purpoſe, the learner muſt be thoroughly acquainted with the following multiplication-table, which is compoſed by adding each digit twelve times.

Twice		Thrice		Four times		Five times		Six times		Seven times	
1 is	2	1 is	3	1 is	4	1 is	5	1 is	6	1 is	7
2	4	2	6	2	8	2	10	2	12	2	14
3	6	3	9	3	12	3	15	3	18	3	21
4	8	4	12	4	16	4	20	4	24	4	28
5	10	5	15	5	20	5	25	5	30	5	35
6	12	6	18	6	24	6	30	6	36	6	42
7	14	7	21	7	28	7	35	7	42	7	49
8	16	8	24	8	32	8	40	8	48	8	56
9	18	9	27	9	36	9	45	9	54	9	63
10	20	10	30	10	40	10	50	10	60	10	70
11	22	11	33	11	44	11	55	11	66	11	77
12	24	12	36	12	48	12	60	12	72	12	84

Eight times		Nine times		Ten times		Eleven times		Twelve times	
1 is	8	1 is	9	1 is	10	1 is	11	1 is	12
2	16	2	18	2	20	2	22	2	24
3	24	3	27	3	30	3	33	3	36
4	32	4	36	4	40	4	44	4	48
5	40	5	45	5	50	5	55	5	60
6	48	6	54	6	60	6	66	6	72
7	56	7	63	7	70	7	77	7	84
8	64	8	72	8	80	8	88	8	96
9	72	9	81	9	90	9	99	9	108
10	80	10	90	10	100	10	110	10	120
11	88	11	99	11	110	11	121	11	132
12	96	12	108	12	120	12	132	12	144

If both factors be under 12, the table exhibits the product at once. If the multiplier only be under 12, we begin at the unit-place, and multiply the figures in their order, carrying the tens to the higher place, as in addition.

Ex. 76859 multiplied by 4, or 76859 added 4 times.

76859	76859
4	76859
307436	76859
	76859
	307436

If the multiplier be 10, we annex a cypher to the multiplicand. If the multiplier be 100, we annex two cyphers; and ſo on. The reaſon is obvious, from the uſe of cyphers in notation.

If the multiplier be any digit, with one or more cyphers on the right hand, we multiply by the figure, and annex an equal number of cyphers to the product. Thus, if it be required to multiply by 50, we firſt multiply by 5, and then annex a cypher. It is the ſame thing as to add the multiplicand fifty times; and this might be done by writing the account at large, dividing the column into 10 parts of 5 lines, finding the ſum of each part, and adding theſe ten ſums together.

If the multiplier conſiſt of ſeveral ſignificant figures, we multiply ſeparately by each, and add the products. It is the ſame as if we divided a long account of addition into parts correſponding to the figures of the multiplier.

Example. To multiply 7329 by 365.

7329	7329	7329	36645 = 5 times.
5	60	300	439740 = 60 times.
36645	439740	2198700	2198700 = 300 times.
			2675085 = 365 times.

It is obvious that 5 times the multiplicand added to 60 times, and to 300 times, the ſame muſt amount to the product required. In practice, we place the products at once under each other; and, as the cyphers ariſing from the higher places of the multiplier, are loſt in the addition, we omit them. Hence may be inferred the following

Rule. "Place the multiplier under the multiplicand, and multiply the latter ſucceſſively by the ſignificant figures of the former; placing the right-hand figure of each product under the figure of the multiplier from which it ariſes; then add the product."

Ex.			
7329	42785	37846	93956
365	91	235	8704
36645	42785	189230	375834
43974	385065	113538	657692
21987	3893435	75692	751648
2675085		8893810	817793024

A number which cannot be produced by the multiplication of two others is called a *prime number;* as 3, 5, 7, 11, and many others.

A number which may be produced by the multiplication of two or more ſmaller ones, is called a *compoſite number.* For example, 27, which ariſes from the multiplication of 9 by 3; and theſe numbers (9 and 3) are called the *component parts* of 27.

Contractions and Varieties in Multiplication.

Firſt, If the multiplier be a compoſite number, we may multiply ſucceſſively by the component parts.

Ex. 7638 by 45 or 5 times 9	7638	1ſt, 5492 by 72
45	9	2d, 13759 by 56
		3d, 56417 by 144
38190	68472	4th, 73048 by 84
30552	5	5th, 166549 by 125
		6th, 378914 by 54
343710	343710	7th, 520813 by 63

Becauſe the ſecond product is equal to five times the firſt, and the firſt is equal to nine times the multiplicand,

plicand, it is obvious that the ſecond product muſt be five times nine, or forty-five times as great as the multiplicand.

Secondly, If the multiplier be 5, which is the half of 10, we may annex a cypher and divide by 2. If it be 25, which is the fourth-part of an 100, we may annex two cyphers, and divide by 4. Other contractions of the like kind will readily occur to the learner.

Thirdly, To multiply by 9, which is one leſs than 10, we may annex a cypher, and ſubtract the multiplicand from the number it compoſes. To multiply by 99,999, or any number of 9's, annex as many cyphers, and ſubtract the multiplicand. The reaſon is obvious; and a like rule may be found, though the unit place be different from 9.

Fourthly, Sometimes a line of the product is more eaſily obtained from a former line of the ſame than from the multiplicand.

Ex. 1ſt.]	1372	2d.]	1348
	84		36
	5488		8088
	10976		4044
	115248		48528

In the firſt example, inſtead of multiplying by 5, we may multiply 5488 by 2: and, in the ſecond, inſtead of multiplying by 3, we may divide 8088 by 2.

Fifthly, Sometimes the product of two or more figures may be obtained at once, from the product of a figure already found.

Ex. 1ſt.]	14356	2d.]	3462321
	648		96484
	114848		13849284
	918784		166191408
	9302688		332382816
			334058579364

In the ſecond example, we multiply firſt by 4; then, becauſe 12 times 4 is 48, we multiply the firſt line of the product by 12, inſtead of multiplying ſeparately by 8 and 4; laſtly becauſe twice 48 is 96, we multiply the ſecond line of the product by 2, inſtead of multiplying ſeparately by 6 and 9.

When we follow this method, we muſt be careful to place the right-hand figure of each product under the right-hand figure of that part of the multiplier which it is derived from.

It would anſwer equally well in all caſes, to begin the work at the higheſt place of the multiplier; and contractions are ſometimes obtained by following that order.

Ex. 1ſt.]	3125	or	3125	2d.]	32452
	642		642		52575
	18750		18750		162260
	12500		131250		811300
	6250		2006250		2433900
	2006250				1706163900

It is a matter of indifference which of the factors be uſed as the multiplier; for 4 multiplied by 3 gives the ſame product as 3 multiplied by 4; and the like holds univerſally true. To illuſtrate this, we may mark three rows of points, four in each . . . . row, placing the rows under each other; . . . . and we ſhall alſo have four rows con- . . . . taining three points each, if we reckon the rows downwards.

Multiplication is proven by repeating the operation, uſing the multiplier for the multiplicand, and the multiplicand for the multiplier. It may alſo be proven by diviſion, or by caſting out the 9's; of which afterwards; and an account, wrought by any contraction, may be proven by performing the operation at large, or by a different contraction.

Compound Multiplication.

Rule I. "If the multiplier do not exceed 12, the "operation is performed at once, beginning at the "loweſt place, and carrying according to the value "of the higher place."

Examples.]			*Cwt.*	*qr.*	*lb.*	*A.*	*R.*	*P.*	*lb.*	*oz.*	*dwt.*
L. 13	6	7	12	2	8	13	3	18	7	5	9
		9			5			6			12
L. 119	19	3	62	3	12	83	—	28	89	5	8

Rule II. "If the multiplier be a compoſite number, whoſe component parts do not exceed 12, multiply firſt by one of theſe parts, then multiply the product by the other. Proceed in the ſame manner if there be more than two."

Ex. 1ſt.]	L.	15	3	8	by 32=8×4
				8	
	L.	121	9	4	=8 times.
				4	
	L.	485	17	4	=32 times.
2d.]	L.	17	3	8	by 75=5×5×3
				3	
	L.	51	11	—	=3 times.
				5	
	L.	257	15	—	=15 times.
				5	
	L.	1288	15	—	=75 times.

Note 1. Although the component parts will anſwer in any order, it is beſt, when it can be done, to take them in ſuch order as may clear off ſome of the lower places at the firſt multiplication, as is done in Ex. 2d.

Note 2. The operation may be proved, by taking the component parts in a different order, or dividing the multiplier in a different manner.

Rule III. "If the multiplier be a prime number, "multiply firſt by the compoſite number next lower, "then by the difference, and add the products."

L.

Multiplication.

L. 35 17 9 by 67=64+3
8 64= 8+8

L. 287 2 —=8 times.
8

L. 2296 16—=64 times.
107 13 3= 3 times.

L. 2404 9 3=67 times.

Here becauſe 8 times 8 is 64, we multiply twice by 8, which gives L. 2296, 16 s. equal to 64 times the multiplicand; then we find the amount of 3 times the multiplicand, which is L. 107 : 13 : 3: and it is evident that theſe added, amount to 67, the multicand.

Rule IV. "If there be a compoſite number a little above the multiplier, we may multiply by that "number, and by the difference, and ſubtract the "ſecond product from the firſt."

L. 17 4 5 by 106=108—2
12 108= 9×12

L. 206 13 —
9

L. 1859 17 —=108 times.
34 8 10= 2 times.

L. 1825 8 2=106 times

Here we multiply by 12 and 9, the component parts of 108, and obtain a product of L. 1860, 6 s. equal to 108 times the multiplicand; and, as this is twice oftener than was required, we ſubtract the multiplicand doubled, and the remainder is the number ſought.

Example. L. 34 : 8 : 2½ by 3465.

Rule V. "If the multiplier be large, multiply by "10, and multiply the product again by 10; by "which means you obtain an hundred times the given number. If the multiplier exceed 1000, multiply by 10 again; and continue it farther if the "multiplier require it; then multiply the given "number by the unit-place of the multiplier; the "firſt product by the ten place, the ſecond product "by the hundred-place; and ſo on. Add the products thus obtained together."

L. 34 8 2½ by 5=L. 172 1 ½= 5 times
10

10 times L. 344 2 1 by 6= 2064 12 6= 60 times
10

100 times L. 3441 — 10 by 4= 13764 3 4= 400 times
10

1000 times L. 34410 8 4 by 3= 103231 5 —=3000 times.

L. 119232 1 10½=3465 times

The uſe of multiplication is to compute the amount of any number of equal articles, either in reſpect of meaſure, weight, value, or any other conſideration. The multiplicand expreſſes how much is to be reckoned for each article; and the multiplier expreſſes how many times that is to be reckoned. As the multiplier points out the number of articles to be added, it is always an abſtract number, and has no reference to any value or meaſure whatever. It is therefore quite improper to attempt the multiplication of ſhillings by ſhillings, or to conſider the multiplier as expreſſive of any denomination. The moſt common inſtances in which the practice of this operation is required, are, to find the amount of any number of parcels, to find the value of any number of articles, to find the weight or meaſure of a number of articles, &c.

This computation, for changing any ſum of money, weight, or meaſure, into a different kind, is called Reduction. When the quantity given is expreſſed in different denominations, we reduce the higheſt to the next lower, and add thereto the given number of that denomination; and proceed in like manner till we have reduced it to the loweſt denomination.

Example. To reduce L. 46 : 13 : 8¾ to farthings.

L. 46
20

920 ſhillings in L. 46
13

933 ſhillings in L. 46 13
12

11196 pence in L. 46 13
8

11204 pence in L. 46 13 8
4

44816 farthings in L. 46 13 8
3

44819 farthings in L. 46 13 8¾

Or thus:

L. 46 13 8¾
20

933
12

11204
4

44819

It is eaſy to take in or add the higher denomination at the ſame time we multiply the lower,

Division.

CHAP. V. DIVISION. 11

In diviſion, two numbers are given; and it is required to find how often the former contains the latter. Thus, it may be aſked how often 21 contains 7, and the anſwer is exactly 3 times. The former given number (21) is called the *Dividend*; the latter (7) the *Diviſor*; and the number required (3) the *Quotient*. It frequently happens that the diviſion cannot be completed exactly without fractions. Thus it may be aſked, how often 8 is continued in 19? the anſwer is twice, and a remainder of 3.

This operation conſiſts in ſubtracting the diviſor from the dividend, and again from the remainder, as often as it can be done, and reckoning the number of ſubtractions; as,

21
7 firſt ſubtraction

14
7 ſecond ſubtraction

7
7 third ſubtraction.

0

19
8 firſt ſubtraction

11
8 ſecond ſubtraction

3 remainder.

As this operation, performed at large, would be very tedious, when the quotient is a high number, it is proper to ſhorten it by every convenient method; and, for this purpoſe, we may multiply the diviſor by any number whoſe product is not greater than the dividend, and ſo ſubtract it twice or thrice, or oftener, at the ſame time. The beſt way is to multiply it by the greateſt number, that does not raiſe the product too high, and that number is alſo the quotient. For example, to divide 45 by 7, we inquire what is the greateſt multiplier for 7, that does not give a product above 45; and we ſhall find that it is 6; and 6 times 7 is 42, which, ſubtracted from 45, leaves a remainder of 3. Therefore 7 may be ſubtracted 6 times from 45; or, which is the ſame thing, 45, divided by 7, gives a quotient of 6, and a remainder of 3.

If the diviſor do not exceed 12, we readily find the higheſt multiplier that can be uſed from the multiplication table. If it exceed 12, we may try any multiplier that we think will anſwer. If the product be greater than the dividend, the multiplier is too great; and, if the remainder, after the product is ſubtracted from the dividend, be greater than the diviſor, the multiplier is too ſmall. In either of theſe caſes, we muſt try another. But the attentive learner, after ſome practice, will generally hit on the right multiplier at firſt.

If the diviſor be contained oftener than ten times in the dividend, the operation requires as many ſteps as there are figures in the quotient. For inſtance, if the quotient be greater than 100, but leſs than a 1000, it requires 3 ſteps. We firſt inquire how many hundred times the diviſor is contained in the dividend, and ſubtract the amount of theſe hundreds. Then we inquire how often it is contained ten times in the remainder, and ſubtract the amount of theſe tens. Laſtly, we inquire how many ſingle times it is contained in the remainder. The method of proceeding will appear from the following example:

To divide 5936 by 8.

From 5936
Take 5600 = 700 times 8
Rem. 336
From which take 320 = 40 times 8
Rem. 16
From which take 16 = 2 times 8
0 742 times 8 in all.

It is obvious, that as often as 8 is contained in 59, ſo many hundred times it will be contained in 5900, or in 5936; and, as often as it is contained in 33, ſo many times it will be contained in 330, or in 336; and thus the higher places of the quotient will be obtained with equal eaſe as the lower. The operation might be performed by ſubtracting 8 continually from the dividend, which will lead to the ſame concluſion by a very tedious proceſs. After 700 ſubtractions, the remainder would be 336; after 40 more, it would be 16; and after 2 more, the dividend would be entirely exhauſted. In practice, we omit the cyphers, and proceed by the following

Rule 1ſt, "Aſſume as many figures on the left "hand of the multiplier as contain the diviſor once "or oftener: find how many times they contain it, "and place the anſwer as the higheſt figure of the "quotient.

2d, "Multiply the diviſor by the figure you have "found, and place the product under the part of "the dividend from which it is obtained.

3d, "Subtract the product from the figures above it.

4th, "Bring down the next figure of the dividend "to the remainder, and divide the number it makes "up, as before."

Examples.] 1ſt. 8)5936(742
56··
33
32
16
16
0

2d. 63)30114(478
252··
491
441
504
504
0

3d. 365)974932(2671 $\frac{17}{365}$
730···
2449
2190
2593
2555
382
365
Remainder 17

The numbers which we divide, as 59, 33, and 16, in the firſt example, are called *dividuals*.

It is uſual to mark a point under the figures of the dividend, as they are brought down, to prevent miſtakes.

If there be a remainder, the diviſion is completed by a vulgar fraction, whoſe numerator is the remainder, and its denominator the diviſor. Thus, in Ex. 3. the quotient is 2671, and remainder 17; and the quotient completed is 2671 $\frac{17}{365}$.

A number which divided another without a remainder is ſaid to meaſure it; and the ſeveral numbers which meaſure another, are called its ***aliquot parts***. Thus, 2, 4, 6, 8, and 12, are aliquot parts of 24. As it is often uſeful to diſcover numbers which meaſure others, we may obſerve,

1ſt, Every number ending with an even figure, that is, with 2, 4, 6, 8, or 0, is meaſured by 2.

2d, Every number ending with 5, or 0, is meaſured by 5.

3d, Every number, whoſe figures, when added, amount to an even number, of 3's or 9's, is meaſured by 3 or 9, reſpectively.

Contractions and Varieties in Diviſion.

Firſt, When the diviſor does not exceed 12, the whole computation may be performed without ſetting down any figures except the quotient.

Ex. 7)35868(5124 or 7)35868
5124

Secondly, When the diviſor is a compoſite number, and one of the component parts alſo meaſures the dividend, we may divide ſucceſſively by the component parts.

Ex. 1ſt.] 30114 by 63.
9)30114
7) 3346
Quotient 478

2d.] 975 by 105 = 5×7×3
5)975
3)195
7) 65
Quotient $9\frac{2}{7}$

This method might be alſo uſed, although the component parts of the diviſor do not meaſure the dividend; but the learner will not underſtand how to manage

manage the remainder till he be acquainted with the doctrine of vulgar fractions.

Thirdly, When there are cyphers annexed to the diviſor, cut them off, and cut off an equal number of figures from the dividend; annex theſe figures to the remainder. *Ex.* To divide 378643 by 5200.

```
52|00)3786|43(72 4243/5200
      364
      ———
       146
       104
       ———
        4243
```

The reaſon will appear by performing the operation at large, and comparing the ſteps.

To divide by 10, 100, 1000, or the like. Cut off as many figures on the right hand of the dividend as there are cyphers in the diviſor. The figures which remain on the left hand compoſe the quotient, and the figures cut off compoſe the remainder.

Fourthly, When the diviſor conſiſts of ſeveral figures we may try them ſeparately, by inquiring how often the firſt figure of the diviſor is contained in the firſt figure of the dividend, and then conſidering whether the ſecond and following figures of the diviſor be contained as often in the correſponding ones of the dividend with the remainder (if any) prefixed. If not, we muſt begin again, and make trial of a lower number. When the remainder is nine, or upwards, we may be ſure the diviſion will hold through the lower places; and it is unneceſſary to continue the trial farther.

Fifthly, We may make a table of the products of the diviſor, multiplied by the nine digits, in order to diſcover more readily how often it is contained in each dividual. This is convenient when the dividend is very long, or when it is required to divide frequently by the ſame diviſor.

73 by 2 = 146
3 = 219
4 = 292
5 = 365
6 = 438
7 = 511
8 = 584
9 = 657

```
73)53872694(737982
   511·····
   ———
    277
    219
    ———
     582
     511
     ———
      716
      657
      ———
       599
       584
       ———
        154
        146
        ———
Rem.      8
```

Sixthly, To divide by 9, 99, 999, or any number of 9's, tranſcribe under the dividend part of the ſame, ſhifting the higheſt figure as many places to the right, as there are 9's in the diviſor. Tranſcribe it again, with the like change of place, as often as the length of the dividend admits; add theſe together, and cut off as many figures from the right hand of the ſum as there are 9's in the diviſor. The figures which remain on the left hand compoſe the quotient, and thoſe cut off the remainder.

If there be any carriage to the unit-place of the quotient, add the number carried likewiſe to the remainder, as in Ex. 2,; and if the figures cut off be all 9's, add 1 to the quotient, and there is no remainder.

Examples. 1ſt.] 99)324123   2d.] 99)547825

```
1ſt.] 99)324123            2d.] 99)547825
            3241                    5478
              32                      54
         ———————                 ———————
         3273|96                 5533|57
Quotient 3273 and rem. 96.             1
                                 ———————
                        Quotient 5333.58 rem.

3d.] 999)476523
            476
         ———————
         476|999
           1
         ———————
Quotient 477
```

To explain the reaſon of this, we muſt recollect, that whatever number of hundreds any dividend contains, it contains an equal number of 99's, together with an equal number of units. In Ex. 1. the dividend contains 3241 hundreds, and a remainder of 23. It therefore contains 3241 times 99, and alſo 3241, beſides the remainder already mentioned.—Again, 3241 contains 32 hundreds, and a remainder of 51: It therefore contains 32 99's, and alſo 32, beſides the remainder of 41. Conſequently the dividend contains 99, altogether, 3241 times, and 32 times, that is 3273 times, and the remainder conſiſts of 23, 41, and 32, added, which makes 96.

As multiplication ſupplies the place of frequent additions, and diviſion of frequent ſubtractions, they are only repetitions and contractions of the ſimple rules, and when compared together, their tendency is exactly oppoſite. As numbers, increaſed by addition are diminiſhed and brought back to their original quantity by ſubtraction; in like manner, numbers compounded by multiplication are reduced by diviſion to the parts from which they were compounded. The multiplier ſhows how many additions are neceſſary to produce the number; and the quotient ſhows how many ſubtractions are neceſſary to exhauſt it. It follows, that the product, divided by the multiplicand, will quote the multiplier; and, becauſe either factor may be aſſumed for the multiplicand, therefore the product divided by either factor quotes the other. It follows, alſo, that the dividend is equal to the product of the diviſor and quotient multiplied together: and hence theſe operations mutually prove each other.

To prove multiplication. Divide the product by either factor. If the operation be right, the quotient is the other factor, and there is no remainder.

To prove diviſion. Multiply the diviſor and quotient together; to the product add the remainder, if any; and, if the operation be right, it makes up the dividend. Otherwiſe divide the dividend (after ſubtracting the remainder, if any) by the quotient. If the operation be right, it will quote the diviſor. The reaſon of all theſe rules may be collected from the laſt paragraph.

Compound Diviſion.

12 **Rule I.** "When the dividend only conſiſts of "different denominations, divide the higher denomination, and reduce the remainder to the next "lower, taking in (p. 296. Rule V.) the given number of that denomination, and continue the diviſion."

Examples.

```
Divide L. 465 : 12 : 8          Divide 345 cwt. 1 q. 8 lb.
  by 72.                          by 22.
   L.  s. d.   L.s.d.              Cwt. q. lb.  Cwt. q. lb.
72) 465 12 8   (6 9 4          22) 345 1 8     (15  2 21
    432 . . .                      22. . .
    ---                            ---
     33                            125
     20                            110
    ---                            ---
72) 672                             15
    648                              4
    ---                            ---
     24                         22)61
     12                            44
    ---                            ---
72) 296                             17
    288                             28
    ---                            ---
      8 Rem.                       144
                                    34
                                   ---
                                22)484
                                   44
                                   ---
                                   44
                                   44
                                   ---
                                    0
```

Or we might divide by the component parts of 72, (as explained under *Thirdly*, p. 298).

Rule II. "When the diviſor is in different de"nominations, reduce both diviſor and dividend to "the loweſt denomination, and proceed as in ſimple "diviſion. The quotient is an abſtract number."

```
To divide L. 38 : 13 s.    To divide 96 Cwt. 1 q. 20lb.
  by L. 3 : 4 : 5.           by 3 cwt. 2 q. 8 lb.
                             Cwt. q. lb.   Cwt. q. lb.
L. 3 4 5  L. 38 13            3 2 8 )      96  1 20
   20         20              4             4
  ---        ---             ---          ---
   64        773              14           385
   12         12              28            28
  ---        ---             ---          ---
  773       )9276(12 quote.  120          3100
             773              28           770
             ---             ---          ---
             1546            4|00)  108|00(27 quote.
             1546
             ---
               0
```

It is beſt not to reduce the terms lower than is neceſſary to render them equal. For inſtance, if each of them conſiſts of an even number of ſixpences, fourpences, or the like, we reduce them to ſixpences, or fourpences, but not to pence.

The uſe of diviſion is to find either of the factors by whoſe multiplication a given number is produced when the other factor is given; and therefore is of two kinds, ſince either the multiplier or the multiplicand may be given. If the former be given, it diſcovers what that number is which is contained ſo many times in another. If the latter be given, it diſcovers how many times one number is contained in another. Thus, it anſwers the queſtions of an oppoſite kind to thoſe mentioned under Rule IV. p. 296. as, To find the quantity of a ſingle parcel or ſhare; to find the value, weight, or meaſure, of a ſingle article; to find how much work is done, proviſions conſumed, intereſt incurred, or the like, in a ſingle day, &c.

The laſt uſe of diviſion is a kind of reduction exactly oppoſite to that deſcribed under Rule V. 296. The manner of conducting and arranging it, when there are ſeveral denominations in the queſtion, will appear from the following examples.

```
1. To reduce 15783 pence        2. To reduce 174865 grs. to
   to pounds, ſh. and pence.       lbs. oz. and dwt. Troy.
                20                            20    12
12) 15783 (1315 (65             24) 174865 (7286 (364 (30
    12...   120.                    168...  60..  36.
    ---     ---                     ---     ---   ---
     37     115                      68     128    04
     36     100                      48     120
    ---     ---                     ---     ---
     18      15                     206      86
     12                             192      80
    ---                             ---      --
     63                              145      6
     60                              144
    ---                             ---
      3                                1
Anſwer, L. 65 : 15 : 3.         Anſ. 30lb. 4oz. 6dwt. 1 gr.
```

In the firſt example, we reduce 15783 pence to ſhillings, by dividing by 12, and obtain 1315 ſhillings, and a remainder of 3 pence. Then we reduce 1315 ſhillings to pounds, by dividing by 20. and obtain 65 pounds and a remainder of 15 ſhillings. The diviſions might have been contracted.

In the practice of arithmetic, queſtions often occur which require both multiplication and diviſion to reſolve. This happens in reduction, when the higher denomination does not contain an exact number of the lower.

Rule *for mixed reduction.* "Reduce the given de"nomination by multiplication to ſome lower one, "which is an aliquot part of both; then reduce that "by diviſion to the denomination required."

Ex. Reduce L. 31742 to guineas.

```
  31742
     20
  -----
21)634840(30230
   63....
   ---
    048
     42
    ---
     64
     63
    ---
     10
```

Here we multiply by 20, which reduces the pounds to ſhillings; and divide the product by 21, which reduces the ſhillings to guineas.

Anſwer, 30230 guineas and 10 ſhill.

As Portugueſe money frequently paſſes here in payments, we ſhall a give a table of the pieces, and their value.

A moidore	=L.	1	7	—
A half moidore	=	—	13	6
A quarter moidore	=	—	6	9
A double Joannes	=	3	12	—
A Joannes	=	1	16	—
A half ditto	=	—	18	—
A quarter ditto	=	—	9	—
An eighth ditto	=	—	4	6

Note 1. Guineas may be reduced to pounds, by adding one-twentieth part of the number.

2. Pounds may be reduced to merks by adding one-half.

3. Merks may be reduced to pounds by ſubtracting one-third.

4. Four moidores are equal to three Joannes: wherefore moidores may be reduced to Joannes, by ſubtracting one-fourth; and Joannes to moidores, by adding one-third.

5. Five Joannes are equal to L. 9. Hence it is eaſy to reduce Portugueze money to Sterling.

Another caſe, which requires both multiplication and diviſion, is, when the value, weight, meaſure, or duration of any quantity is given, and the value, &c. of a different quantity required, we firſt find the value, &c. of a ſingle article by diviſion, and then the value, &c. of the quantity required, by multiplication.

Ex. If 3 yards coſt 15 s. 9 d. what will 7 yards coſt, at the ſame rate?

s. d.
3) 15 9 Price of 3 yards.
5 3 Price of 1 yard by Rule IV. p. 296.
7

L. 1 16 9 Price of 7 yards (by par. *ult.* p. 299. col. 1.

Many other inſtances might be adduced, where the operation and the reaſon of it are equally obvious. Theſe are generally, though unneceſſarily, referred to the rule of proportion.

We ſhall now offer a general obſervation on all the operations in Arithmetic. When a computation requires ſeveral ſteps, we obtain a juſt anſwer, whatever order we follow. Some arrangements may be preferable to others in point of eaſe, but all of them lead to the ſame concluſion. In addition, or ſubtraction, we may take the articles in any order, as is evident from the idea of number; or, we may collect them into ſeveral ſums, and add and ſubtract theſe, either ſeparately or together. When both the ſimple operations are required to be repeated, we may either complete one of them firſt, or may introduce them promiſcuouſly; and the compound operations admit of the ſame variety. When ſeveral numbers are to be multiplied together, we may take the factors in any order, or we may arrange them into ſeveral claſſes, find the product of each claſs, and then multiply the products together. When a number is to be divided by ſeveral others, we may take the diviſors in any order, or we may multiply them into each other, and divide by the product; or we may multiply them into ſeveral parcels, and divide by the products ſucceſſively. Laſtly, when multiplication and diviſion are both required, we may begin with either; and when both are repeatedly neceſſary, we may collect the multipliers into one product, and the diviſors into one another; or we may collect them into parcels, or uſe them ſingly, and that in any order. Still, we ſhall obtain the proper anſwer, if none of the terms be neglected.

When both multiplication and diviſion are neceſſary to obtain the anſwer of a queſtion, it is generally beſt to begin with the multiplication, as this order keeps the account as clear as poſſible from fraction. The example laſt given may be wrought accordingly as follows:

s. d.
15 9
7

3)5 10 3
1 16 9

Some accountants prove the operations of arithmetic by a method which they call caſting out the 9's, depending on the following principles:

Firſt, If ſeveral numbers be divided by any diviſor, (the remainders being always added to the next number), the ſum of the quotients, and the laſt remainder, will be the ſame as thoſe obtained when the ſum of the numbers is divided by the ſame diviſor. Thus, 19, 15, and 23, contain, together, as many 5's, as many 7's, &c. as their ſum 57 does, and the remainders are the ſame; and, in this way, addition may be proven by diviſion. It is from the correſpondence of the remainders, that the proof, by caſting out the 9's, is deduced.

Secondly, If any figure, with cyphers annexed, be divided by 9, the quotient conſiſts entirely of that figure; and the remainder is alſo the ſame. Thus, 40, divided by 9, quotes 4, remainder 4; and 400 divided by 9, quotes 4, remainder 44. The ſame holds with all the digits; and the reaſon will be eaſily underſtood; every digit, with a cypher annexed, contains exactly ſo many tens; it muſt therefore contain an equal number of 9's, beſides a remainder of an equal number of units.

Thirdly, If any number be divided by 9, the remainder is equal to the ſum of the figures of the number, or to the remainder obtained, when that ſum is divided by 9. For inſtance, 3765, divided by 9, leaves a remainder of 3, and the ſum of 3, 7, 6, and 5, is 21; which divided by 9, leaves a remainder of 3. The reaſon of this will appear from the following illuſtration:

3000 divided by 9	quotes	333;	remainder 3
700	quotes	77;	remainder 7
60	quotes	6;	remainder 6
5	quotes	0;	remainder 5
3765		416	Sum of Rem. 21
Again. 21 divided by 9	quotes	2;	remainder 3

Wherefore, 3765 divid. by 9 quotes 418; remainder 3; for the reaſon given. Hence we may collect the following rules for practice:

To caſt the 9's out of an number, or to find what remainder will be left when any number is divided by 9: Add the figures; and when the ſum exceeds 9, add the figures which would expreſs it. Paſs by the nines; and, when the ſum comes exactly to 9, neglect it, and begin anew. For example, if it be required to caſt the 9's out of 3573294, we reckon thus: 3 and 5

5 is 8, and 7 is 15; 1 and 5 is 6, and 3 is 9, which we neglect; 2 and (paſſing by 9) 4 is 6; which is the remainder or Result. If the article out of which the 9's are to be caſt contains more denominations than one, we caſt the 9's out of the higher, and multiply the reſult by the value of the lower, and carry on the product (caſting out the 9's, if neceſſary), to the lower.

To prove addition, caſt the 9's out of the ſeveral articles, carrying the reſults to the following articles; caſt them alſo out of the ſum. If the operation be right, the reſults will agree.

To prove ſubtraction, caſt the 9's out of the minuend; caſt them alſo out of the ſubtrahend and remainder together; and if you obtain the ſame reſult, the operation is preſumed right.

To prove multiplication, caſt the 9's out of the multiplicand, and alſo out of the multiplier, if above 9. Multiply the reſults together, and caſt the 9's if neceſſary, out of their product. Then caſt the 9's out of the product, and obſerve if this reſult correſpond with the former.

```
Ex. 1ſt.] 9276 reſ. 6×8=48 reſ. 3.
             8
       ———————
         74208 reſ. 3.
   2d.] 7898 reſ. 5×3=15 reſ. 6.
          48 reſ. 3.
      ———————
       63184
      31592
      ———————
      379104 reſ. 6.
```

The reaſon of this will be evident, if we conſider multiplication under the view of repeated addition. In the firſt example it is obviouſly the ſame. In the ſecond, we may ſuppoſe the multiplicand repeated 48 times. If this be done, and the 9's caſt out, the reſult, at the end of the 9th line, will be 0; for any number, repeated 9 times, and divided by 9, leaves no remainder. The ſame muſt happen at the end of the 18th, 27th 36th, and 45th lines; and the laſt reſult will be the ſame as if the multiplicand had only been repeated 3 times. This is the reaſon for caſting out the 9's from the multiplier as well as the multiplicand.

To prove diviſion, caſt the 9's out of the diviſor, and alſo out of the quotient; multiply the reſults, and caſt the 9's out of the product. If there be any remainder, add to it the reſult, caſting out the 9's, if neceſſary. If the account be right, the laſt reſult will agree with that obtained from the dividend.

```
Ex. 42) 2490 (59 reſ. 5×6=30 reſ. 3.
reſ. 6   210
       ———————
          390
          378
         —————
   Rem.   12      -      -     reſ. 3.
                                  —
```

And the reſult of the dividend is 6.

This depends on the ſame reaſon as the laſt; for the dividend is equal to the product of the diviſor and quotient added to the remainder.

We cannot recommend this method, as it lies under the following diſadvantages:

Firſt, If an error of 9, or any of its multiples, be committed, the reſults will nevertheleſs agree; and ſo the error will remain undiſcovered. And this will always be the caſe, when a figure is placed or reckoned in a wrong column; which is one of the moſt frequent cauſes of error.

Secondly, When it appears by the diſagreement of the reſults, that an error has been committed, the particular figure or figures in which the error lies are not pointed out; and conſequently, it is not eaſily corrected.

Chap. VI. RULE of PROPORTION.

Sect. i. Simple Proportion. 13

Quantities are reckoned proportional to each other, when they are connected in ſuch a manner, that if one of them be increaſed or diminiſhed, the other increaſes or diminiſhes at the ſame time; and the degree of the alteration on each is a like part of its original meaſure; thus four numbers are in the ſame proportion, the firſt to the ſecond as the third to the fourth, when the firſt contains the ſecond, or any part of it, as often as the third contains the fourth, or the like part of it. In either of theſe caſes, the quotient of the firſt, divided by the ſecond, is equal to that of the third divided by the fourth; and this quotient may be called the *meaſure of the proportion.*

Proportionals are marked down in the following manner:

6 : 3 :: 8 : 4
12 : 36 :: 9 : 27
9 : 6 :: 24 : 18
16 : 24 :: 10 : 15

The rule of proportion directs us, when three numbers are given, how to find a fourth, to which the third may have the ſame proportion that the firſt has to the ſecond. It is ſometimes called the *Rule of Three,* from the three numbers given; and ſometimes the *Golden Rule,* from its various and extenſive utility.

Rule. "Multiply the ſecond and third terms together, and divide the product by the firſt."

Ex. To find a fourth proportional to 18, 27, and 34.

```
18 : 27 :: 34 : 51
     34
     ——
    108
    81
    ———
18)918(51
   90
   ——
    18
    18
    —
     0
```

To explain the reaſon of this, we muſt obſerve, that if two or more numbers be multiplied or divided alike, the products or quotients will have the ſame proportion.

18 : 27
Multiplied by 34, 612 : 918
Divided by 18, 34 : 51

The products 612, 918, and the quotients 34, 51, have therefore the ſame proportion to each other that 18 has to 27. In the courſe of this operation, the products of the firſt and third term is divided by the firſt; therefore the quotient is equal to the third.

The firſt and ſecond terms muſt always be of the ſame kind; that is, either both monies, weights, meaſures, both abſtract numbers, or the like. The fourth, or number ſought, is of the ſame kind as the third.

When any of the terms is in more denominations than one, we may reduce them all to the loweſt. But this is not always neceſſary. The firſt and ſecond ſhould not be reduced lower than directed p. 299, col. 1. par. *penult.*; and, when either the ſecond or third is a ſimple number, the other, though in different denominations, may be multiplied without reduction.

```
                L.   s.   d.
   Ex. 5 : 7 :: 25   11   3
                          7
               ———————————L.   s.   d.
          5)178   18   9(35   19   9
```

The accountant muſt conſider the nature of every queſtion, and obſerve the circumſtance which the proportion depends on; and common ſenſe will direct him to this if the terms of the queſtion be underſtood. It is evident that the value, weight and meaſure of any commodity is proportioned to its quantity; that the amount of work or conſumption is proportioned to the time; that gain, loſs or intereſt, when the rate and time are fixed, is proportioned to the capital ſum from which it ariſes; and that the effect produced by any cauſe is proportioned to the extent of the cauſe. In theſe, and many other caſes, the proportion is direct, and the number ſought increaſes or diminiſhes along with the term from which it is derived.

In ſome queſtions, the number ſought becomes leſs, when the circumſtances from which it is derived become greater. Thus, when the price of goods increaſes, the quantity which may be bought for a given ſum is ſmaller. When the number of men employed at work is increaſed, the time in which they may comple it becomes ſhorter; and, when the activity of any cauſe is increaſed, the quantity neceſſary to produce a given effect is diminiſhed. In theſe, and the like, the proportion is ſaid to be inverſe.

General Rule *for ſtating all queſtions, whether direct or inverſe.* "Place that number for the third "term which ſignifies the ſame kind of thing with "what is ſought, and conſider whether the number "ſought will be greater or leſs. If greater, place the "leaſt of the other terms for the firſt; but, if leſs, "place the greateſt for the firſt."

Ex. 1ſt] If 30 horſes plough 12 acres, how many will 42 plough in the ſame time?

```
   H.   H.   A.
   30 : 42 :: 12
```

Here, becauſe the thing ſought is a number of acres, we place 12, the given number of acres, for the third term; and, becauſe 42 horſes will plough more than 12, we make the leſſer number 30, the firſt term, and the greater number, 42, the ſecond term.

Ex. 2d.] If 40 horſes be maintained for a certain ſum on hay, at 5 d. per ſtone, how many will be maintained on the ſame ſum when the price of hay riſes to 8 d.

```
   d.  d.   H.
   8 : 5 :: 40
```

Here, becauſe a number of horſes is ſought, we make the given number of horſes, 40, the third term; and, becauſe fewer will be maintained for the ſame money, when the price of hay is dearer, we make the greater price, 8 d. the firſt term; and the leſſer price 5d. the ſecond term.

The firſt of theſe examples is direct, the ſecond inverſe. Every queſtion conſiſts of a ſuppoſition and demand. In the firſt, the ſuppoſition is, that 30 *horſes plough* 12 *acres*, and the demand, *how many* 42 *will plough?* and the firſt term of the proportion, 30, is found in the ſuppoſition, in this, and every other direct queſtion. In the ſecond, the ſuppoſition is, *that* 40 *horſes are maintained on hay at 5d.* and the demand, *how many will be maintained on hay at 8d?* and the firſt term of the proportion, 8, is found in the demand, in this and every other inverſe queſtion.

When an account is ſtated, if the firſt and ſecond term, or firſt and third, be meaſured by the ſame number, we may divide them by that meaſure, and uſe the quotients in their ſtead.

Ex. If 36 yards coſt 42 ſhillings, what will 27 coſt?

```
   Y.   Y.   ſh.
   36 : 27 :: 42          Here 36 and 27 are both
    4 :  3 :: 42         meaſured by 9, and we work
               3         with the quotients 4 and 3.
             ——— s.  d.
         4)126(31  6
```

Sect. ii. Compound Proportion. 14

Sometimes the proportion depends upon ſeveral circumſtances. Thus, it my be aſked, if 18 men conſume 6 bolls corn in 28 days, how much will 24 men conſume in 56 days? Here the quantity required depends partly on the number of men, partly on the time, and the queſtion may be reſolved into the two following ones:

1ſt. If 18 men conſume 6 bolls in a certain time, how many will 24 men conſume in the ſame time?

```
M.   M.   B. B.
18 : 24 :: 6 : 8        Anſwer. 24 men will conſume
      6                 8 bolls in the ſame time.
    ———
18)144(8
```

2d. If a certain number of men conſume 8 bolls in 28 days, how many will they conſume in 56 days?

```
D.   D.   B.  B.
28 : 56 :: 8 : 16      Anſ. The ſame number of men
      8               will conſume 16 bolls in 56 days.
    ———
18)448(16
```

In the courſe of this operation, the original number of bolls, 6, is firſt multiplied into 24, then divided by 18, then multiplied into 8, then divided by 28. It would anſwer the ſame purpoſe to collect the mutipliers into one product, and the diviſors into another; and then to multiply the given number of bolls by the former, and divide the product by the latter. p. 300. col. 1. par. *ult.*

The above queſtion may therefore be ſtated and wrought as follows:

Men

Proportion

Men 18 : 24 :: 6 bolls
Days 28 : 56

144 144
36 120

504 1344
6

504)8064(16

Here we multiply 18 into 28 for a diviſor, and 6 into the product of 24 by 56, for a dividend.

" In general, ſtate the ſeveral particulars on which " the queſtion depends, as ſo many ſimple proportions, " attending to the ſenſe of the queſtion to diſcover " whether the proportions ſhould be ſtated directly or " inverſely; then multiply all the terms in the firſt " rank together, and all thoſe in the ſecond rank to" gether; and work with the products as directed in " the ſimple rule (Sect i. p. 301.)"

Example. If 100 men make 3 miles of road in 27 days, in how many days will 150 men make 5 miles?

Men 150 : 100 :: 27 days
Miles 3 5

450 500
27

450)13500(30 days, anſ.

Here the firſt ſtating is inverſe, becauſe more men will do it in fewer days; but the ſecond is direct, becauſe more miles will require more days.

The following contraction is often uſeful. After ſtating the proportion, if the ſame number occurs in both ranks, daſh it out from both; or, if any term in the firſt rank, and another in the ſecond rank are meaſured by the ſame numbers, daſh out the original terms, and uſe the quotients in their ſtead.

Ex. If 18 men conſume L. 30 value of corn in 9 months, when the price is 16 s. per boll, how many will conſume L. 54 value in 6 months, when the price is 12 s. per boll? In this queſtion, the proportion depends upon three particulars, the value of corn, the time and the price. The firſt of which is direct, becauſe the more the value of proviſions is, the more time is required to conſume them; but the ſecond and third are inverſe, for the greater the time and price is, fewer men will conſume an equal value.

Value $\ddot{30}$: $\ddot{74}$ :: 18 men.
Months $\dot{6}$: $\dot{9}$
Price $\ddot{12}$: $\ddot{16}$
10 9
$\dot{3}$ $\dot{3}$
4

36
18

288
36

10)648($64\frac{9}{10}$

Here we obſerve that 6 in the firſt rank meaſures 54 in the ſecond: ſo we daſh them out, and place the quotient 9 in the ſecond rank. Next, becauſe 30 and 9 are both meaſured by 3, we daſh them out, and place down the quotients 10 and 3; then, becauſe 12 and 16 are both meaſured by 4, we daſh them out, and place down the quotients 3 and 4. Laſtly, becauſe there is now 3 in both columns, we daſh them out, and work with the remaining terms, according to the rule.

The monies, weights and meaſures, of different countries, may be reduced from the proportion which they bear to each other.

Ex. If 112 lb. averdupois make 104 lb. of Holland, and 100 lb. of Holland make 89 of Geneva, and 110 of Geneva make 117 of Seville, how many lbs. of Seville will make 100 lb. averdupois.

112 : 104 :: 100
100 : 89
110 : 117

If it be required, how many lb. averdupois will make 100 of Seville, the terms would have been placed in the different columns thus:

104 : 112 :: 100
89 : 100
117 : 110

Sect. iii. Distributive Proportion. 15

If it be required to divide a number into parts, which have the ſame proportion to each other, that ſeveral other given numbers have, we add theſe numbers together, and ſtate the following proportion: As the ſum is to the particular numbers, ſo is the number required to be divided to the ſeveral parts ſought.

Ex. 1ſt.] Four partners engage to trade in company; A's ſtock is L. 150, B's L. 320, C's L. 350, D's L. 500, and they gain L. 730; Required how much belongs to each, if the gain be divided among them in proportion to their ſtocks?

					Rem.
A's ſtock L.	150	1320 : 150 :: 730 :	L. 82	19	1 — 120
B's	320	1320 : 320 :: 730 :	176	19	4 — 960
C's	350	1320 : 350 :: 730 :	193	11	2 — 720
D's	500	1320 : 500 :: 730 :	276	10	3 — 840
Whole ſtock	1320	Proof	L. 730		

This account is proved by adding the gains of the partners; the ſum of which will be equal to the whole gain, if the operation be right; but, if there be remainders, they muſt be added, their ſum divided by the common diviſor, and the quotient carried to the loweſt place.

Ex. 2d.] A bankrupt owes A L. 146, B L. 170, C L. 45, D L 480, and E L. 72; his whole effects are only L. 342 : 7 : 6. How much ſhould each have?

A's debt L.	146	913 : 146 ::	L. 342	7	6 :	L. 54	15		A's ſhare.
B's	170	913 : 170 ::	342	7	6	63	15		B's
C's	45	913 : 45 ::	342	7	6	16	17	6	C's
D's	480	913 : 480 ::	342	7	6	180			D's
E's	72	913 : 72 ::	342	7	6	27			E's
	L. 913					L. 342	7	6	

This might alſo be calculated, by finding what compoſition the bankrupt was able to pay per pound; which is obtained by dividing the amount of his effects by the amount of his debts; and comes to 7 s. 6 d. and then finding by the rules of practice, how much each debt came to at that rate.

Chap. VII. RULES for PRACTICE. 16

The operations explained in the foregoing chapters comprehend the whole ſyſtem of arithmetic, and are ſufficient for every computation. In many caſes, however, the work may be contracted, by adverting to the particular circumſtances of the queſtion. We ſhall explain, in this chapter, the moſt uſeful methods which practice has ſuggeſted for rendering mercantile computations eaſy; in which, the four elementary rules of arithmetic are ſometimes jointly, ſometimes ſeparately employed.

Sect. i. Computation of Prices.

The value of any number of articles, at a pound, a ſhilling ſhillings, or a penny, is an equal number of pounds, ſhillings or pence; and theſe two laſt are eaſily reduced to pounds. The value, at any other rate, may be calculated by eaſy methods, depending on ſome contraction already explained, or on one or more of the following principles.

1ſt, If the rate be an aliquot part of a pound, a ſhilling, or a penny, then an exact number of articles may be bought for a pound, a ſhilling, or a penny; and the value is found by dividing the given number accordingly. Thus, to find the price of ſo many yards at 2 s. 6 d. which is the eighth-part of a pound, we divide the quantity by eight, becauſe every eight yards coſt L. 1.

2d, If the rate be equal to the ſum of two other rates which are eaſily calculated, the value may be found by computing theſe ſeparately, and adding the ſums obtained. Thus, the price of ſo many yards, at 9 d. is found, by adding their prices, at 6 d. and 3 d. together.

3d, If the rate be equal to the difference of two eaſy rates, they may be calculated ſeparately, and the leſſer ſubtracted from the greater. Thus, the value of ſo many articles at 11 d. is found, by ſubtracting their value at a penny from their value at a ſhilling. We may ſuppoſe that a ſhilling was paid for each article, and then a penny returned on each.

4th, If the rate be a compoſite number, the value may be found by calculating what it comes to at one of the component parts, and multiplying the ſame by the other.

Case I. "When the rate is an aliquot part of a "pound, divide the quantity by the number which may "be bought for a pound."

Table of the aliquot parts of L. 1.

10 ſhillings	= $\frac{1}{2}$ of L. 1.	1 ſhilling 4 d.	= $\frac{1}{15}$ of L. 1.
6 s. 8 d.	= $\frac{1}{3}$	1 s. 3 d.	= $\frac{1}{16}$
5 s.	= $\frac{1}{4}$	1 s.	= $\frac{1}{20}$
4 s.	= $\frac{1}{5}$	8 d.	= $\frac{1}{30}$
3 s. 4 d.	= $\frac{1}{6}$	6 d.	= $\frac{1}{40}$
2 s. 6 d.	= $\frac{1}{8}$	4 d.	= $\frac{1}{60}$
2 s.	= $\frac{1}{10}$	3 d.	= $\frac{1}{80}$
1 s. 8 d.	= $\frac{1}{12}$	2 d.	= $\frac{1}{120}$

Ex. 1ſt.] What is the value of 7463 yards, at 4 s?
5)7463
L. 1492 12 s.

2d.] What is the value of 1773 yards, at 3 d?
8|0)177|3
L. 22 3 3

In the firſt example we divide by 5, becauſe 4 s. is $\frac{1}{5}$ of a pound; the quotient 1492 ſhows how many pounds they amount to; beſides which there remains three yards at 4 s. and theſe come to 12 s. In the ſecond example, we divide by 80, as directed, and the quotient gives L. 22, and the remainder 13 yards, which at 3 d. comes to 3 s. and 3 d.

This method can only be uſed in calculating for the particular prices ſpecified in the table. The following 6 caſes comprehend all poſſible rates, and will therefore exhibit different methods of ſolving the foregoing queſtions.

Case II. "When the rate conſiſts of ſhillings only, "multiply the quantity by the number of ſhillings, "and divide the product by 20: Or, if the number "of ſhillings be even, multiply by half the number, "and divide the product by 10.

Ex. 1ſt.] 4573 at 13 s.
13
———
13719
4573
———
20)59449
L. 2972 9 s.

2d.] 7543 at 14 s.
7
———
10)52801
L. 5280 2 s.

The learner will eaſily perceive, that the method in which the ſecond example is wrought, muſt give the ſame anſwer as if the quantity had been multiplied by 14, and divided by 20; and, as the diviſion by 10 doubles the laſt figure for ſhillings, and continues all the reſt unchanged for pounds, we may obtain the anſwer at once, by doubling the right-hand figure of the product before we ſet it down.

If the rate be the ſum of two or more aliquot parts of a pound, we may calculate theſe as directed in Caſe I. and add them. If it be any odd number of ſhillings, we may calculate for the even number next lower, and add thereto the value at a ſhilling. If it be 19 s. we may ſubtract the value at a ſhilling, from the value at a pound.

Case III. "When the rate conſiſts of pence only."

Method 1. If the rate be an aliquot part of a ſhilling, divide the quantity accordingly, which gives the anſwer in ſhillings; if not, it may be divided into two or more aliquot parts: calculate theſe ſeparately, and add the values; reduce the anſwer to pounds.

1 penny is $\frac{1}{12}$ of a ſhilling.
2 d. $\frac{1}{6}$ of ditto.
3 d. $\frac{1}{4}$ of ditto.
4 d. $\frac{1}{3}$ of ditto.
6 d. $\frac{1}{2}$ of ditto.
5 d. is the ſum of 4 d. and 1 d. or of 2 d. and 3 d.
7 d. is the ſum of 4 d. and 3 d. or of 6 d. and 1 d.
8 d. is the ſum of 6 d. and 2 d. or the double of 4 d.
9 d. is the ſum of 6 d. and 3 d.
10 d. is the ſum of 6 d. and 4 d.
11 d. is the ſum of 6 d. 3 d. and 2 d.

Ex. 1ſt.] 7423 at 4 d.
———
3)7423
20)2474 4
L. 123 14 4

Here, becauſe 4 d. is one third of a ſhilling, we divide by 3, which gives the price in ſhills. and reduce theſe by diviſion to pounds.

2d.] 9786 at 9 d.
———
At 6 d. = $\frac{1}{2}$ of 1 s. 4893
At 3 d. = $\frac{1}{2}$ of 6 d. 2446 6
— ———
At 9 d. 7339 6
L. 366 19 6

Here we ſuppoſe, that firſt 6 d. and then 3 d. is paid for each article; half the quantity is the number of ſhillings which they would coſt at 6 d. each. Half of that is the coſt at 3 d. and theſe added and reduced give the anſwer.

3d.] 4856 at 11 d.
———
At 6d. = $\frac{1}{2}$ of 1s. 2428
At 3d. = $\frac{1}{2}$ of 6d. 1214
At 2d. = $\frac{1}{3}$ of 6d. 809 4
— ———
11 d. 4451 4
L. 222 11 4

Here we calculate what the articles would coſt at 6 d. at 3 d. and at 2 d. and add the values.

It is ſometimes eaſier to calculate at two rates, whoſe difference is the rate required, and ſubtract the leſſer value from the greater. Thus, the laſt example may be wrought by ſubtracting the value at a penny from the value at a ſhilling. The remainder muſt be the lue at 11d.

At 1 s.	4856 s.	
At 1 d.$=\frac{1}{12}$	404	8
At 11d.	4451	4
	L. 222 11	4

10 d. may be wrought as the difference of 1 s. and 2 d.; and feveral other rates in like manner.

Meth. 2. *Multiply the quantity by the number of pence, the product is the anfwer in pence. Reduce it to pounds.*

Meth. 3. *Find the value at a penny by divifion, and multiply the fame by the number of pence.*

Case IV. "When the rate confifts in farthings only, find the value in pence, and reduce it by divifion to pounds."

Ex. 1ft. 37843 at 1 farthing.
4)37843 farth.
12) 9460$\frac{3}{4}$ pence
788 4$\frac{3}{4}$
L. 39 8 4$\frac{3}{4}$

2d. 23754 at $\frac{1}{2}$ d.
2)23754 halfpence
12)11877 pence
989 9
L. 49 9 9

3d. 72564 at $\frac{3}{4}$d
3
4)217692 farth.
1) 54423 pence
4535 3
L. 226 15 3

Or, 72564
At $\frac{1}{2}$d. 3682 d.
At $\frac{1}{4}$d. 18141 d.
12)54423 d.
4535 5
L. 226 15 3

We may alfo find the amount in twopences, threepences, fourpences, or fixpences, by one divifion, and reduce thefe as directed in Cafe I.

Case V. "When the rate confifts of pence and farthings, find the value of the pence, as directed in Cafe III. and that of the farthings from the proportion which they bear to the pounds. Add thefe together, and reduce."

Ex. 1ft.] 3287 at 5$\frac{1}{4}$d.

At 4 d.$=\frac{1}{3}$ of 1s.	1095	8
At 1 d.$=\frac{1}{4}$ of 4d.	373	11
At 1 f.$=\frac{1}{4}$ of 1d.	68	5$\frac{3}{4}$
At 5$\frac{1}{4}$	1438	$\frac{3}{4}$
	L. 71 18	$\frac{3}{4}$

2d.] 4573 at 2$\frac{3}{4}$d.

At 2 d.$=\frac{1}{6}$ of 1s.	762	2
At $\frac{1}{2}$d.$=\frac{1}{4}$ of 2d.	190	6$\frac{1}{2}$
At $\frac{1}{4}$d.$=\frac{1}{2}$ of $\frac{1}{2}$d.	85	3$\frac{1}{4}$
At 2$\frac{3}{4}$	1037	11$\frac{3}{4}$
	L. 51 17	11$\frac{3}{4}$

3d.] 2842 at 3$\frac{3}{4}$d.

At 3 d.$=\frac{1}{4}$ of 1s.	710	6
At 3 f.$=\frac{1}{4}$ of 3d.	177	7$\frac{1}{2}$
At 3$\frac{3}{4}$d.	887	1$\frac{1}{2}$
	L. 44 8	1$\frac{1}{2}$

4th.] 3572 at 7$\frac{1}{2}$d.

At 6 d.$=\frac{1}{2}$ of 1s.	1386	
At 1$\frac{1}{2}$d.$=\frac{1}{4}$ of 6d.	346	6
At 7$\frac{1}{2}$d.	1732	6
	L. 87 12	6

It is fometimes beft to join fome of the pence with the farthings in the calculation. Thus, in Ex. 4. we reckon the value at 6d. and at 3 halfpence, which makes 7$\frac{1}{2}$d.

If the rate be 1$\frac{1}{2}$d. which is an eighth-part of a fhilling, the value is found in fhillings, by dividing the quantity by 8.

Case VI. "When the rate confifts of fhillings and lower denominations."

Method 1. *Multiply the quantity by the fhillings, and find the value of the pence and farthings, if any, from the proportion which they bear to the fhillings. Add and reduce.*

Ex. 1ft.] 4258 at 17s. 3d.

	17	
	29806	
	4258	
17 s.	72386	
3 d.$=\frac{1}{4}$ of 1s.	1064	6
17 s. 3 d.	73450	6
	L. 3672 10	6

2d.] 4582 at 12s. 4$\frac{1}{2}$d.

	12	
12 s.	65784	
3 d.$=\frac{1}{4}$ of 1s.	1370	6
1$\frac{1}{2}$d.$=\frac{1}{2}$ of 3d.	685	3
12 s. 4$\frac{1}{2}$d.	67839	9
	L. 3391 19	9

Method 2. *Divide the rate into aliquot parts of a pound; calculate the values correfponding to thefe, as directed in* Cafe 1. *and add them.*

Ex. 1ft.] 3894 at 17 s. 6 d.

10s. $=\frac{1}{2}$	L. 1947		
5 $=\frac{1}{4}$	973	10	
2 6 d.$=\frac{1}{8}$	486	15	
17 s. 6 d.	L. 3407	5	

2d.] 1765 at 9 s. 2 d.

6s. 8d.$=\frac{1}{3}$	L. 588	6	8
2 6 $=\frac{1}{8}$	220	12	6
9s. 2d.	808	19	2

Sometimes part of the value is more readily obtained from a part already found; and fometimes it is eafieft to calculate at a higher rate, and fubtract the value at the difference.

3d.] 63790 at 5 s. 4 d.

4s. $=\frac{1}{5}$	L. 12758		
1s.4d.$=\frac{1}{3}$of 4s.	4252	13	4
5s. 4d.	L. 17010	13	4

4th.] 3664 at 14 s. 9 d.

10s.$=\frac{1}{2}$	L. 1832	
5 s. $=\frac{1}{2}$of 10s.	916	
15 s.	2748	
3d.$=\frac{1}{20}$of 5s.	45	16
14s. 9d.	L. 2702	4

Method 3. *If the price contain a compofite number of pence, we may multiply the value at a penny by the component parts.*

Ex. 5628 at 2 s. 11 d. or 35 d.
12)5628
20) 469
L. 23 9
5
L. 117 5
7
L. 820 15

Case VII. "When the rate conſiſts of pounds and "lower denominations."

Method 1. *Multiply by the pounds, and find the value of the other denominations from the proportion which they bear to the pounds.*

	Ex. 1ſt.] 3592 at L. 3 : 12 : 8.
	3
L. 3	10776
12s $=\frac{1}{5}$ of L. 3	2155 ·4
8d$=\frac{1}{18}$ of 12s.	119 14 8
L. 3 12 8	L. 13050 18 8

	2d.] 543 at L. 2 : 5 : 10$\frac{1}{2}$.
	2
L. 2	1086
5 s $=\frac{1}{4}$ of L 1.	135 15
10d$=\frac{1}{6}$ of 5s.	22 12 6
$\frac{1}{2}$d$=\frac{1}{20}$ of 10d.	1 2 7$\frac{1}{2}$
	L. 1245 10 1$\frac{1}{2}$

Method 2. *Reduce the pounds to ſhillings, and proceed as in* Caſe VI.

	Ex. 1ſt.] 3592 at L.3 : 12 : 8			2d.] 3683 at L. 2 : 4 : 11
	72	20		45
	7184	72		18415
	25144			14732
	258624		At 45s.	165735
4d.$=\frac{1}{3}$s.	1197 4		At 1d.$=\frac{1}{12}$s.	307 11
4d.$=\frac{1}{3}$s.	1197 4		44s. 11d.	165427 1
8d.	261018 8			L. 8271 7 1
	L. 13050 18 8			

The learner ſhould at firſt try every calculation more ways than one; which will not only ſerve the purpoſe of proving the operation, but will render him expert at diſcovering the beſt method of ſolving each queſtion, and will lead him to invent other methods; for we have not exhauſted the ſubject.

Thus, if the number of articles be 20, each ſhilling of the rate makes a pound of the amount. If it be 12, each penny of the rate makes a ſhilling of the amount. If 240, each penny of the rate makes a pound of the amount. If 480, each half-penny makes a pound. If 960, each farthing makes a pound. If the number of articles be a mutiple, or an aliquot part of any of theſe, the amount is eaſily calculated. And if it be near to any ſuch number, we may calculate for that number, and add or ſubtract for the difference.

We have hitherto explained the various methods of computation, when the quantity is a whole number, and in one denomination. It remains to give the proper directions when the quantity contains a fraction, or is expreſſed in ſeveral denominations.

When the quantity contains a fraction, work for the integers by the preceding rules, and for the fraction take proportional parts.

When the quantity is expreſſed in ſeveral denominations and the rate given for the higher; calculate the higher, conſider the lower ones as fractions, and work by the laſt rule.

When the rate is given for the lower denomination, reduce the higher denomination to the lower, and calculate accordingly.

Note 1ſt. 7 lb. 14 lb. and 21 lb. are aliquot parts of 1 qr.: and 16 lb. is $\frac{1}{7}$ of 1 cwt.; and are therefore eaſily calculated.

2d. If the price of a dozen be ſo many ſhillings, that of an article is as many pence; and if the price of a groſs be ſo many ſhillings, that of a dozen is as many pence.

3d. If the price of a ton or ſcore be ſo many pounds, that of 1 cwt. or a ſingle article, is as many ſhillings.

4th. Though a fraction leſs than a farthing is of no conſequence, and may be rejected, the learner muſt be careful leſt he loſe more than a farthing, by rejecting ſeveral remainders in the ſame calculation.

Sect. ii. Deductions *on* Weights, &c.

The full weight of any merchandiſe, together with that of the caſk, box, or other package, in which it is contained, is called the *groſs weight.* From this we muſt make proper deductions, in order to diſcover the quantity, for which price or duty ſhould be charged, which is called the *nett weight.*

Tare is the allowance for the weight of the package; and this ſhould be aſcertained by weighing it before the goods are packed. Sometimes, however, particularly in payment of duty, it is cuſtomary to allow ſo much *per* C. or ſo much *per* 100 lb. in place of tare.

Tret is an allowance of 4 lb. on 104 granted on currants, and other goods on which their is waſte, in order that the weight may anſwer when the goods are retailed.

Cloff, or Draught, is a further allowance granted on ſome goods in London, of 2 lb. on every 3 C. to turn the ſcale in favour of the purchaſer. The method of calculating theſe and the like will appear from the following examples.

Ex. 1ſt. What is the nett weight of 17 C. 2 q. 14 lb. tare 18 lb. *per* cwt.

	C. q. lb.	*C. q. lb.*
	17 2 14 groſs, or,	17 2 14
		6
16 lb.$=\frac{1}{7}$C.	2 2 2	105 3 —
2lb.$=\frac{1}{8}$of 16lb	1 7	3
18lb.	2 3 9$\frac{1}{4}$ tare.	317 1
	14 3 4$\frac{3}{4}$ nett.	28)317$\frac{1}{4}$lb. *C. q. lb.*
		4) 11 9$\frac{1}{4}$(2 3 9$\frac{1}{4}$ t.

In the firſt method, we add the tare at 16 lb. which is $\frac{1}{7}$ of the groſs weight to the tare, at 2lb. which is $\frac{1}{8}$ of the former. In the ſecond, we multiply the groſs weight by 18; the tare is 1 lb. for each cwt. of the product, and is reduced by diviſion to higher denominations.

2d.] What is Tret of 158 C. 2 q. 24 lb.?

	C. q. lb.	*C. q. lb.*
26)	158 2 26.	(6 — 11 Tret.
	156	
	2	
	4	
	10	
	28	
	286	
	280	
	0	

Becauſe tret is always 4 lb. in 104, or 1 lb. in 26, it is obtained by dividing by 26.

3d.] What is the cloff on 28 C. 2 q.?

```
   C.  q.
   28  2
       2
  ———————
3) 57  (19 lb.
```

This allowance being 2 lb. on every 3 C. might be found by taking ⅓ of the number of C's and multiplying it by 2. It is better to begin with multiplication, for the reaſon given p. 300. col. 2. par. 1.

19 Sect. iii. Commission, &c.

It is frequently required to calculate allowances on ſums of money, at the rate of ſo many *per* L. 100. Of this kind is Commission, or the allowance due to a factor for buying or ſelling goods, or tranſacting any other buſineſs; Premium of Insurance, or allowance given for engaging to repay one's loſſes at ſea, or otherwiſe; Exchange, or the allowance neceſſary to be added or ſubtracted for reducing the money of one place to that of another; Premiums on Stocks, or the allowance given for any ſhare of a public ſtock above the original value. All theſe and others of a like kind are calculated by the following.

Rule. "Multiply the ſum by the rate, and divide the product by 100. If the rate contain a fraction, take proportional parts."

Ex. What is the commiſſion on L. 728, at 2¾ *per cent.*

```
                  728
                    2
                 ————
2 per cent.      1456
  ½               364
  ¼               182
                 ————
           1|00)20|02
                   20
                 ————
                   40
                   12
                 ————
                 4|80
                    4 Anſw. L. 20——4¾
                 ————
                 3|20
```

When the rate is given in guineas, which is common in caſes of inſurance, you may add a twentieth-part to the ſum before you calculate. Or you may calculate at an equal number of pounds, and add a twentieth-part to the anſwer.

When the given ſum is an exact number of 10 pounds, the calculation may be done without ſetting down any figures. Every L. 10, at ½ *per cent.* is a ſhilling; and at other rates in proportion. Thus, L. 170, at ½ *per cent.* is 17 s.; and, at ¼ *per cent.* 8 s. 6 d.

20 Sect. iv. Interest.

Intereſt is the allowance given for the uſe of money by the borrower to the lender. This is computed at ſo many pounds for each hundred lent for a year, and a like proportion for a greater or a leſs time. The higheſt rate is limited by our laws to 5 *per cent.* which is called the *legal intereſt*; and is due on all debts conſtituted by bond or bill, which are not paid at the proper term, and is always underſtood when no other rate is mentioned.

The intereſt of any ſum for a year, at any rate, is found by the method explained in the laſt ſection.

The intereſt of any number of pounds for a year, at 5 *per cent.* is one twentieth-part, or an equal number of ſhillings. Thus, the intereſt of L. 34675 for a year is 34675 ſhillings.

The intereſt for a day is obtained by dividing the intereſt for a year, by the number of days in a year. Thus, the intereſt of L. 34675 for a day is found by dividing 34675 ſhillings by 365, and comes to 95 ſhillings.

The intereſt for any number of days is obtained by multiplying the daily intereſt by the number of days. Thus, the intereſt of L. 34675 for 17 days, is 17 times 95 ſhillings, or 1615 ſhillings; and this divided by 20, in order to reduce it, comes to L. 80 : 15 s.

It would have ſerved the ſame purpoſe, and been eaſier to multiply at firſt by 17, the number of days; and, inſtead of dividing ſeparately by 365, and by 20, to divide at once by 7300, the product of 365 multiplied by 20; and this diviſion may be facilitated by the table inſerted p. 298. col. 1.

The following practical rules may be inferred from the foregoing obſervations.

I. *To calculate intereſt at 5 per cent.* "Multiply the principal by the number of days, and divide the product by 7300."

II. *To calculate intereſt at any other rate.* "Find what it comes to at 5 *per cent.* and take a proper proportion of the ſame for the rate required."

Ex. 1ſt.] Intereſt on L. 34675 for 17 days, at 5 *per cent.*

```
             34675
                17
            ——————
            242725
            34675
            ——————L.  s.
    73|00)5894|75(80  15
          584
         ———————
            5475
              20
            ——————
            1095|00
            73
            ——————
             365
             365
            ——————
              0
```

Ex. 2d. Intereſt on 304 : 3 : 4 for 8 days, at 4 *per cent.*

```
         L. 304   3   4
                      8
         ——————————————— s.  d.
  73|00)2433    6   8  (6   8
           20
  ————————————
       486|66
       438
      ————————
        4866
          12
      ————————
       584|00
       584
       ——————
         0
```

Int. at 5 per cent.	L.	—6	8
Deduce $\frac{1}{5}$		—1	4
Int. at 4 per cent.	L.	—5	4

When partial payments are made, we proceed in the following manner: Let us ſuppoſe a bill of L. 170 was due 12th of Auguſt, that L. 54 was paid on the 18th September, L. 56 on the 17th October, and the balance on the 14th November; and let it be required to find how much intereſt is due.

		Days.		
Aug. 12.	L. 170	37	1190	
Sept. 18. pd.	54		510	
				6290
	116	29	1044	
Oct. 17. pd.	56		232	
				3364
	60	28		1680
Nov. 14. pd.	60			
			7300)	11334(L. 1 : 11 : ½.
	0			

Here we ſubtract the ſeveral payments from the original ſum in their order, placing the dates in the margin: and from this it appears that there is intereſt due on L. 170 from 12th Auguſt to 18th September, or L. 110 from 18th September to 17th October, and on L. 60 from 17th October to 14th November. We next compute the number of days in each of theſe periods, and mark it againſt the reſpective ſum. Then we multiply each ſum by the number of days; reſerving a column, when neceſſary, for the products of the ſeveral figures in the multiplier. Laſtly, we add theſe products, and divide their ſum by 7300.

Intereſt on current accounts is calculated nearly in the ſame manner. For example, let the intereſt due on the following account be required to 31ſt July, at 4 per cent?

Dr. Mr A. Baird, his account current with W. Neil, Cr.

1775.		L.	s.	d.	1775.		L.	s.	d.
Jan. 15.	to caſh	160			Mar. 22.	By caſh	50		
Mar. 12.	To ditto	36			May 16.	By ditto	37		
June 23.	To ditto	13	4	6	June 15.	By ditto	25	12	6
July 19.	To ditto	26	13	4	28.	By ditto	32	5	4

1775.		L.	s.	d.	Days		
Jan. 1	Dr.	160			50	960	
Mar. 1	Dr.	36				800	
							8960
	Dr.	196			10		1960
22.	Cr.	50					
	Dr.	146			55	730	
May 16.	Cr.	37				730	
							8030
	Dr.	109			30		3270
June 15.	Cr.	25	12	6			
	Dr.	83	7	6	8		667
23.	Dr.	13	4	6			
	Dr.	96	12		5		483
28.	Cr.	32	5	4			
	Dr.	64	6	8	21	64	
July 19.	Dr.	26	13	4		1287	
							1351
31.		91			12		1092
					197	7300	25813 (L. 3 10 8$\frac{2}{3}$ at

Month	Days
Jan.	16
Feb.	28
Mar.	31
Apr.	30
May	31
June	30
July	31
Days	197

Deduce $\frac{1}{5}$ part		14	1$\frac{3}{4}$
Intereſt at 4 per cent.	L. 2	16	7

Here the ſums on either ſide of the account are introduced according to the order of their dates. Thoſe on the Dr. ſide are added to the former balance, and thoſe on the Cr. ſide ſubtracted. Before we calculate the days, we try if the laſt ſum L. 91, be equal to the balance of the account, which proves the additions and ſubtractions; and, before multiplying, we try if the ſum of the column of days be equal to the number of days, from 15th January to 31ſt of July.

In the 5th and 6th multiplications, we begin at the pence column, and take in the carriage. In the 7th, inſtead of multiplying the 6s. 8d. by 21, we add the third-part 21 to the product, becauſe 6 s. 8 d. is the third of a pound. This is done by marking down the ſecond line 1287, inſtead of 1280. As the computation on the odd ſhillings and pence is troubleſome, and makes a very ſmall increaſe of the intereſt, ſome neglect them altogether; others add one to the pound, when the ſhillings exceed 10, and neglect them when below it.

2d.] Required intereſt on the following account to 31ſt December, allowing 5 per cent, when the balance is due to J. T. and 4 per cent. when due to N. W.

Dr. Mr J. T. his account current with N. W. Cr.

		L.			L.
Dec. 31.	To balance	150	April 9.	By caſh	70
Mar. 12.	To caſh	120	May 12.	By caſh	300
June 17.	To caſh	165	June 3.	By caſh	240
Sept. 24.	To caſh	242	Aug. 2.	By caſh	10
Oct. 9.	To caſh	178			

1775.		L.		Days			
Dec. 31.	Dr.	150		71	150		
1776.					1050		
Mar. 12.	Dr.	120				10650	
					2160		
	Dr.	270		28	540		
April 9.	Cr.	70				7560	
	Dr.	200		33		6600	
May 12.	Cr.	300	—				
	Cr.	100		22		—	2200
June 3.	Cr.	240	—				
	Cr.	340		14	1360	—	4760
17.	Dr.	165	—		340		
	Cr.	175		46	1050	—	8050
Aug. 2.	Cr.	10	—		700		
	Cr.	185		53	555	—	9805
Sept. 24.	Dr.	242	—		925		
	Dr.	57		15	285		
Oct. 9.	Dr.	178	—		57		
						855	
Dec. 31.	Dr.	235		83	705		
					1880		
				365		19505	
					7300	45170	24815

Intereſt due to N. W. at 5 per cent.	L.	6	8	9
Deduce $\frac{1}{5}$ - -		1	5	5
Due to N. W at 4 per cent.	L.	5	3	4
Due to J. T. at 5 per cent.		3	7	11$\frac{3}{4}$
Balance due to N. W.	L.	1	15	4$\frac{1}{4}$

In this account, the balance is ſometimes due to the one party, ſometimes to the other. At the beginning, there is a balance due to N. W.: and, on the 9th of April, there is L. 200 due him. On the 12th of May, J. T. pays him L. 300, which diſcharges what he owed, and leaves a balance of L. 100 due him. The balance continues in J. T's favour till the 24th of September, when N. W. pays L. 242. Theſe changes are diſtinguiſhed by the marks Dr. and Cr. The products are extended in different columns, and divided ſeparately.

When payments are made on conſtituted debts, at conſiderable diſtances of time, it is uſual to calculate the intereſt to the date of each payment, and add it to the principal, and then ſubtract the payment from the amount.

Ex. A bond for L. 540 was due the 18th Aug. 1772; and there was paid 19th March 1773, L. 50; and 19th December 1773, L. 25; and 23d September 1774 L. 25; and 18th Auguſt 1775 L. 110. Required the intereſt and balance due on the 11th November 1775?

A bond due 13th Auguſt 1772		L. 540		
Intereſt to 19th March 1773, 218 days	L. 16 2 6	16	2	6
		L. 556	2	6
Paid 19th March 1773		50		
Balance due 19th March 1773		L. 506	2	6
Intereſt to 19th December 1773, 275 days	19 1 2	19	1	2
		L. 525	3	8
Paid 19th December 1773		25		
Balance due 19th December 1773		L. 500	3	8
Intereſt to 23d September 1774, 278 days	19 0 9	19	0	9
		L. 519	4	5
Paid 23d September 1774		25		
Balance due 23d September 1774		L. 494	4	5
Intereſt to 18th Auguſt 1775, 329 days	22 5 3	22	5	3
		L. 516	9	8
Paid 18th Auguſt 1775		110		
Balance due 18th Auguſt 1775		L. 406	9	8
Intereſt to 11th November 1775, 85 days	4 14 6	4	14	6
Balance due 11th November 1775		L. 411	4	2
Amount of the intereſt	L. 81 4 2			

21 CHAP. VIII. VULGAR FRACTIONS.

IN order to underſtand the nature of vulgar fractions, we muſt ſuppoſe unity (or the number 1) divided into ſeveral equal parts. One or more of theſe parts is called a *fraction*, and is repreſented by placing one number in a ſmall character above a line, and another under it: For example, two-fifth parts is written thus, $\frac{2}{5}$. The number under the line (5) ſhows how many parts unity is divided into, and is called the *denominator*. The number above the line (2) ſhews how many of theſe parts are repreſented, and is called the *numerator*.

It follows from the manner of repreſenting fractions, that, when the numerator is increaſed, the value of the fraction becomes greater; but, when the denominator is increaſed, the value becomes leſs. Hence we may infer, that, if the numerator and denominator be both increaſed, or both diminiſhed, in the ſame proportion, the value is not altered; and therefore, if we multiply both by any number whatever, or divide them by any number which meaſures both, we ſhall obtain other fractions of equal value. Thus, every fraction may be expreſſed in a variety of forms, which have all the ſame ſignification.

A fraction annexed to an integer, or whole number, makes a mixed number. For example, five and two third-parts, or $5\frac{2}{3}$. A fraction whoſe numerator is greater than its denominator is called an *improper fraction*. For example, ſeventeen third-parts, or $\frac{17}{3}$. Fractions of this kind are greater than unity. Mixed numbers may be repreſented in the form of improper fractions, and improper fractions may be reduced to mixed numbers, and ſometimes to integers. As fractions whether proper or improper, may be repreſented in different forms, we muſt explain the method of reducing them from one form to another, before we conſider the other operations.

PROBLEM I. "To reduce mixed numbers to impro-
"per fractions; Multiply the integer by the denomi-
"nator of the fraction, and to the product add the nu-
"merator. The ſum is the numerator of the impro-
"per fraction ſought, and is placed above the given
"denominator." *Ex.* $5\frac{2}{3}=\frac{17}{3}$

5 integer.
3 denominator.

15 product
2 numerator given.

17 numerator ſought.

Becauſe one is equal to two halves, or 3 third parts, or 4 quarters, and every integer is equal to twice as many halves, or four times as many quarters, and ſo on; therefore, every integer may be expreſſed in the form of an improper fraction, having any aſſigned denominator: The numerator is obtained by multiplying the integer into the denominator. Hence the reaſon of the foregoing rule is evident. 5, reduced to an improper fraction, whoſe denominator is 3, makes $\frac{15}{3}$, and this added to $\frac{2}{3}$ amounts to $\frac{17}{3}$.

PROBLEM II. "To reduce improper fractions to
"whole or mixed numbers: Divide the numerator
"by the denominator."

Ex. $\frac{112}{17}=6\frac{10}{17}$

$$17)112(6\tfrac{10}{17}$$

$$\begin{array}{r} 102 \\ \hline 10 \end{array}$$

1. $\frac{3248}{16}$
2. $\frac{342}{12}$
3. $\frac{7536}{27}$
4. $\frac{15764}{328}$
5. $\frac{365}{12}$
6. $\frac{7394}{35}$
7. $\frac{8642}{93}$
8. $\frac{4362}{218}$

This problem is the converſe of the former, and the reaſon may be illuſtrated in the ſame manner.

PROBLEM III. "To reduce fractions to lower terms.
"Divide both numerator and denominator by any num-
"ber which meaſures both, and place the quotients in
"the form of a fraction."

Example. $\frac{135}{360} = \frac{27}{72} = \frac{3}{8}$

Here we obſerve that 135 and 360 are both meaſured by 5, and the quotients form $\frac{27}{72}$, which is a fraction of the ſame value as $\frac{135}{360}$ in lower terms. Again, 27 and 72 are both meaſured by 9, and the quotients form $\frac{3}{8}$, which is ſtill of equal value, and in lower terms.

It is generally ſufficient, in practice, to divide by ſuch meaſures as are found to anſwer on inſpection, or by the rules given p. 396. col 2. But if it be required to reduce a fraction to the loweſt poſſible terms, we muſt divide the numerator and denominator by the greateſt number which meaſures both. What number this is may not be obvious, but will always be found by the following rule.

To find the greateſt common meaſure of two numbers, divide the greater by the leſſer, and the diviſor by the remainder continually, till nothing remain; the laſt diviſor is the greateſt common meaſure.

Example. Required the greateſt number which meaſures 475 and 589?

```
475)589(1
    475
    ———
    114)475(4
        456
        ———
         19)114)6
            114
            ———
              0
```

Here we divide 589 by 475, and the remainder is 114; then we divide 475 by 114, and the remainder is 19; then we divide 114 by 19, and there is no remainder: from which we infer; that 19 the laſt diviſor, is the greateſt common meaſure.

To explain the reaſon of this, we muſt obſerve, that any number which meaſures two others, will alſo meaſure their ſum, and their difference, and will meaſure any multiple of either. In the foregoing example, any number which meaſures 589, and 475, will meaſure their difference 114; and will meaſure 456, which is a multiple of 114; and any number which meaſures 475, and 476, will alſo meaſure their difference 19. Conſequently, no number greater than 19 can meaſure 589 and 475. Again, 19 will meaſure them both, for it meaſures 114, and therefore meaſures 456, which is a multiple of 114, and 475, which is juſt 19 more than 456; and, becauſe it meaſures 475 and 114, it will meaſure their ſum 589. To reduce $\frac{475}{589}$ to the loweſt poſſible terms, we divide both numbers by 19, and it comes to $\frac{25}{31}$.

If there be no common meaſure greater than 1, the fraction is already in the loweſt terms.

If the greateſt common meaſure of 3 numbers be required, we find the greateſt meaſure of the two firſt, and then the greateſt meaſure of that number, and the third. If there be no numbers, we proceed in the ſame manner.

Problem IV. "To reduce fractions to others of "equal value that have the ſame denominator: 1ſt. "Multiply the numerator of each fraction by all the "denominators except its own. The products are nu-"merators to the reſpective fractions ſought." 2d. "Multiply all the denominators into each other; the "product is the common denominator."

Ex. $\frac{4}{5}$ and $\frac{7}{9}$ and $\frac{3}{8}=\frac{288}{360}$ and $\frac{280}{360}$ and $\frac{135}{360}$.

$4\times9\times8=288$ firſt numerator.

$7\times5\times8=280$ ſecond numerator.

$3\times5\times9=135$ third numerator.

$5\times9\times8=360$ common denominator.

Here we multiply 4, the numerator of the firſt fraction, by 9 and 3 the denominators of the two others; and the product 288 is the numerator of the fraction ſought, equivalent to the firſt. The other numerators are found in like manner, and the common denominator 360, is obtained by multiplying the given denominators 5, 9, 8, into each other. In the courſe of the whole operation, the numerators and denominators of each fraction are multiplied by the ſame number, and therefore their value is not altered.

The fractions thus obtained may be reduced to lower terms, if the ſeveral numerators and denominators have a common meaſure greater than unity. Or, after arranging the number for multiplication, as is done above, if the ſame number occur in each rank, we may daſh them out and neglect them; and, if numbers which have a common meaſure occur in each, we may daſh them out and uſe the quotients in their ſtead; or any number which is a multiple of all the given denominators, may be uſed as a common denominator. Sometimes a number of this kind will occur on inſpection, and the new numerators are found by multiplying the given ones by the common denominator, and dividing the products by the reſpective given denominators.

If the articles given for any operation be mixed numbers, they are reduced to improper fractions by problem I. If the anſwer obtained be an improper fraction, it is reduced to a mixed number by problem II. And, it is convenient to reduce fractions to lower terms, when it can be be done, by problem III. which makes their value better apprehended, and facilitates any following operation. The reduction of fractions to the ſame denominator by problem IV. is neceſſary to prepare them for addition or ſubtraction, but not for multiplication or diviſion.

1. Addition *of* Vulgar Fractions. 22

Rule. "Reduce them, if neceſſary, to a common "denominator; add the numerators, and place the "ſum above the denominator."

Ex. 1ſt.] $\frac{3}{5}+\frac{2}{9}=\frac{27}{45}+\frac{10}{45}$ by problem IV. $=\frac{37}{45}$

2d.] $\frac{5}{7}+\frac{8}{9}+\frac{9}{10}=\frac{450}{630}+\frac{560}{630}+\frac{567}{630}=\frac{1577}{630}$ $\frac{450}{660}$

by problem II. $=3\frac{317}{630}$ $\frac{567}{1577}$

The numerators of fractions that have the ſame denominator ſignify like parts; and the reaſon for adding them is equally obvious, as that for adding ſhillings or any other inferior denomination.

Mixed numbers may be added, by annexing the ſum of the fractions to the ſum of the integers. If the former be a mixed number, its integer is added to the other integers.

2. Subtraction *of* Vulgar Fractions. 23

Rule. "Reduce the fractions to a common deno-"minator; ſubtract the numerator of the ſubtrahend "from the numerator of the minuend, and place the "remainder above the denominator."

Ex. Subtract $\frac{2}{7}$ from $\frac{5}{12}$ remainder $\frac{11}{84}$.

$\left.\begin{matrix}\frac{5}{12}=\frac{35}{84}\\ \frac{2}{7}=\frac{24}{84}\end{matrix}\right\}$ by Prob. IV.

from 35
take 24
rem. 11

To ſubtract a fraction from an integer: ſubtract the numerator from the denominator, and place the remainder above the denominator; prefix to this the integer diminiſhed by unity.

Ex. Subtract $\frac{3}{5}$ from 12 remainder $11\frac{2}{5}$

To ſubtract mixed numbers, proceed with the fractions by the foregoing rule, and with the integers in the common method. If the numerator of the fraction in the ſubtrahend exceed that in the minuend, borrow the value of the denominator, and repay it by adding 1 to the unit-place of the ſubtrahend.

Ex. Subtract $145\frac{7}{9}$ from $248\frac{3}{5}$

$$\left.\begin{array}{l}\frac{3}{5}=\frac{27}{45}\\ \frac{7}{9}=\frac{35}{45}\end{array}\right\}\text{ by Prob. IV.}\qquad \begin{array}{r}248\frac{27}{45}\\ 145\frac{35}{45}\\ \hline 102\frac{37}{45}\end{array}\qquad \begin{array}{r}27\\ 45\\ 72\\ 35\\ 37\end{array}$$

Here, becauſe 27 the numerator of the fraction in the minuend is leſs than 35, the numerator of the ſubtrahend, we borrow 45 the denominator; 27 and 45 make 72, from which we ſubtract 35, and obtain 37 for the numerator of the fraction in the remainder, and we repay what was borrowed, by adding 1 to 5 in the unit-place of the ſubtrahend.

The reaſon of the operations in adding or ſubtracting fractions will be fully underſtood, if we place the numerators of the fractions in a column like a lower denomination, and add or ſubtract them as integers, carrying or borrowing according to the value of the higher denomination.

24 3. MULTIPLICATION *of* VULGAR FRACTIONS.

RULE. "Multiply the numerators of the factors "together for the numerator of the product, and the "denominators together for the denominator of the "product."

Ex. 1ſt.] $\frac{2}{3}\times\frac{5}{7}=\frac{10}{21}$
$2\times5=10$ num.
$3\times7=21$ den.

2d.] $8\frac{2}{5}\times7\frac{3}{4}=\frac{1302}{20}=65\frac{2}{20}$
$8\frac{2}{5}=\frac{42}{5}$ by prob. I.
$7\frac{3}{4}=\frac{31}{4}$ by ditto.
$42\times31=1302$
$5\times\ 4=\ \ 20$

To multiply $\frac{5}{7}$ by $\frac{2}{3}$ is the ſame, as to find what two third-parts of $\frac{5}{7}$ comes to; if one-third part only had been required, it would have been obtained by multiplying the denominator 7 by 3, becauſe the value of fractions is leſſened when their denominators are increaſed; and this comes to $\frac{5}{21}$; and, becauſe two-thirds were required, we muſt double that fraction, which is done by multiplying the numerator by 2, and comes to $\frac{10}{21}$. Hence we infer, that fractions of fractions, or compound fractions, ſuch as $\frac{2}{7}$ of $\frac{3}{5}$ are reduced to ſimple ones by multiplication. The ſame method is followed when the compound fraction is expreſſed in three parts or more.

If a number be multiplied by any integer, its value is increaſed: If it be multiplied by 1, or taken one time, it undergoes no alteration. If it be multiplied by a proper fraction, or taken from one-half, two-thirds, or the like, its value is diminiſhed, and the product is leſs than the number multiplied.

The foregoing rule extends to every caſe, when there are fractions in either factor. For mixed numbers may be reduced to improper fractions, as is done in Ex. 2d.; and integers may be written, or underſtood to be written in the form of fractions whoſe numerator is 1. It will be convenient, however, to give ſome further directions for proceeding, when one of the factors is an integer, or when one or both are mixed numbers.

1ſt. To multiply an integer by a fraction, multiply it by the numerator, and divide the product by the denominator. *Ex.* $3756\times\frac{3}{5}=2253\frac{3}{5}$

$$\begin{array}{r}3756\\ 3\\ \hline 5)11268(2253\frac{3}{5}\end{array}$$

2d. To multiply an integer by a mixed number, we multiply it firſt by the integer, and then by the fraction, and add the products.

Ex. $148\times5\frac{3}{4}=793\frac{1}{2}$

$$\begin{array}{rr}138\times5=690 & \\ 138\times\ \frac{3}{4} & \\ 3 & \\ \hline 4)414(& 103\frac{1}{2}\\ & \overline{793\frac{1}{2}}\end{array}$$

3d. To multiply a mixed number by a fraction, we may multiply the integer by the fraction, and the two fractions together, and add the products.

Ex. $15\frac{3}{8}\times\frac{2}{9}=3\frac{5}{12}$

$$\begin{array}{l}15\ \times\frac{2}{9}=3\ \frac{3}{9}\ =3\frac{4}{12}\\ \ \ \frac{3}{8}\times\frac{2}{9}=\ \frac{6}{72}\ =\ \ \frac{1}{12}\\ \hline \qquad\qquad\qquad\ 3\frac{5}{12}\end{array}$$

4th. When both factors are mixed numbers, we may multiply each part of the multiplicand firſt by the integers of the multiplier, and then by the fraction, and add the four products.

Ex. $8\frac{2}{5}$ by $7\frac{3}{4}$

$$\begin{array}{llll}8\ \times\ 7= & & 56 & \\ 8\ \times\ \frac{3}{4}=\frac{24}{4}= & & 6 & \text{by prob. II.}\\ \frac{2}{5}\times\ 7\ =\frac{14}{5}=2\frac{4}{5}= & & 2\frac{16}{20} & \\ \frac{2}{5}\times\ \frac{3}{4}= & & \frac{6}{20} & \\ \hline & & & \end{array}$$

product $65\frac{2}{20}$ as before.

25 4. DIVISION *of* VULGAR FRACTIONS.

RULE I. "Multiply the numerator of the dividend by the denominator of the diviſor. The product is the numerator of the quotient."

II. "Multiply the denominator of the dividend by "the numerator of the diviſor. The product is the "denominator of the quotient."

Ex. Divide $\frac{2}{5}$ by $\frac{7}{9}$ Quotient $\frac{18}{35}$
$2\times9=18$
$5\times7=35$

To explain the reaſon of this operation, let us ſuppoſe it required to divide $\frac{5}{7}$ by 7, or to take one-ſeventh part of that fraction. This is obtained by multiplying the denominator by 7; for the value of fractions is diminiſhed by increaſing their denominators, and comes to $\frac{2}{35}$. Again, becauſe $\frac{7}{9}$ is nine times leſs than ſeven, the quotient of any number divided by $\frac{7}{9}$ will be nine times greater than the quotient of the ſame number divided by 7. Therefore we multiply $\frac{2}{35}$ by 9, and obtain $\frac{18}{35}$.

If the diviſor and dividend have the ſame denominator, it is ſufficient to divide the numerators.

Ex. $\frac{12}{17}$ divided by $\frac{3}{17}$ quotes 4.

The quotient of any number divided by a proper fraction is greater than the dividend. It is obvious, that any integer contains more halves, more third-parts, and the like, than it contains units; and, if an integer and fraction be divided alike, the quotients will have the ſame proportion to the numbers divided; but the value of an integer is increaſed when the diviſor is a proper fraction; therefore, the value of a fraction in the like caſe is increaſed alſo.

The foregoing rule may be extended to every caſe, by reducing integers and mixed numbers to the form of improper fractions. We ſhall add ſome directions for ſhortening the operation when integers and mixed numbers are concerned.

1ſt. When the dividend is an integer, multiply it by the denominator of the diviſor, and divide the product by the numerator.

Ex. Divide 368 by $\frac{5}{7}$

```
         7
      ------
      5)2576 (515⅕ quotient.
```

2d. When the diviſor is an integer, and the dividend a fraction, multiply the denominator by the diviſor, and place the product under the numerator.

Ex. Divide $\frac{3}{8}$ by 5 quotient $\frac{3}{40}$

$8 \times 5 = 40$

3d. When the diviſor is an integer, and the dividend a mixed number, divide the integer, and annex the fraction to the remainder; then reduce the mixed number thus formed, to an improper fraction, and multiply its denominator by the diviſor.

Ex. To divide $576\frac{4}{11}$ by 7 quotient $82\frac{26}{77}$

```
7) 576 (82
   56
  ----
    16
    14
  ----
   2 4/11 = 26/11
  11 × 7 = 77
```

Here we divide 576 by 7, the quotient is 82, and the remainder 2, to which we annex the fraction $\frac{4}{11}$; and reduce $2\frac{4}{11}$ to an improper fraction $\frac{26}{11}$, and multiply its denominator by 7, which gives $\frac{26}{77}$.

Hitherto we have conſidered the fractions as abſtract numbers, and laid down the neceſſary rules accordingly. We now proceed to apply theſe to practice. Shillings and pence may be conſidered as fractions of pounds, and lower denominations of any kind as fractions of higher; and any operation, where different denominations occur, may be wrought by expreſſing the lower ones in the form of vulgar fractions, and proceeding by the foregoing rules. For this purpoſe, the two following problems are neceſſary.

PROBLEM V. "To reduce lower denominations to "fractions of higher, place the given number for the "numerator, and the value of the higher for the de-"nominator." *Examples.*

1. Reduce 7 d. to the fraction of a ſhilling. Anſ. $\frac{7}{12}$
2. Reduce 7 d. to a fraction of a pound. Anſ. $\frac{7}{240}$
3. Reduce 15 s. 7 d. to a fraction of a pound. Anſ. $\frac{187}{240}$.

PROBLEM VI. "To value fractions of higher deno-"minations, multiply the numerator by the value of "the given denomination, and divide the product by "the denominator; if there be a remainder, multi-"ply it by the value of the next denomination, and "continue the diviſion."

Ex. 1ſt.] Required the value of $\frac{17}{60}$ of L 1. 2d.] Required the value of $\frac{8}{9}$ of 1 Cwt.

```
     17                      8
     20                      4
   ------  s.  d.          ---- qrs.  lb.
60)340(  5   8          9)32(   3    15 5/9
    300                    27
   ----                   ----
     40                     5
     12                    28
   ----                   ----
60)480                  9)140
    480                     9
   ----                   ----
      0                     50
                            45
                           ----
                             5
```

In the firſt example, we multiply the numerator 17 by 20, the number of ſhillings in a pound, and divide the product 340 by 60, the denominator of the fraction, and obtain a quotient of 5 ſhillings; then we multiply the remainder 40 by 12, the number of pence in a ſhilling, which produces 480, which divided by 60 quotes 8 d. without a remainder. In the ſecond example we proceed in the ſame manner; but as there is a remainder, the quotient is completed by a fraction.

Sometimes the value of the fraction does not amount to a unit of the loweſt denomination; but it may be reduced to a fraction of that or any other denomination, by multiplying the numerator according to the value of the places. Thus $\frac{1}{1289}$ of a pound is equal to $\frac{20}{1289}$ of a ſhilling, or $\frac{240}{1289}$ of a penny, $\frac{960}{1289}$ of a farthing.

CHAP. IX. DECIMAL FRACTIONS.

Sect. i. NOTATION *and* REDUCTION. 26

THE arithmetic of vulgar fractions is tedious, and even intricate to beginners. The difficulty ariſes chiefly from the variety of denominators; for when numbers are divided into different kinds of parts, they cannot be eaſily compared. This conſideration gave riſe to the invention of decimal fractions, where the units are divided into like parts, and the diviſions and ſubdiviſions are regulated by the ſame ſcale which is uſed in the Arithmetic of Integers. The firſt figure of a decimal fraction ſignifies tenth parts, the next hundredth parts, the next thouſandth parts, and ſo on: and the columns may be titled accordingly. Decimals are diſtinguiſhed by a point, which ſeparates them from integers, if any be prefixed.

The uſe of cyphers in decimals, as well as in integers, is to bring the ſignificant figures to their proper places, on which their value depends. As cyphers, when placed on the left hand of an integer, have no ſignification, but when placed on the right hand, increaſe the value ten times each; ſo cyphers, when placed on the right hand of a decimal, have no ſignification; but when placed on the left hand diminiſh the value ten times each.

The notation and numeration of decimals will be obvious from the following examples:

4.7	ſignifies Four, and ſeventh tenth-parts.
.47	Four tenth-parts, and ſeven hundredth-parts, or 47 hundredth-parts.
.047	Four hundredth-parts, and ſeven thouſandth-parts, or 47 thouſandth-parts.
.407	Four tenth-parts, and ſeven thouſandth-parts, or 407 thouſandth-parts.
4.07	Four, and ſeven hundredth-parts.
4.007	Four, and ſeven thouſandth-parts.

The column next the decimal point is ſometimes called *decimal primes*, the next *decimal ſeconds*; and ſo on.

To reduce vulgar fractions to decimal ones: "Annex a cypher to the numerator, and divide it by "the denominator, annexing a cypher continually "to the remainder."

Ex. 1ſt.] $\frac{12}{75}$=.16 2d.] $\frac{5}{64}$=.078125 3d.] $\frac{2}{3}$=.666.

```
 75)120(16    64)500(078125    3)20(666.
    75            448             18
    ---           ---             ---
    450           520            *20
    450           512             18
    ---           ---             ---
     0             80              20
                   64              18
                   --              ---
                   160             20
                   128
                   ---
                    320
                    320
                    ---
```

4th.] $\frac{5}{6}$=.833 5th.] $\frac{7}{27}$=.259 6th.] $\frac{7}{22}$=.3, 18, 18,

```
 6)50(83      27)70(259       22)70(31818
   48             54              66
   ---            ---             ---
  *20             160            *40
   18             135             22
   ---            ---             ---
    20             250            180
    18             243            176
    ---            ---            ---
     20            *70            *40
                                   22
                                   ---
                                   180
```

The reaſon of this operation will be evident, if we conſider that the numerator of a vulgar fraction is underſtood to be divided by the denominator; and this diviſion is actually performed when it is reduced to a decimal.

In like manner, when there is a remainder left in diviſion, we may extend the quotient to a decimal, inſtead of completing it by a vulgar fraction, as in the following example.

```
         25)646(25 21/25 or 25.84.
            50
            ---
            126
            125
            ---
   Rem. 21.0
          200
          ---
           100
           100
           ---
             0
```

From the foregoing examples, we may diſtinguiſh the ſeveral kinds of decimals. Some vulgar fractions may be reduced exactly to decimals, as Ex. 1ſt and 2d, and are called *terminate* or *finite decimals*. Others cannot be exactly reduced, becauſe the diviſion always leaves a remainder; but, by continuing the diviſion, we will perceive how the decimal may be extended to any length whatever. Theſe are called *infinite decimals*. If the ſame figure continually returns, as in Ex. 3d and 4th, they are called *repeaters*. If two or more figures return in their order, they are called *circulates*. If this regular ſucceſſion go on from the beginning, they are called *pure repeaters*, or *circulates*, as Ex. 3d and 5th. If otherwiſe, as Ex. 4 and 6th, they are mixed repeaters or circulates, and the figures prefixed to thoſe in regular ſucceſſion are called the *finite part*. Repeating figures are generally diſtinguiſhed by a dot, and cirulates by a comma, or other mark, at the beginning and end of the circle; and the beginning of a repeater or circulate is pointed out in the diviſion by an aſteriſk.

Lower denominations may be conſidered as fractions of higher ones, and reduced to decimals accordingly. We may proceed by the following rule, which is the ſame, in effect, as the former.

To reduce lower denominations to decimals of higher: "Annex a cypher to the lower denomination, and divide it by the value of the higher. When there are "ſeveral denominations, begin at the loweſt, and re"duce them in their order."

Ex. To reduce 5 cwt. 2 qr. 21 lb. to a decimal of a ton?

```
28)210(.75     4)2.75(.6875     20)5.6874(.284375
   196            24                40
   ---            ---               ---
    140            35               168
    140            32               160
    ---            ---              ---
     0              30               87
                    28               80
                    ---              ---
                     20               75
                     20               60
                     --               ---
                      0               150
                                      140
                                      ---
                                       100
                                       100
                                       ---
                                        .0
```

Here, in order to reduce 21 lb. to a decimal of 1 qr. we annex a cypher, and divide by 28, the value of 1 qr. This gives .75. Then we reduce 2.75 qrs. to a decimal of 1 cwt. by dividing by 4, the value of 1 cwt. and it comes to .6875. Laſtly, 5.6875 cwt. is reduced to a decimal of a ton by dividing by 20, and comes to .284375.

To value a decimal fraction: "Multiply it by the "value of the denomination, and cut off as many de"cimal places from the product as there are in the "multiplicand. The reſt are integers of the lower de"nomination.

Example. What is the value of .425 of L. 1?

```
      .425
        20
     -----
 ſh. 8.500
         6
     -----
  d. 3.000
```

Sect. ii. ARITHMETIC *of* TERMINATE DECIMALS.

THE value of decimal places decreaſe like that of integers, ten of the lower place in either being equal to one of the next higher; and the ſame holds in paſſing from decimals to integers. Therefore, all the operations are performed in the ſame way with decimals, whether placed by themſelves or annexed to integers, as with pure integers. The only peculiarity lies in the arrangement and pointing of the decimals.

In addition and ſubtraction, " Arrange units under " units, tenth-parts under tenth-parts, and proceed as " in integers."

```
  32.035      from 13.348      and 12.248
 116.374      take  9.2993         10.6752
 160.63            ------          -------
  12.3645          4.0487           1.5728
 -------
 321.4035
```

In Multiplication, " Allow as many decimal places " in the product as there are in both factors. If the " product has not ſo many places, ſupply them by " prefixing cyphers on the left hand."

```
Ex. 1ſt.)  1.37     2d.] 43.75     3d.] .1572
           1.8            48             .12
          -----         -----          ------
          1096          35000          .01864
          137          17500
         -----         -------
          2.466        21.0000
```

The reaſon of this rule may be explained, by obſerving, that the value of the product depends on the value of the factors; and ſince each decimal place in either factor diminiſhes its value ten times, it muſt equally diminiſh the value of the product.

To multiply decimals by 10, move the decimal point one place to the right; to multiply by 100, 1000, or the like, move it as many places to the right as there are cyphers in the multiplier.

In diviſion, " Point the quotient ſo that there may " be an equal number of decimal places in the divi- " dend as in the diviſor and quotient together."

Therefore, if there be the ſame decimal places in the diviſor and dividend, there will be as many in the quotient.

If there be more in the dividend, the quotient will have as many as the dividend has more than the diviſor.

If there be more in the diviſor, we muſt annex (or ſuppoſe annexed) as many cyphers to the dividend as may complete the number in the diviſor, and all the figures of the quotient are integers.

If the diviſion leave a remainder, the quotient may be extended to more decimal places; but theſe are not regarded in fixing the decimal point.

The reaſon for fixing the decimal point, as directed, may be inferred from the rule followed in multiplication. The quotient multiplied by the diviſor produces the dividend; and therefore the number of decimal places in the dividend is equal to thoſe in the diviſor and quotient together.

The firſt figure of the quotient is always at the ſame diſtance from the decimal point, and on the ſame ſide as the figure of the dividend, which ſtands above the unit place of the firſt product. This alſo takes place in integers; and the reaſon is the ſame in both.

It was formerly obſerved, that numbers were diminiſhed when multiplied by proper fractions, and increaſed when divided by the ſame. Thus, multiplication by fractions correſponds with diviſion by integers; and diviſion by fractions with multiplication by integers; when we multiply by $\frac{1}{2}$ or .5, we obtain the ſame anſwers as when we divide by 2, and every integer has a correſpondent decimal, which may be called its *reciprocal.* Multiplication by that decimal ſupplies the place of diviſion by the integer, and diviſion ſupplies the place of multiplication.

To find the reciprocal of any number, divide 1 with cyphers annexed by that number.

Ex. Required the reciprocal of 625.

```
625)1.000(.0016
     625
     ----
     3750
     3750
     ----
        0
```

The product of any number multiplied by .0016 is the ſame as the quotient divided by 625. *Example.*

```
625)9375(15          9375
    625              .0016
    ----             ------
    3125             56250
    3125             9375
    ----             -------
       0             15.0000
```

Becauſe .0016 is $\frac{1}{625}$ of unity, any number multiplied by that fraction will be diminiſhed 625 times. For a like reaſon, the quotient of any unmber divided by .0016, will be equal to the product of the ſame multiplied by 625. *Example.*

```
.0016)516.0000(322500        516
      48 ....                625
      --                    ----
       36                   2580
       32                  1032
       --                 3096
        40                ------
        32                322500
        --
         80
         80
         --
          0
```

Sect. iii. APPROXIMATE DECIMALS. 28

IT has been ſhown that ſome decimals, though extended to any length, are never complete: and others which terminate at laſt, ſometimes conſiſt of ſo many places, that it would be difficult in practice to extend them fully. In theſe caſes, we may extend the decimal to three, four, or more places, according to the nature of the articles, and the degree of accuracy required, and reject the reſt of it as inconſiderable. In this manner we may perform any operation with eaſe by the common rules, and the anſwers we obtain are ſufficiently exact for any purpoſe in buſineſs. Decimals thus reſtricted are called *approximates.*

Shillings, pence, and farthings, may be eaſily reduced to decimals of three places, by the following rule. Take half the ſhillings for the firſt decimal place, and the number of farthings increaſed by one, if it amount to 24, or upwards; by two, if it amount to 48 or upwards; and by three, if it amounts to 72 or upwards, for the two next places.

The reaſon of this is, that 20 ſhillings make a pound, two ſhillings is the tenth part of a pound; and therefore

fore half the number of ſhillings makes the firſt decimal place. If there were 50 farthings in a ſhilling, or 1000 in a pound, the units of the farthings in the remainder would be thouſandth-parts, and the tens would be hundredth-parts, and ſo would give the two next decimal places; but becauſe there are only 48 farthings in a ſhilling, or 960 in a pound, every farthing is a little more than the thouſandth-part of a pound; and ſince 24 farthings make 25 thouſandth-parts, allowance is made for that exceſs by adding one for every 24 farthings, as directed.

If the number of farthings be 24, 48, or 72, and conſequently the ſecond and third decimal places 25, 50, and 75, they are exactly right; otherwiſe they are not quite complete, ſince there ſhould be an allowance of $\frac{1}{24}$ not only for 24, 48, and 72 farthings, but for every other ſingle farthing. They may be completed by the following rule: Multiply the ſecond and third decimal places, or their exceſs above 25, 50, 75 by 4. If the product amount to 24 or upwards, add 1; if 48, add 2; if 72, add 3. By this operation we obtain two decimal places more; and by continuing the ſame operation, we may extend the decimal till it terminate in 25, 50, 75, or in a repeater.

Decimals of ſterling money of three places may eaſily be reduced to ſhillings, pence, and farthings, by the following rule. Double the firſt decimal place, and if the ſecond be 5 or upwards, add 1 thereto for ſhillings. Then divide the ſecond and third decimal places, or their exceſs above 50, by 4, firſt deducing 1, if it amount to 25, or upwards: the quotient is pence, and the remainder farthings.

As this rule is the converſe of the former one, the reaſon of the one may be inferred from that of the other. The value obtained by it, unleſs the decimal terminate in 25, 50, or 75, is a little more than the true value; for there ſhould be a deduction not only of 1 for 25, but a like deduction of $\frac{1}{24}$ on the remaining figures of theſe places.

We proceed to give ſome examples of the arithmetic of approximates, and ſubjoin any neceſſary obſervations.

ADDITION.

Cwt.	*qrs.*	*lb.*	
3	2	14	= 3.625
2	3	22	= 2.94642
3	3	19	= 3.91964
4	1	25	= 4.47321
14	3	24	14.96427

SUBTRACTION.

Cwt.	*qrs.*	*lb.*	
3	2	2	= 3.51785
1	1	19	= 1.41964
2	—	9	2.09821

If we value the ſum of the approximates, it will fall a little ſhort of the ſum of the articles, becauſe the decimals are not complete.

Some add one to the laſt decimal place of the approximate, when the following figure would have been 5, or upwards. Thus the full decimal of 3 qrs. 22 lb. is .946,428571, and therefore .94643 is nearer to it than .94642. Approximates, thus regulated, will in general give exacter anſwers, and ſometimes above the true one, ſometimes below it.

The mark + ſignifies that the approximate is leſs than the exact decimal, or requires ſomething to be added. The mark — ſignifies that it is greater, or requires ſomething to be ſubtracted.

MULTIPLICATION.

	Meth. 2d.]	*Meth.* 3d.]
8278 +	8278	8278
2153 +	2153	3512
24834	16556|	16556
41390	827|8	827
8278	413|90	413
16556	24|834	24
1782|2534	1782|2534	1782

Here the four laſt places are quite uncertain. The right-hand figure of each particular product is obtained by multiplying 8 into the figures of the multiplier; but if the multiplicand had been extended, the carriage from the right-hand place would have been taken in; conſequently the right-hand place of each particular product, and the four places of the total product, which depend on theſe, are quite uncertain. Since part of the operation, therefore, is uſeleſs, we may omit it; and, for this purpoſe, it will be convenient to begin (as in p. 296. col. 1. *fifth* variety) at the higheſt place of the multiplier. We may perceive that all the figures on the right hand of the line in Method 2. ſerve no purpoſe, and may be left out, if we only multiply the figures of the multiplicand, whoſe products are placed on the right hand of the line. This is readily done by inverting the multiplier in method 3. and beginning each product with the multiplication of that figure which ſtands above the figure of the multiplier that produces it, and including the carriage from the right-hand place.

If both factors be approximates, there are as many uncertain places, at leaſt in the product, as in the longeſt factor. If only one be an approximate, there are as many uncertain places as there are figures in that factor, and ſometimes a place or two more, which might be affected by the carriage. Hence we may infer, how far it is neceſſary to extend the approximates, in order to obtain the requiſite number of certain places in the product.

DIVISION.

.3724—)798|64327+(2144 or	$3\dot{7}\dot{2}\dot{4}$)79864327(2144
744|8	7448
53|84	538
37|24	372
16|602	166
14|896	148
1|7063	18
1|4892	14
2171	4

Here all the figures on the right hand of the line are uncertain; for the right-hand figure of the firſt product 7448 might be altered by the carriage, if the diviſor were extended; and all the remainders and dividuals that follow are thereby rendered uncertain. We may omit theſe uſeleſs figures; for which purpoſe, we daſh a figure on the right hand of the diviſor at each ſtep, and neglect it when we multiply by the figure of the quotient next obtained: but we include the carriage. The operation, and the reaſon of it, will appear clear, by comparing the operation at large, and contracted, in the above example.

CHAP. X. INTERMINATE DECIMALS.

29 Sect. i. REDUCTION of INTERMINATE DECIMALS.

As the arithmetic of interminate decimals, otherwiſe called the *arithmetic of infinites*, is facilitated by comparing them with vulgar fractions, it will be proper to inquire what vulgar fractions produce the ſeveral kinds of decimals, terminate or interminate, repeaters or circulates, pure or mixed. And, firſt, we may obſerve, that vulgar fractions, which have the ſame denominator, produce decimals of the ſame kind. If the decimals correſponding to the numerator 1 be known, all others are obtained by multiplying theſe into any given numerator, and always retain the ſame form, providing the vulgar fraction be in its loweſt terms.

Thus, the decimal equal to $\frac{3}{7}$ is .142857,
which multiplied by 3

produces the decimal equal to $\frac{3}{7}$. .428571,

Secondly. If there be cyphers annexed to the ſignificant figures of the denominator, there will be an equal number of additional cyphers prefixed to the decimal. The reaſon of this will be evident, if we reduce theſe vulgar fractions to decimals, or if we conſider that each cypher annexed to the denominator diminiſhes the value of the vulgar fraction ten times, and each cypher prefixed has a like effect on the value of the decimal.

Thus, $\frac{1}{7}=.142857$, $\frac{7}{25}=.28$ $\frac{1}{22}=.0,45$,
$\frac{1}{70}=.0,142857$, $\frac{7}{2500}=.0028$ $\frac{1}{2200}=.000,45$,

we may therefore confine our attention to vulgar fractions, whoſe numerator is 1, and which have no cyphers annexed to the ſignificant figures of the denominator.

Thirdly. Vulgar fractions, whoſe denominators are 2 or 5, or any of their powers, produce terminate decimals; for, if any power of 2 be multiplied by the ſame power of 5, the product is an equal power of 10, as appears from the following table:

$2 \times 5 = 10$
2^2 or 4×5^2 or $25 = 100$ or 10^2
2^3 or 8×5^3 or $125 = 1000$ or 10^3
2^4 or 16×5^4 or $625 = 10000$ or 10^4
2^5 or 32×5^5 or $3125 = 100000$ or 10^5

And the reaſon is eaſily pointed out; for $2^3 \times 5^3 = 2 \times 2 \times 2 \times 5 \times 5 \times 5$; or, becauſe the factors may be taken in any order, $= 2 \times 5 \times 2 \times 5 \times 2 \times 5$; and this, if we multiply the factors by pairs, becomes $10 \times 10 \times 10$, or 10^3. The like may be ſhown of any other power. And we may infer, that if any power of 10 be divided by a like power of 2 or 5, the quotient will be an equal power of 5 or 2 reſpectively, and will come out exact, without a remainder; and, ſince the vulgar fractions above-mentioned are reduced to decimals by ſome ſuch diviſion, it follows that the equivalent decimals are terminate.

The number of places in the decimal is pointed out by the exponent of the power; for the dividend muſt be a like power of 10, or muſt have an equal number of cyphers annexed to 1, and each cypher of the dividend gives a place of the quotient.

Ex. $\frac{1}{32}=.03125$, a decimal of 5 places, and $32=2^5$.

32)1.00000(.03125
96 . . .
———
40
32
———
80
64
———
160
160

Again, no denominators except 2, 5, or their powers, produce terminate decimals. It is obvious from p. 298. col. 2. par. 4. that, if any denominator which produces a terminate decimal be multiplied thereby, the product will conſiſt of 1, with cyphers annexed; and conſequently the loweſt places of the factors, multiplied into each other, muſt amount to 10, 20, or the like, in order to ſupply a cypher for the loweſt place of the product; but none of the digits give a product of this kind, except 5 multiplied by the even numbers: therefore one of the factors muſt terminate in 5, and the other in an even number. The former is meaſured by 5, and the latter by 2, as was obſerved p. 297. col. 2. par. 7. Let them be divided accordingly, and let the quotients be multiplied. This laſt product will be exactly one tenth-part of the former; and therefore will conſiſt of 1, with cyphers annexed, and the factors which produce it are meaſured by 5 and 2, as was ſhown before. This operation may be repeated; and one of the factors may be divided by 5, and the other by 2, till they be exhauſted; conſequently they are powers of 5 and 2.

Fourthly. Vulgar fractions, whoſe denominators are 3 or 9, produce pure repeating decimals.

Thus, $\frac{1}{9}=.11\dot{1}$ $\frac{5}{9}=.55\dot{5}$
$\frac{2}{9}=.22\dot{2}$ $\frac{2}{3}$ or $\frac{6}{9}=.06\dot{6}$
$\frac{1}{3}$ or $\frac{3}{9}=.33\dot{3}$ $\frac{7}{9}=.77\dot{7}$
$\frac{4}{9}=.444$ $\frac{8}{9}=.888$

The repeating figure is always the ſame as the numerator. Hence we infer, that repeating figures ſignify ninth-parts; a repeating 3 ſignifies $\frac{1}{3}$; a repeating 6 ſignifies $\frac{2}{3}$; and a repeating 9 ſignifies $\frac{9}{9}$, or 1.

The value of repeating decimals may alſo be illuſtrated by collecting the values of the different places: for example, let the value of $11\dot{1}$ be required; the firſt decimal place ſignifies $\frac{1}{10}$, the next $\frac{1}{100}$, the next $\frac{1}{1000}$. The ſum of the two firſt places is $\frac{11}{100}$, of the three places $\frac{111}{1000}$; and ſo on. If we ſubtract theſe values ſucceſſively from $\frac{1}{9}$, the firſt remainder is $\frac{1}{90}$, the ſecond $\frac{1}{900}$, the third $\frac{1}{9000}$. Thus, when the value of the ſucceſſive figures is reckoned, the amount of them approaches nearer and nearer to $\frac{1}{9}$, and the difference becomes 10 times leſs for each figure aſſumed; and, ſince the decimal may be extended to any length, the difference will at laſt become ſo ſmall, that it need not be regarded. This may give a notion of a decreaſing ſeries, whoſe ſum may be exactly aſcertained, though the number of terms be unlimited.

Fifthly. Vulgar fractions, whoſe denominators are a product of 3 or 9 multiplied by 2, 5, or any of their powers, produce mixed repeaters. The reaſon of this will be evident, if, in forming the decimal, we divide the numerator ſucceſſively by the component parts of the denominator, as directed p. 297. col 1. par. *ult.*

&c.

Intermi-nate Deci-mals.

&c. The firſt diviſor is 2, 5, or ſome of their powers; and conſequently gives a finite quotient by p. 316. col. 1, part 3, &c. The ſecond diviſor is 3 or 9; and therefore, when the figures of the dividend are exhauſted, and figures annexed to the remainder, the quotient will repeat, by p. 316. col. 2. part 2.

Ex. $\frac{1}{144}$ 144=16×9.

```
                                      9
144)1.000( 00694̇      or 16)1.00(.0625
     864                      96.00694̇
     ----                    ------
     1360                      40
     1296                      32
     ----                      --
   * 640                       80
     576                       80
     ---                       --
     640                        0
```

In order to illuſtrate this ſubject further, we ſhall explain the operation of caſting out the threes, which reſembles that for caſting out the nines, formerly laid down, p. 300. col. 2. par. 4.—p. 301. col. 2 par. 3. and depends on the ſame principles, being a method of finding the remainder of a number divided by 3. If the ſame number be divided by 3 and by 9, the remainders will either agree, or the ſecond remainder will exceed the firſt by 3 or by 6. The reaſon of this will be obvious, if we ſuppoſe a collection of articles aſſorted into parcels of 3, and afterwards into parcels of 9, by joining three of the former together. If the leſſer parcels be all taken up in compoſing the greater ones, the remainder will be the ſame at the end of the ſecond aſſortment as before; but if one of theſe leſſer parcels be left over, the remainder will be more, and if two of them be left over, the remainder will be 6 more. Therefore, when the nines are caſt out from any number, and the reſult divided by 3, the remainder is the ſame as when the number is divided by 3: Thus, the reſults on caſting out the 3's may be derived from thoſe obtained by caſting out the 9's; and the ſame correſpondence which was pointed out with reſpect to the latter, for proving the operations of arithmetic, applies alſo to the former.

To caſt out the 3's from any number, add the figures, neglecting 3, 6, and 9; and when the ſum amounts to 3, 6, or 9, reject them, and carry on the computation with the exceſs only. For example, take 286754: in caſting out the 3's we compute thus, 2 and 8 is 10, which is three times 3, and 1 over; 1 and (paſſing by 6) 7 is 8, which is twice 3, and 2 over; 2 and 5 is 7, which is twice 3, and 1 over; *laſtly*, 1 and 4 is 5, which contains 3 once, and 2 over, ſo the reſult is 2.

If the 3's be caſt out from 2^2 or 4, the reſult is 1; from 2^3 or 8, the reſult is 2; from 2^4 or 16, the reſult is 1; and univerſally the odd powers of 2 give a reſult of 2, and the even powers give a reſult of 1. As every higher power is produced by multiplying the next lower by 2, the reſult of the product may be found by multiplying the reſult of the lower power by 2, and caſting out the 3's, if neceſſary. Therefore, if the reſult of any power be 1, that of the next higher is 2, and that of the next higher (4 with the 3's caſt out or) 1. Thus the reſults of the powers of 2 are 1 and 2 by turns; alſo, becauſe the reſult of 5, when the 3's are caſt out, is 2, its powers will have the ſame reſults as the correſponding powers of 2.

Intermi-nate Deci-mals.

If the denominator be a product of an even power of 2 or 5, multiplied by 3, the repeating figure of the correſponding decimal is $\dot{3}$; but, if it be the product of an odd power, the repeating figure is 6. For, in forming the decimal, we may divide by the component parts of the denominator, and the firſt diviſor is a power of 2 or 5; therefore the firſt quotient is a like power of 4 or 2, (p. 316. col. 1. par. 3. &c.) and this power is again divided by 3. If it be an even power, the remainder or reſult is 1, as was demonſtrated above: and if cyphers be annexed to the remainder, and the diviſion continued, it quotes a repeating 3; but if it be an odd power, the remainder is 2, and the quotient continued by annexing cyphers is a repeating 6.

If the denominator be 9, multiplied by 2, or any of its powers, the repeating figure may be found by caſting out the 9's from the correſponding power of 5; and if it be multiplied by 5 or any of its powers, by caſting out the 9's from the correſponding power of 2. For if the decimal be formed by two diviſions, the firſt quotes the correſponding power; and the ſecond, becauſe the diviſor is 9, repeats the reſulting figure after the dividend is exhauſted.

If any mixed repeater be multiplied by 9, the product is a terminate decimal, and may be reduced (p. 316. col. 1. part 3. &c.) to a vulgar fraction, whoſe denominator is 2, 5, or ſome of their powers; therefore all mixed repeaters are derived from vulgar fractions, whoſe denominators are products of 2, 5, or their powers multiplied by 3 or 9.

Sixthly. All denominators, except 2, 5, 3, 9, the powers of 2 and 5, and the products of theſe powers, multiplied by 3 or 9, produce circulating decimals. We have already ſhown, that all terminate decimals are derived from 2, 5, or their powers; all pure repeaters, from 3 or 9; and all mixed repeaters, from the products of the former multiplied by the latter. The number of places in the circle is never greater than the denominator diminiſhed by unity. Thus $\frac{1}{7}$ produces .142857, a decimal of 6 places; and $\frac{1}{17}$ produces .0588235294117647, a decimal of 16 places. The reaſon of this limit may be inferred from the diviſion; for whenever a remainder which has recurred before returns again, the decimal muſt circulate, and the greateſt number of poſſible remainders is one leſs than the diviſor: But frequently the circle is much ſhorter. Thus $\frac{1}{11}$ = .09, a circle of 2 places.

When a vulgar fraction, whoſe numerator is 1, produces a pure circulate, the product of the circle multiplied by the denominator will conſiſt of as many 9's as there are places in the circle. Thus $\frac{1}{7}$ = .142857, which multiplied by 7 produces 999999. The like holds in every decimal of the ſame kind; for they are formed by dividing 10, or 100, or 1000, or ſome like number, by the denominator, and the remainder is 1, when the decimal begins to circulate; for the diviſion muſt be then exactly in the ſame ſtate as at the beginning: Therefore if the dividend had been leſs by 1, or had conſiſted entirely of 9's, the diviſion would have come out without a remainder; and ſince the quotient, multiplied by the diviſor, produces the dividend, as was ſhown p. 298. col. 2. part 3. it follows, that the circulating figures, multiplied by the denominator, produce an equal number of 9's.

Every vulgar fraction, which produces a pure circulate

Interminate Decimals.

late, is equal to one whoſe numerator is the circulating figures, and its denominator a like number of 9's. If the numerator be one, the vulgar fraction is reduced to that form by multiplying both terms into the circle of the decimal; and if the numerator be more than 1, the equivalent decimal is found by multiplying that which correſponds to the numerator 1 into any other numerator.

Thus $\frac{1}{7}$=.142857,=$\frac{142857}{999999}$ and $\frac{1}{37}$=.027.=$\frac{27}{999}$
$\frac{2}{7}$=·285714,=$\frac{285714}{999999}$ $\frac{2}{37}$=.054.=$\frac{54}{999}$
$\frac{3}{7}$=·428571,=$\frac{428571}{999999}$ $\frac{8}{37}$=.216.=$\frac{216}{999}$

Hence we may infer, that pure circulates are equal in value to vulgar fractions whoſe numerators conſiſt of the circulating figures, and denominators of as many 9's as there are places in the circle. To place this in another point of view, we ſhall reduce a vulgar fraction, whoſe numerator conſiſts entirely of 9's, to a decimal.

```
375    999)375000(.375,
999        2997..
           ------
            7530
            6993
           ------
            5370
            4995
           ------
           * 375
```

The remainder is now the ſame as the dividend, and therefore the quotient muſt circulate; and, in general, ſince any number with 3 cyphers annexed, may be divided by 1000, without a remainder, and quotes the ſignificant figures; therefore, when divided by 999, it muſt quote the ſame figures, and leave an equal remainder. This alſo applies to every diviſor which conſiſts entirely of 9's. Circles of two places, therefore, ſignify ninety-ninth-parts; circles of 3 places ſignify nine hundred and ninety-ninth-parts; and ſo on.

The value of circulating decimals may alſo be illuſtrated by adding the values of the places. Thus, if two figures circulate, the firſt circle ſignifieth hundredth parts, and every following circle ſignifies one hundred-times leſs than the preceding; and their values added, as in p. 316. col. 2. part 3. will approach nearer to ninety-ninth-parts than any aſſigned difference, but will never exactly complete it.

All denominators which are powers of 3, except 9, produce pure circulates; and the number of places in the circle is equal to the quotient of the denominator divided by 9.

Thus, $\frac{1}{27}$=.037, a circle of 3 places, and 27 divided by 9=3.
$\frac{1}{81}$=.012345679, a circle of 9 places, and 81 divided by 9=9.

Theſe decimals may be formed, by dividing the numerator by the component parts of the denominator. In the firſt example, the component parts of the numerator are 9 and 3. The diviſion by 9 quotes a pure circulate, and the circulating figure is not 3, 6, or 9, if the vulgar fraction be in its loweſt terms. And any other repeating figure divided by 3, quotes a pure circulate of 3 places; for the firſt dividual muſt leave a remainder of 1 or 2. If the firſt remainder be 1, the ſecond remainder is 2, (becauſe, if 1 be prefixed to the repeating figure, and the 3's be caſt out, the reſult is 2); and, for a like reaſon, the third dividual clears off without a remainder. If the firſt remainder be 2, the ſecond is (twice 2 or 4, with the 3's caſt out, or) 1, and the third 0; ſo the circle is always complete at 3 places, and the diviſion begins anew. The ſum of ſuch a circle cannot be a multiple of 3; for ſince the repeating figure is not 3, nor any of its multiples, the ſum of three places is not a multiple of 9, and therefore cannot be divided by 9, nor twice by 3, without a remainder.

Interminate Decimals.

Again, if the decimal equal to $\frac{1}{27}$ be divided by 3, we ſhall obtain the decimal equal to $\frac{1}{81}$. The dividend, as we have ſhown already, is a pure circulate of 3 places, whoſe ſum is not a multple of 3. Therefore, when divided by 3, the firſt circle leaves a remainder of 1 or 2, which being prefixed to the ſecond, and the diviſion continued, the remainder, at the end of the ſecond circle, is 2 or 1, and, at the end of the third circle, there is no remainder; all which may be illuſtrated by caſting out the 3's. The diviſion being completed at 9 places, finiſhes the circle; and it may be ſhown, as before, that the ſum of theſe places is not a multiple of 3. The learner will apprehend all this if he reduce theſe, or the like vulgar fractions, to decimals, by ſucceſſive diviſions.

27 = 9 × 3, and 9)1.0(.1111, and 3).1111(.037,
81 = 27 × 3, and 3)037,037,037(.012345679.

For the ſame reaſon, if any circulating decimal, not a multiple of 3, be divided by 3, the quotient will circulate thrice as many places as the dividend; and if any circulate obtained by ſuch diviſion be multiplied by 3, the circle of the product will be reſtricted to one-third of the places in the multiplicand.

All vulgar fractions, whoſe denominators are multiples of 2, 5, or their powers, except thoſe already conſidered, produce mixed circulates; for they may be reduced by dividing by the component parts of the denominator. The firſt diviſor is 2, 5, or ſome of their powers, and therefore gives a finite quotient. The ſecond diviſor is none of the numbers enumerated p. 317. col. 2. part 2. and therefore gives a circulating quotient when the ſignificant figures of the dividend are exhauſted, and cyphers annexed to the remainder.

```
      Ex. 1/216                 216=27×8.
216)1.000(.004,629,    or  8)1.000
      864                 27) .125(.004,629,
      ---                      108
    *1360                      ---
     1296                     *170
    ------                     162
      640                      ---
      432                       80
     -----                      54
     2080                      ---
     1944                      260
    ------                     243
   * 1360                      ---
                                17
```

All mixed circulates are derived from vulgar fractions

Intermi-nate Deci-mals.

tions of this kind, whoſe denominators are multiples of 2, 5, or their powers; and therefore all other denominators, except 3 and 9, produce pure circulates. The reader will eaſily perceive, that when a decimal is formed from a vulgar fraction whoſe numerator is 1, when the remainder 1 occurs in the diviſion, the decimal is a pure circulate; but if any other remainder occurs twice, the decimal is a mixed circulate. We are to ſhow that this laſt will never happen, unleſs the diviſor be a multiple of 2, 5, or their powers. If two numbers be prime to each other, their product will be prime to both; and if two numbers be propoſed, whereof the firſt does not meaſure the ſecond, it will not meaſure any product of the ſecond, if the multiplier be prime to the firſt. Thus, becauſe 7 does not meaſure 12, it will not meaſure any product of 12 by a multiplier prime to 7. For inſtance, it will not meaſure 12×3, or 36. Otherwiſe, the quotient of 12 divided by 7, or $1\frac{5}{7}$ multiplied by 3, would be a whole number, and 5×3 would be meaſured by 7, which it cannot be, ſince 5 and 3 are both prime to 7.

Now, if we inſpect the foregoing operation, we ſhall perceive that the product of 136, the remainder, where the decimal begins to circulate, multiplied by 999, is meaſured by the denominator 216. But 999 is not meaſured by the denominator, otherwiſe the decimal would have been a pure circulate; therefore 126 and 136 are not prime to each other, but have a common meaſure, and that meaſure muſt apply to 864, a multiple of 126, and to 1000, the ſum of 136 and 864; ſee p. 309, col. 2. par. *ult.* &c. But it was proven, p. 316. col. 1. par. 1. that no numbers, except the powers of 5 and 2, meaſure a number conſiſting of 1 with cyphers annexed; conſequently the denominator muſt be meaſured by a power of 2 or 5. The reader will perceive, that the exponent of the power muſt be the ſame as the number of cyphers annexed to 1, or as the number of figures in the finite part of the decimal.

We ſhall now recapitulate the ſubſtance of what has been ſaid with reſpect to the formation of decimals. 2, 5, and their powers, produce finite decimals, by p. 316. col. 1 par. 3. &c. and the number of places is meaſured by the exponent of the power. 3 and 9 produce pure repeaters (p. 316. col. 2. par. 2.) The products of 2, 5, and their powers, by 3, or 9, produce mixed repeaters by p. 316. col. 2. par. *ult.* their products by other multipliers, produce mixed circulates by p. 316. col. 2. par. *ult.* and all numbers of which 2 and 5 are not aliquot parts, except 3 and 9, produce pure circulates. To find the form of a decimal correſponding to any denominator, divide by 2, 5, and 10, as often as can be done without a remainder: the number of diviſions ſhows how many finite places there are in the decimal, by p. 318. col. 2. par. 3. If the dividend be not exhauſted by theſe diviſions, divide a competent number of 9's by the laſt quotient, till the diviſion be completed without a remainder: the number of 9's required ſhow how many places there are in the circle; and the reaſon may be inferred from p. 317. col. 2. par. 5.

We ſhall conclude this ſubject by marking down the decimals produced by vulgar fractions, whoſe numerator is 1, and denominators 30; and under that the reader may obſerve their connection with the denominators.

Intermi-nate Deci-mals.

$\frac{1}{2}=.5$

$\frac{1}{3}=.33\dot{3}$

$\frac{1}{4}=.25$

$\frac{1}{5}=.2$

$\frac{1}{6}=.166\dot{6}$

$\frac{1}{7}=.142857,$

$\frac{1}{8}=.125$

$\frac{1}{9}=.11\dot{1}$

$\frac{1}{10}=.1$

$\frac{1}{11}=.09,09,$

$\frac{1}{12}=.083\dot{3}3$

$\frac{1}{13}=.079623,$

$\frac{1}{14}=.0714285,$

$\frac{1}{15}=.06\dot{6}6$

$\frac{1}{16}=.0625$

$\frac{1}{17}=.0588235294117647,$

$\frac{1}{18}=.055\dot{5}$

$\frac{1}{19}=.052631578947368421,$

$\frac{1}{20}=.05$

$\frac{1}{21}=.047619$

$\frac{1}{22}=.0,45,45$

$\frac{1}{23}=.0434782608695652173913,$

$\frac{1}{24}=.04166\dot{6}$

$\frac{1}{25}=.04$

$\frac{1}{26}=.0384615,$

$\frac{1}{27}=.037,$

$\frac{1}{28}=.03,571428,$

$\frac{1}{29}=.0344827586206896551724137931,$

$\frac{1}{30}=0333$

RULES *for reducing interminate decimals to vulgar fractions.*

I. "If the decimal be a pure repeater, place the repeating figure for the numerator, and 9 for the denominator."

II. "If the decimal be a pure circulate, place the circulating figures of the numerator, and as many 9's as there are places in the circle for the denominator."

III. "If there be cyphers prefixed to the repeating or circulating figures, annex a like number to the 9's in the denominator."

IV. "If the decimal be mixed, ſubtract the finite part from the whole decimal. The remainder is the numerator; and the denominator conſiſts of as many 9's as there are places in the circle, together with as many cyphers as there are finite places before the circle."

Thus, 235,62,$=\frac{23327}{99000}$

From the whole decimal	23562
we ſubtract the finite part	234
and the remainder	23327 is the numerator.

The reaſon may be illuſtrated by dividing the decimal into two parts, whereof one is finite, and the other a pure repeater or circulate, with cyphers prefixed. The ſum of the vulgar fractions correſponding to theſe will be the value of the decimal ſought.

.235,62, may be divided into .235 $=\frac{235}{1000}$ by rule I.

and .000,62$=\frac{62}{99000}$ by rules II. III.

In order to add theſe vulgar fractions, we reduce them to a common denominator; and, for that purpoſe, we multiply both terms of the former by 99, which gives $\frac{23265}{99000}$; then we add the numerators.

235 or by method explained p. 295. col. 1. par. 3.

		Sum of numerators.		
235				
99				
2115	23500	23265	or	23562
2115	235	62		235
23265	23265	23327		23327

The value of circulating decimals is not altered, though one or more places be ſeparated from the circle, and conſidered as a finite part, providing the circle be completed. For example, .27 may be written .2,72, which is reduced by the laſt of the foregoing rules to $\frac{270}{990}$, or $\frac{27}{99}$, which is alſo the value of .27. And if two or more circles be joined, the value of the decimal is ſtill the ſame. Thus, 2727,$=\frac{2727}{9999}$, which is reduced by dividing the terms 101 to $\frac{27}{99}$.

Intermi-nate Deci-mals.

All circulating decimals may be reduced to a ſimilar form, having a like number both of finite and circulating places. For this purpoſe, we extend the finite part of each as far as the longeſt, and then extend all the circles to ſo many places as may be a multiple of the number of places in each.

Ex. .34,725, extended .34,725725725725;
1,4562, 14,562456245624.

Here the finite part of both is extended to two places, and the circle to 12 places, which is the leaſt multiple for circles of 3 and 4 places.

30 Sect. ii. ADDITION *and* SUBTRACTION *of* INTERMINATE DECIMALS.

To add repeating decimals, "Extend the repeating "figures one place beyond the longeſt finite ones, and "when you add the right-hand column, carry to the "next by 9."

Ex. $.3752\dot{4}$	or $3752\dot{4}$	$.2\dot{5}$	$.29\dot{6}$	$\frac{7}{36}$
.8	$8888\dot{8}$	$.32\dot{8}$	.42	$\frac{11}{45}$
.643	643	$.469\dot{7}$	.7548	$\frac{11}{71}$
.73	$7333\dot{3}$	$.3\dot{6}$	$.3\dot{1}$	$\frac{\dot{}}{75}$
	264046			

To ſubtract repeating decimals, "Extend them as "directed for addition, and borrow at the right-hand "place if neceſſary, by 9.

$.9356\dot{6}$	.646	$.735\dot{8}$	$.738\dot{2}$	.469
$.8473\dot{8}$	$.5342\dot{7}$	.62563	$.6\dot{8}$	$.3\dot{5}$
$.0872\dot{7}$	$.1117\dot{2}$			

The reaſon of theſe rules will be obvious, if we recollect that repeating figures ſignify ninth-parts. If the right-hand figure of the ſum or remainder be 0, the decimal obtained is finite; otherwiſe it is a repeater.

To add circulating decimals, "Extend them till they "become ſimilar (p. 319. col. 1. par. ult. &c.); and "when you add the right-hand column, include the figure which would have been carried if the circle had "been extended further.

Ex. 1ſt.]	*Extended.*	*Ex.* 2d.]	*Extended.*
.574,	.574,574,	.874,	.874,874874,
.2,698,	.266,869,	$.146\dot{3}$	.146,333333,
.428	.428	.1,58,	.158,585858,
.37,983,	.379,839,	.32,	.323,232323,
	1.652,284,		1.503,026390,

Note 1. Repeaters mixed with circulates are extended and added as circulates.

Note 2. Sometimes it is neceſſary to inſpect two or more columns for aſcertaining the carriage; becauſe the carriage from a lower column will ſometimes raiſe the ſum of the higher, ſo as to alter the carriage from it to a new circle. This occurs in Ex. 2.

Note 3. The ſum of the circles muſt be conſidered as a ſimilar circle. If it conſiſt entirely of cyphers, the amount is terminate. If all the figures be the ſame, the amount is a repeater. If they can be divided into parts exactly alike, the amount is a circle of fewer places; but, for the moſt part, the circle of the ſum is ſimilar to the extended circles.

.3,868,	.0842,	$\frac{2}{7}$	.368	.003094,	$\frac{6}{81}$
.4,375,	.08,42	$\frac{2}{3}$	.57,	.765,	$\frac{7}{78}$
.853492,	.0,842	$\frac{\dot{}}{11}$	.895	.76,	$\frac{\dot{}}{11}$
.62,	$.08\dot{4}2$	$\frac{16}{17}$	.724	.765,	$\frac{3}{11}$

To ſubtract circulating decimals, "Extend them till "they become ſimilar; and when you ſubtract the "right-hand figure, conſider whether 8 would have "been borrowed if the circles had been extended fur"ther, and make allowance accordingly.

.5,72,	.974,	or .974974,	.8,135,	or .8,135135,
.4,86,	.86	.868686,	.452907	or .4,529074,
.0,85,		.106288,		.3,606060,
				or, 3,60

Sect. iii. MULTIPLICATION *of* INTERMINATE DECIMALS.

CASE I. "When the multiplier is finite, and the "multiplicand repeats, carry by 9 when you multiply "the repeating figure: The right-hand figure of each "line of the product is a repeater; and they muſt be "extended and added accordingly."

$$
\begin{array}{r}
\textit{Ex.}\ .1349\dot{4}\\
.367\\
\hline
9446\dot{1}\\
80966\dot{6}\\
4048333\\
\hline
.0495246\dot{1}
\end{array}
$$

If the ſum of the right-hand column be an even number of 9's, the product is finite; otherwiſe, it is a repeater.

CASE II. "When the multiplier is finite, and the "multiplicand circulates, add to each product of the "right-hand figure the carriage which would have "been brought to it if the circle had been extended. "Each line of the product is a circle ſimilar to the "multiplicand, and therefore they muſt be extended "and added accordingly."

The product is commonly a circulate ſimilar to the multiplicand; ſometimes it circulates fewer places, repeats, or becomes finite; it never circulates more places.

Ex. .37,46,×.235			
235	1.	.674,	×.78
	2.	.37,	×.86
187,32,	3.	.625,	×.42
1123,93,	4.	.4793,	×4.8
7492,92,	5.	.3,75,	×1.24
.08804,19,	6.	.2,963,	×.36

CASE III. "When the multiplier repeats or circulates, find the product as in finite multipliers, and "place under it the products which would have ariſen "from the repeating or circulating figures, if extend"ed."

Ex. 1ſt.]

$$
\begin{array}{r|l}
\multicolumn{2}{r}{.958\times.8}\\
\multicolumn{2}{r}{8}\\
\hline
7664 & \\
766 & 4\\
76 & \dot{6}4\\
7 & 664\\
 & 7664\\
\hline
\multicolumn{2}{l}{.851\dot{5}}
\end{array}
$$

2d.]

$$
\begin{array}{r|l}
\multicolumn{2}{r}{.784\times.86,}\\
\multicolumn{2}{r}{36}\\
\hline
\multicolumn{2}{r}{4704}\\
\multicolumn{2}{r}{2352}\\
\hline
28224 & \\
282 & 24\\
2 & 8224\\
\hline
\multicolumn{2}{r}{.284,09,}
\end{array}
$$

2

3d.]

Intermediate Decimals.

```
3d.]   .714285,×54,
                54
       ————————————
          2859142
         35714285
       ————————————
        31,571428|571428|571428,
            385714|285714|285714,
              3857|142857|142857,
                  |——————|←——————
                38|571428|571428,
                  |385714|285714,
                  |  3857|142875,
                  |      |———————
                  |    38|571428
                  |      |385714
                  |      |  3857
                  |      |    38
       ——————————————————————————
        38.961038,961038,961038,
```

It is evident, that, if a repeating multiplier be extended to any length, the product ariſing from each figure will be the ſame as the firſt, and each will ſtand one place to the right hand of the former. In like manner, if a circulating multiplier be extended, the product ariſing from each circle will be alike, and will ſtand as many places to the right hand of the former as there are figures in the circle. In the foregoing examples, there are as many of theſe products repeated as is neceſſary for finding the total product. If we place down more, or extend them further, it will only give a continuation of the repeaters or circulates.

This is obvious in Ex. 1ſt and 2d. As the learner may not apprehend it ſo readily in Ex. 3d, when the multiplicand is a circulate, and conſequently each line of the product is alſo a circulate, we have divided it into columns, whoſe ſums exhibit the ſucceſſive circles. The ſum of the firſt column is 38,961037, and there is a carriage of 1 from the right-hand column, which completes 38,961038. This one is ſupplied from the three firſt lines of the ſecond column, the ſum of which is 999999, and being increaſed by 1, in conſequence of the carriage from the third column, amounts to 1,000000, and therefore carries 1 to the firſt column, and does not affect the ſum of the remaining lines, which are the ſame as thoſe of the firſt column. The third column contains two ſets of theſe lines, which amount to 999999, beſides the line which compoſe the circle. Each of theſe ſets would be completed into 1,000000 by the carriage from the 4th column, if extended, and each would carry 1 to the ſecond column. One of theſe would complete the ſum of the three firſt lines, and the other would complete the ſum of the circle. In like manner, if the circles be extended ever ſo far, the increaſing carriages will exactly anſwer for the increaſing deficiencies, and the ſum will be always a continuation of the circle: but the product could not circulate, unleſs the ſum of the lines marked off in the ſecond column had conſiſted entirely of 9's; or had been ſome multiple of a number of 9's; and the circles muſt be extended till this take place, in order to find the complete product.

The multiplication of intermediate decimals may be often facilitated, by reducing the multiplier to a vulgar fraction, and proceeding as directed p. 311. col. 1. par. 6. Thus,

Intermediate Decimals.

```
4th.]  .3824×7̇.=7/9          5th.]  .384×.25̇=23/90
             7                        23      2
       ——————————                   ————     ——
       9)2.6768                     1152     23
          .9742̇                      768
                                  ————————
                                  90)8.832
                                     .09813
```

Therefore, in order to multiply by 3̇, we take one-third part of the multiplier; and, to multiply by 6̇, we take two-thirds of the ſame. Thus,

```
6th.]  .784=.3̇×1/3.          7th.]  .8761×.6̇=2/3
                                          2
                                     ————————
       3).784                        3)1.7522
          .2613̇                         .58406̇
```

As the denominator of the vulgar fractions always conſiſts of 9's, or of 9's with cyphers annexed, we may uſe the contraction explained p. 298. col. 1. par. *ult.* &c.; and this will lead us exactly to the ſame operation which was explained p. 320. col. 2. par. *ult.* &c. on the principles of decimal arithmetic.

```
8th.]  .735×.3,26,=323/990      9th.]  .278×365,=365/999
            323      3                    365
         ———————   ————                 ——————
           2205    323                   1390
          1470                          1668
         2205                           834
         ————————                      ————————
99|0)237405                       999)101470,
       2374,05                          101,
         23,74                        ————————
           ,23                        .101,571,
     ——————————
      .239803,
```

When the multiplier is a mixed repeater or circulate, we may proceed as in Ex. 5th and 8th; or we may divide the multiplier into two parts, of which the firſt is finite, and the ſecond a pure repeater or circulate, with cyphers prefixed, and multiply ſeparately by theſe, and add the products.

```
Thus, .384×.25̇  or by .2 =.0768   or thus,    .384
             and by .05 =.02133̇                .25̇
                        ———————             ——————
                         .09813              9)1920
                                             ——————
                                               2133̇
                                               768
                                             ——————
                                              09813̇
```

In the following examples, the multiplicand is a repeater; and therefore the multiplication by the numerator of the vulgar fraction is performed as directed p. 320. col. 2. par. 2.

```
10th.] .683̇×.5̇5/9                 11th.]  .63×.2,39,= 237/990
          5                                .237     2
       ------                            -------------
   9)3.416̇(.37,962,                        443̇  237
     27                                   1899̇
    ----                                 12666̇
      71                                ----------
      63                             99)15010(.15,16,
     ----                                99
    * 86                                ----
      81                                511
     ----                               495
       56                               ----
       54                             * 160
      ----                               99
        26                              ----
        18                               610
       ----                              594
      * 86                             *  16
```

In the following examples the multiplicand is a circulate, and therefore the multiplication by the numerator is performed as directed p. 320. col. 2. par. 4.

```
12th.]  .3,81,×53̇=48/90
           48   5
          ---------
          3054  48
         15272
         ---------
    9|0)183,27,(.203,63,
         18
        ------
      * 032
         27
        ----
          57
          54
         ----
        * 32
```

```
13th.]  .12,×03=3/99
           3
        --------
   99)36,36(.03673094582185491276̇4,
      666
       723
        306
         936
          453
           576
            813
             216
              183
               846
                543
                 486
                  903
                   126
                    273
                     756
                      633
                       396
                     * 036
```

In Ex. 13th, we have omitted the products of the diviſor, and only marked down the remainders. Theſe are found, by adding the left-hand figure of the dividual to the remaining figures of the ſame. Thus 363 is the firſt dividual, and 3 the left-hand figure, added to 63, the remaining figures, gives 66, for the firſt remainder; and the ſecond dividual, 666, is completed by annexing the circulating figure 6. The reaſon of which may be explained as follows. The higheſt place of each dividual ſhows, in this example, how many hundreds it contains; and as it muſt contain an equal number of ninety-nines, and alſo an equal number of units, it follows, that theſe units, added to the lower places, muſt ſhow how far the dividual exceeds that number of ninety-nine. The figure of the quotient is generally the ſame as the firſt place of the dividual, ſometimes one more. This happens in the laſt ſtep of the foregoing example, and is diſcovered when the remainder found, as here directed, would amount to 99, or upwards; and the exceſs, above 99 only, muſt in that caſe be taken to complete the next dividual.

```
14th.].01,×.01,=1/99
     1
   -----
99).01,(000102030405060708091011121314151617181920
       (2122232425262728293031323334353637383940
       (4142434445464748495051525354555657585960
       (6162636465666768697071727374757677787980
       (81828384858687888990919293949596979899
```

The number of places in the circle of the product is ſometimes very great, though there be few places in the factors: but it never exceeds the product of the denominator of the multiplier, multiplied by the number of places in the circle of the multiplicand. Therefore, if the multiplier be 3̇ or 6, the product may circulate three times as many places as the multiplicand; if the multiplier be any other repeater, nine times as many; if the multiplier be a circulate of two places, ninety-nine times as many; thus, in the laſt example, .01, a circulate of two places, multiplied by .01, a circulate of two places, produces a circulate of twice 99, or 198 places. And the reaſon of this limit may be inferred from the nature of the operation; for the greateſt poſſible number of remainders, including 0, is equal to the diviſor 99; and each remainder may afford two dividuals, if both the circulating figures, 3 and 6, occur to be annexed to it. If the multiplier circulate three places, the circle of the product, for a like reaſon, may extend nine hundred and ninety-nine times as far as that of the multiplicand. But the number of places is often much leſs.

The multiplication of the interminate decimals may be proven, by altering the order of the factors, (p. 295. col. 2. par. 2.) or by reducing them both to vulgar fractions in their loweſt terms, multiplying theſe as directed p. 310. col. 2. par. 3. and reducing the product to a decimal.

Sect. iv. DIVISION of INTERMINATE DECIMALS. 32

CASE I. "When the dividend only is interminate, "proceed as in common arithmetic; but, when the "figures of the dividend are exhauſted, annex the re-"peating figure, or the circulating figures in their or-"der, inſtead of cyphers, to the remainder."

Ex.

Intermi-nate Decimals.

Ex. 1ſt.] Divide .5376 by 7,

$$\begin{array}{r}
7.).537\dot{6}(.76,095238,\\
49\\
\hline
42\\
42\\
\hline
{*}\ 066\\
63\\
\hline
36\\
35\\
\hline
16\\
14\\
\hline
26\\
21\\
\hline
56\\
56\\
\hline
{*}\ 066
\end{array}$$

2d.] Divide $.84\dot{3}$ by 5

$$\begin{array}{r}
.5)843(.168\dot{6}\\
5\\
\hline
34\\
30\\
\hline
43\\
40\\
\hline
{*}\ 33\\
30\\
\hline
33
\end{array}$$

3d.] Divide $.6532\dot{8}$ by [8.

$8).6532\dot{8}(.08166\dot{1}.$

In theſe accounts the quotient is never finite. It may repeat, if the dividend repeats; or, if the dividend circulate, it may circulate an equal number of places, often more, and never fewer. The greateſt poſſible extent of the circle is found by multiplying the diviſor into the number of places in the circle of the dividend. Thus, a circulate of 3 places, divided by 3, quotes a circulate of 3 times 3, or 9 places.

Case II. " When the diviſor is interminate, the " multiplications and ſubtractions muſt be performed, " according to the directions given for repeating and " circulating decimals."

Ex. 1ſt.] Divide .37845 by $\dot{5}$

$$\begin{array}{r}
\dot{5}).37845(.68121\\
\underline{33333\dot{3}}\\
4511\dot{6}\\
\underline{4444\dot{4}}\\
67\dot{2}\\
\underline{55\dot{5}}\\
11\dot{6}\\
\underline{111}\\
\dot{5}\\
\dot{5}\\
\hline
0
\end{array}$$

2d.] Divide .245892 by 2,18,

$$\begin{array}{r}
.2,18,).245892(1.127005\\
.218181,81,\\
\hline
27710,18,\\
21818,18,\\
\hline
5892,00,\\
4363,63,\\
\hline
1528,36,\\
1527,27,\\
\hline
1090,90,\\
10,90,90,\\
\hline
0
\end{array}$$

Extraction of Roots.

The foregoing method is the only one which properly depends on the principles of decimal arithmetic; but it is generally ſhorter to proceed by the following rule.

" Reduce the diviſor to a vulgar fraction, multiply " the dividend by the denominator, and divide the product by the numerator."

Ex. 1ſt.] Divide .37845 by $\dot{5}=\frac{5}{9}$

$$\begin{array}{r}
9\\
\hline
5)3.40605(.68121
\end{array}$$

2d.] Divide $.3784\dot{5}$ by $\dot{6}=\frac{2}{3}$

$$\begin{array}{r}
3\\
\hline
2)1.1353\dot{6}(.56768\dot{3}
\end{array}$$

Note 1. Diviſion by $\dot{3}$ triples the dividend, and diviſion by $\dot{6}$ increaſes the dividend one-half.

Note 2. When the diviſor circulates, the denominator of the vulgar fraction conſiſts of 9's, and the multiplication is ſooner performed by the contraction explained p. 295. col. 1. par. 1. It may be wrought in the ſame way, when the diviſor repeats, and the denominator, of conſequence, is 9.

Note 3. If a repeating dividend be divided by a repeating or circulating diviſor; or, if a circulating dividend be divided by a ſimilar circulating dividend; or, if the number of places in the circle of the diviſor be a multiple of the number in the dividend; then the product of the dividend multiplied by the denominator of the diviſor will be terminate, ſince like figures are ſubtracted from like in the contracted multiplication, and conſequently no remainder left. The form of the quotient depends on the diviſor, as explained at large, p. 316. col. 1. par. 1.—p. 318. col. 2. par. 3.

Note 4. In other caſes, the original and multiplied dividend, are ſimilar, and the form of the quotient is the ſame as in the caſe of a finite diviſor. See p. 322. col. 2. par. *ult.* &c.

Note 5. If the terms be ſimilar, or extended till they become ſo, the quotient is the ſame as if they were finite, and the operation may be conducted accordingly; for the quotient of vulgar fractions that have the ſame denominator is equal to the quotient of their numerators.

Chap. XI. Of the EXTRACTION of ROOTS. 33

The origin of powers by involution has already been explained under the article Algebra. There now remains therefore only to give the moſt expeditious methods of exracting the ſquare and cube roots; the reaſons of which will readily appear from what is ſaid under that article. As for all powers above the cube, unleſs ſuch as are multiples of either the ſquare and cube, the extraction of their roots admits of no deviation from the algebraic canon which muſt be always conſtructed on purpoſe for them.

If the root of any power not exceeding the ſeventh power, be a ſingle digit, it may be obtained by inſpection, from the following table of powers.

1ſt power or root.	2d power or ſquare.	3d power or cube.	4th power or biquadrate.	5th power or ſurſolid.	6th power or cube ſquared.	7th power.
1	1	1	1	1	1	1
2	4	8	16	32	64	128
3	9	27	81	243	729	2187
4	16	64	256	1024	4096	16384
5	25	125	625	3125	15625	78125
6	36	216	1296	7776	46656	279936
7	49	343	2401	16807	117649	823543
8	64	512	4096	32768	262144	2097152
9	81	729	6561	59049	531441	4782969

34

Sect. i. EXTRACTION *of the* SQUARE ROOT.

RULE I. “ Divide the given number into periods “ of two figures, beginning at the right hand in inte“ gers, and pointing towards the left. But in deci“ mals begin at the place of hundreds, and point to“ ward the right. Every period will give one figure “ in the root.”

II. “ Find by the table of powers, or by trial, “ the neareſt leſſer root of the left hand period, place “ the figure ſo found in the quot, ſubtract its ſquare “ from the ſaid period, and to the remainder bring “ down the next period for a dividual or reſolvend.”

III. “ Double the quot for the firſt part of the “ diviſor; inquire how often this firſt part is contain“ ed in the whole reſolvend, excluding the unit place; “ and place the figure denoting the anſwer both in the “ quot and on the right of the firſt part; and you have “ the diviſor complete.”

IV. “ Multiply the diviſor thus completed by the “ figure put in the quot, ſubtract the product from “ the reſolvend, and to the remainder bring down the “ following period for a new reſolvend, and then pro“ ceed as before.”

Note 1. If the firſt part of the diviſor, with unity ſuppoſed to be annexed to it, happen to be greater than the reſolvend, in this caſe place 0 in the quot, and alſo on the right-hand of the partial diviſor; to the reſolvend bring down another period; and proceed to divide as before.

Note 2. If the product of the quotient-figure into the diviſor happen to be greater than the reſolvend, you muſt go back, and give a leſſer figure to the quot.

Note 3. If, after every period of the given number is brought down, there happen at laſt to be a remainder, you may continue the operation, by annexing periods, or pairs of cyphers, till there be no remainder, or till the decimal part of the quot repeat or circulate, or till you think proper to limit it.

Ex. 1ſt. Required the ſquare root of 133225.

```
                 . . .
Square number  133225(365 root            365
               9                          365
                                         ----
1 div. 66)     432 reſolvend.            1825
               396 product.             2190
                                        1095
2 div. 725)    3625 reſolvend.          ------
               3625 product.            133225 proof.
```

2d.] Required the ſquare root of 72, to eight decimal places.

```
   . . . . .
   72.00000000(8.48528137 root.
   64
   ---
 164)800
     656
     ----
 1688)14400
      13504
      ------
  16965)89600
        84825
        ------
  169702)477500
         339404
         ------
  169704)138096
    .... 135763
         ------
           2333
           1697
           ----
            636
            509
            ---
            127
            118
            ---
            (9)
```

After getting half of the decimal places, work by contracted diviſion for the other half; and obtain them with the ſame accuracy as if the work had been at large.

3d.]. Required the ſquare root of .2916.

```
   . .
 .2916(.54 root.
  25
  ---
104)416
    416
    ---
```

If the ſquare root of a vulgar fraction be required, find the root of the given numerator for a new numerator, and find the root of the given denominator for a new denominator. Thus, the ſquare root of $\frac{4}{9}$ is $\frac{2}{3}$, and the root of $\frac{16}{25}$ is $\frac{4}{5}$; and thus the root of $\frac{25}{4}$ ($=6\frac{1}{4}$) is $\frac{5}{2}=2\frac{1}{2}$.

But if the root of either the numerator or denominator cannot be extracted without a remainder, reduce the vulgar fraction to a decimal, and then extract the root, as in Ex. 3d. above.

Sect. ii. EXTRACTION *of the* CUBE ROOT.

35

RULE I. “ Divide the given number into periods “ of three figures, beginning at the right-hand in in“ tegers, and pointing towards the left. But in deci“ mals, begin at the place of thouſands, and point to“ wards the right. The number of periods ſhows the “ number of figures in the root.”

II. “ Find by the table of powers, or by trial, the “ neareſt leſſer root of the left-hand period; place the “ figure ſo found in the quot; ſubtract its cube from “ the ſaid period; and to the remainder bring down “ the next period for a dividual or reſolvend.”

The diviſor conſiſts of three parts, which may be found as follows.

III.

Extraction of Roots.

III. “ The firſt part of the diviſor is found thus: Multiply the ſquare of the quot by 3, and to the product annex two cyphers; then inquire how often this firſt part of the diviſor is contained in the reſolvend, and place the figure denoting the anſwer in the quot.”

IV. “ Multiply the former quot by 3, and the product by the figure now put in the quot; to this laſt product annex a cypher; and you have the ſecond part of the diviſor. Again, ſquare the figure now put in the quot for the third part of the diviſor; place theſe three parts under one another, as in addition; and their ſum will be the diviſor complete.”

V. “ Multiply the diviſor, thus completed, by the figure laſt put in the quot, ſubtract the product from the reſolvend, and to the remainder bring down the following period for a new reſolvend, and then proceed as before.”

Note 1. If the firſt part of the diviſor happen to be equal to or greater than the reſolvend, in this caſe, place 0 in the quot, annex two cyphers to the ſaid firſt part of the diviſor, to the reſolvend bring down another period, and proceed to divide as before.

Note 2. If the product of the quotient-figure into the diviſor happen to be greater than the reſolvend, you muſt go back, and give a leſſer figure to the quot.

Note 3. If, after every period of the given number brought down, there happen at laſt to be a remainder, you may continue the operation by annexing periods of three cyphers till there be no remainder, or till you have as many decimal places in the root as you judge neceſſary.

Ex. 1ſt.] Required the cube root of 12812904.

```
                     ·  ·  ·
Cube number 12812904(234 root.
              8
             ———
1ſt part  1200 ⎫        )4812 reſolvend.
2d part    180 ⎬
3d part      9 ⎭
1 diviſor 1389×3=4167 product
————————————————————————————————
1ſt part  158700 ⎫   )645904 reſolvend.
2d part     2760 ⎬
3d part       16 ⎭
2 diviſor 161476×4=645904 product.
```

P R O O F.

```
   234          Square 54756
   234                   234
  ————                ——————
   936                219024
  702                164268
 468                109512
 ——————              ————————
Square 54756        Cube 12812904
```

2d.] Required the cube root of $28\frac{3}{4}$

```
                  ·   ·  ·
               28.750000(3.06 root.
               27
               ——
 270000 ⎫  )1750000 reſolv.
   5400 ⎬
     36 ⎭
 ——————
Div. 275436×6=1652616 prod.
              ———————
               97384 rem.
```

P R O O F.

```
  3.06          Sq. 9.3636
  3.06                3.06
 —————              ——————
  1836              561816
 918               280908
 ——————            ———————
Sq. 9.3636         28.652616
                       97384 rem.
                   ———————————
                   28.750000 cube.
```

If the cube root of a vulgar fraction be required, find the cube root of the given numerator for a new numerator, and the cube root of the given denominator for a new denominator. Thus, the cube root of $\frac{8}{27}$ is $\frac{2}{3}$, and the cube root of $\frac{27}{64}$ is $\frac{3}{4}$: and thus the cube root of $\frac{125}{8}$ ($=15\frac{5}{8}$) is $\frac{5}{2}=2\frac{1}{2}$.

But if the root of either the numerator or denominator cannot be extracted without a remainder, reduce the vulgar fraction to a decimal, and then extract the root.

ARIUS, a divine of the fourth century, the head and founder of the **Arians**, a ſect which denied the eternal divinity and ſubſtantiality of the Word. He was born in Libya, near Egypt. Euſebius biſhop of Nicomedia, a great favourite of Conſtantia ſiſter of the emperor Conſtantine and wife of Licinius, became a zealous promoter of Arianiſm. He took Arius under his protection, and introduced him to Conſtantia; ſo that the ſect increaſed, and ſeveral biſhops embraced it openly. There aroſe, however, ſuch diſputes in the cities, that the emperor, in order to remedy theſe diſorders, was obliged to aſſemble the council of Nice, where, in the year 325, the doctrine of Arius was condemned. Arius was baniſhed by the emperor, all his books were ordered to be burnt, and capital puniſhment was denounced againſt whoever dared to keep them. After five years baniſhment, he was recalled to

Conſtantinople, where he preſented the emperor with a confeſſion of his faith, drawn up ſo artfully, that it fully ſatisfied him. Notwithſtanding which, Athanaſius, now advanced to the ſee of Alexandria, refuſed to admit him and his followers to communion. This ſo enraged them, that, by their intereſt at court, they procured that prelate to be depoſed and baniſhed. But the church of Alexandria ſtill refuſing to admit Arius into their communion, the emperor ſent for him to Conſtantinople; where, upon delivering in a freſh confeſſion of his faith in terms leſs offenſive, the emperor commanded Alexander, the biſhop of that church, to receive him the next day into his communion: but that very evening Arius died. The manner of his death was very extraordinary: as his friends were conducting him in triumph to the great church of Conſtantinople, Arius, preſſed by a natural neceſſity, ſtepped aſide to eaſe himſelf; but expired on the ſpot, his bowels guſhing out.

But the hereſy did not die with the hereſiarch; his party continued ſtill in great credit at court. Athanaſius, indeed, was ſoon recalled from baniſhment, and as ſoon removed again; the Arians being countenanced by the government, and making and depoſing biſhops as it beſt ſerved their purpoſes. In ſhort, this ſect continued with great luſtre above 300 years: it was the reigning religion of Spain for above two centuries; it was on the throne both in the eaſt and weſt; it prevailed in Italy, France, Pannonia, and Africa; and was not extirpated till about the end of the 8th century.

This hereſy was again ſet on foot in the weſt by Servetus, who, in 1531, wrote a little treatiſe againſt the myſtery of the Trinity. After his death, Arianiſm got footing in Geneva; from whence it removed into Poland; but at length, degenerated, in a great meaſure, into Socinianiſm. Eraſmus ſeems to have aimed at reviving Arianiſm, in his commentaries on the New Teſtament; and the learned Grotius ſeems to lean a little that way.

With regard to the ſtate of Arianiſm in England, it may be ſufficient to obſerve, that from the numerous publications of that caſt which are daily making their appearance, it ſeems to be rather a growing, than exploded, doctrine there.

Plate LVII. fig. 1 ARK, or *Noah's* ARK, a floating veſſel built by Noah for the preſervation of his family and the ſeveral ſpecies of animals during the deluge.

The ark has afforded ſeveral points of curious inquiry among the critics and naturaliſts, relating to its form, capacity, materials, &c.

The wood whereof the ark was built is called in the Hebrew *Gopher-wood*, and in the ſeptuagint *ſquare timbers*. Some tranſlate the original *cedar*, others *pine*, others *box*, &c. Pelletier prefers cedar on account of its incorruptibility, and the great plenty of it in Aſia: whence Herodotus and Theophaſtrus relate, that the kings of Egypt and Syria built whole fleets thereof, inſtead of deal.

The learned Mr Fuller, in his Miſcellanies, has obſerved, that the wood whereof the ark was built was nothing but that which the Greeks call *κυπαρισσος*, or the *cypreſs-tree*; for, taking away the termination, *kupar* and *gopher* differ very little in ſound. This obſervation the great Bochart has confirmed, and ſhown very plainly that no country abounds ſo much with this wood as that part of Aſſyria which lies about Babylon.

In what place Noah built and finiſhed his ark is no leſs made a matter of diſputation. But the moſt probable opinion is, that it was built in Chaldea, in the territories of Babylon, where there was ſo great a quantity of cypreſs in the groves and gardens in Alexander's time, that that prince built a whole fleet out of it for want of timber. And this conjecture is confirmed by the Chaldean tradition, which makes Xithurus (another name for Noah) ſet ſail from that country.

The dimenſions of the ark, as given by Moſes, are 300 cubits in length, 50 in breadth, and 30 in height; which ſome have thought too ſcanty, conſidering the number of things it was to contain; and hence an argument has been drawn againſt the authority of the relation. To ſolve this difficulty many of the ancient fathers, and the modern critics, have been put to very miſerable ſhifts: But Buteo and Kircher have proved geometrically, that, taking the common cubit of a foot and a half, the ark was abundantly ſufficient for all the animals ſuppoſed to be lodged in it. Snellius computes the ark to have been above half an acre in area. Father Lamy ſhows, that it was 110 feet longer than the church of St Mary at Paris, and 64 feet broader: and if ſo, it muſt have been longer than St Paul's church in London, from weſt to eaſt, and broader than that church is high in the inſide, and 54 feet of our meaſure in height; and Dr Arbuthnot computes it to have been 81062 tons.

The things contained in it were, beſides eight perſons of Noah's family, one pair of every ſpecies of unclean animals, and ſeven pair of every ſpecies of clean animals, with proviſions for them during the whole year. The former appears, at firſt view, almoſt infinite; but if we come to a calculation, the number of ſpecies of animals will be found much leſs than is generally imagined; out of which, in this caſe, are excepted ſuch animals as can live in the water; and biſhop Wilkins ſhows that only 72 of the quadrupeds kind needed a place in the ark.

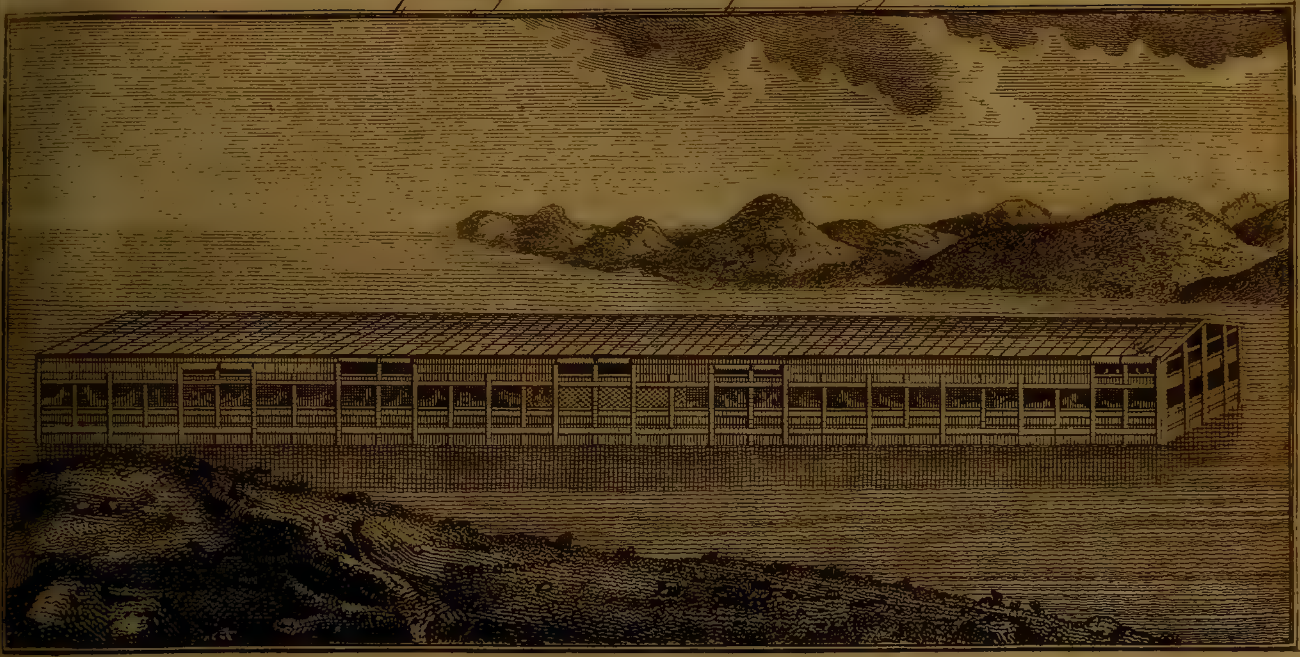
By the deſcription Moſes gives of the ark, it appears to have been divided into three ſtories, each ten cubits or 15 feet high; and it is agreed on, as moſt probable, that the loweſt ſtory was for the beaſts, the middle for the food, and the upper for the birds, with Noah and his family; each ſtory being ſubdivided into different apartments, ſtalls, &c. though Joſephus, Philo, and other commentators, add a kind of fourth ſtory under all the reſt; being, as it were, the hold of the veſſel, to contain the ballaſt and receive the filth and feces of ſo many animals: but F. Calmet thinks, that what is here reckoned a ſtory, was no more than what is called the *keel* of ſhips, and ſerved only for a conſervatory of freſh water. Drexelius makes 300 apartments; F. Fourneir, 333; the anonymous author of the Queſtions on Geneſis, 400; Buteo, Temporarius, Arias Montanus, Hoſtus, Wilkins, Lamy, and others, ſuppoſe as many partitions as there were different ſorts of animals. Pelletier makes only 72, viz. 36 for the birds, and as many for the beaſts. His reaſon is, that if we ſuppoſe a greater number, as 333 or 400, each of the eight perſons in the ark muſt have had 37, 41, or 50 ſtalls to attend and cleanſe daily, which he thinks impoſſible to have been done. But it is obſerved, that there is not much in this; to diminiſh the number of ſtalls without a diminution of animals is vain; it being perhaps more difficult to take care of 300 animals in 72 ſtalls than in 300. As to the number of animals contained in the ark, Buteo computes that it could not be equal to 500 horſes; he even reduces the whole to the dimenſions of 56 pair of oxen. F. Lamy enlarges it to 64 pair of oxen, or 128 oxen; ſo that, ſuppoſing one ox equal to two horſes, if the ark had room for 256 horſes, there muſt have been room for all the animals. But the ſame author demonſtrates, that one floor of it would ſuffice for 500 horſes, allowing nine ſquare feet to a horſe.

As to the food in the ſecond ſtory, it is obſerved by Buteo from Columella, that 30 or 40 pounds of hay ordinarily ſuffices for an ox a day; and that a ſolid cubit of hay, as uſually preſſed down in our hay ricks, weighs

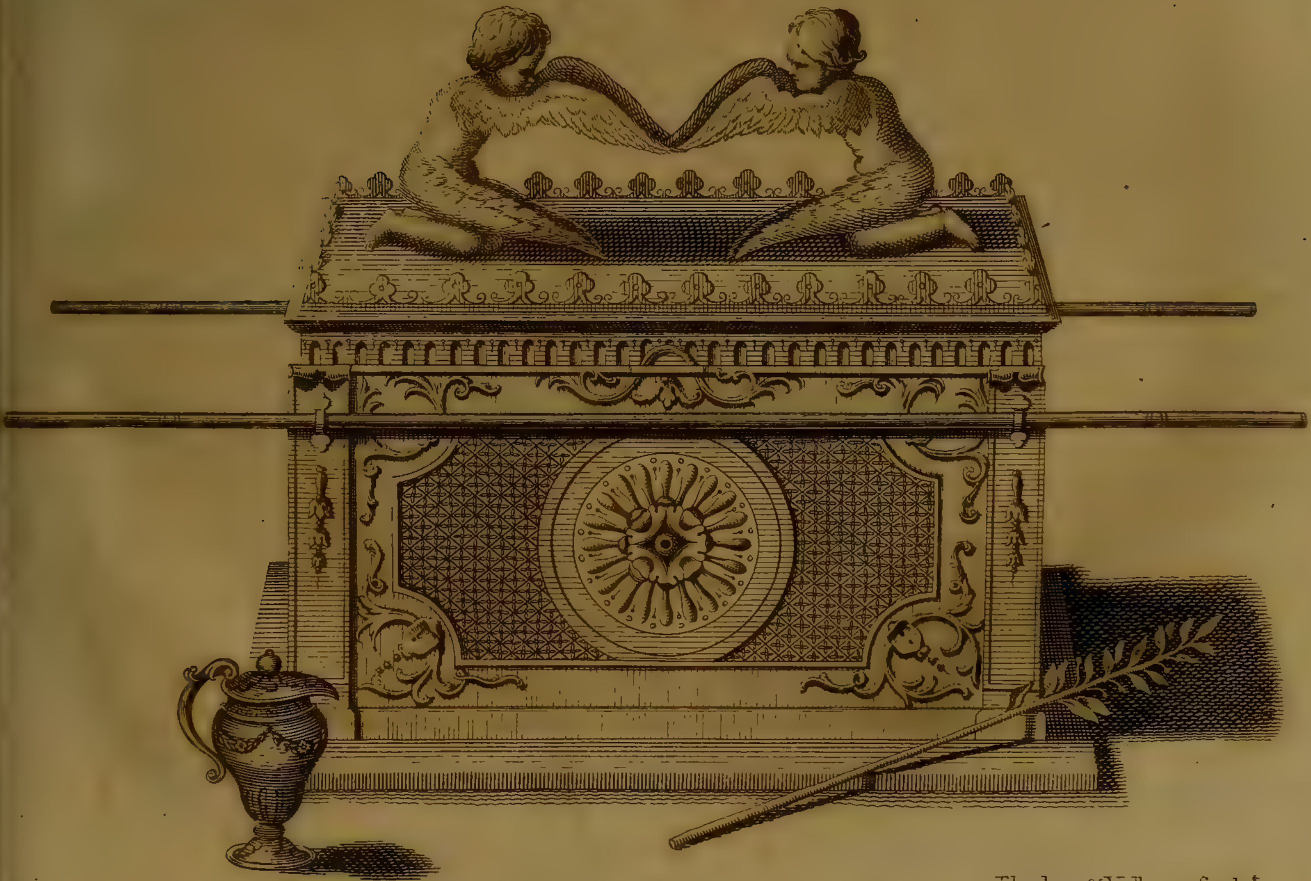
NOAH'S ARK.

Plate LVII.

floating on the waters of the Deluge.



ARK of the COVENANT.



Thackara & Vallance, Sculp.^{t}

weighs about 40 pounds; ſo that a ſquare cubit of hay is more than enough for one ox in one day. Now, it appears, that the ſecond ſtory contained 150,000 ſolid cubits; which divided between 206 oxen will afford each more hay, by two-thirds, than he can eat in a year. Biſhop Wilkins computes all the carnivorous animals equivalent, as to the bulk of their bodies, and their food, to 27 wolves; and all the reſt to 280 beeves. For the former, he allows 1825 ſheep; and for the latter, 109,500 cubits of hay: all which will be eaſily contained in the two firſt ſtories, and a deal of room to ſpare. As to the third ſtory, nobody doubts of its being ſufficient for the fowls; with Noah, his ſons, and daughters. Upon the whole, the learned biſhop remarks, that of the two, it appears much more difficult to aſſign a number and bulk of neceſſary things to anſwer the capacity of the ark, than to find ſufficient room for the ſeveral ſpecies of animals already known to have been there. This he attributes to the imperfection of our liſt of animals, eſpecially thoſe of the unknown parts of the earth; adding, that the moſt expert mathematician at this day could not aſſign the proportion of a veſſel better accommodated to the purpoſe than is here done: and hence he finally concludes, that the capacity of the ark, which had been made an objection againſt ſcripture, ought to be eſteemed a confirmation of its divine authority; ſince, in thoſe ruder ages, men, being leſs verſed in arts and philoſophy, were more obnoxious to vulgar prejudices than now; ſo that, had it been an human invention, it would have been contrived according to thoſe wild apprehenſions which ariſe from a confuſed and general view of things as much too big as it had been repreſented too little.

But it muſt be obſerved, that, beſides the places requiſite for the beaſts and birds, and their proviſions, there was room required for Noah to lock up houſehold utenſils, the inſtruments of huſbandry, grains and ſeeds to ſow the earth with after the deluge; for which purpoſe it is thought that he might ſpare room in the third ſtory for 36 cabbins, beſides a kitchen, a hall, four chambers, and a ſpace about 48 cubits in length to walk in.

Plate LVII. fig. 2.

Ark of the Covenant, a ſmall cheſt or coffer, three feet nine inches in length, two feet three inches in breadth, and two feet three inches in height, in which were contained the golden pot that had manna, and Aaron's rod, and the tables of the covenant. This coffer was made of ſhittim-wood, and covered with a lid, which was made of ſolid gold. The ark was repoſited in the holieſt place of the tabernacle. It was taken by the Philiſtines, and detained 20, ſome ſay 40, years, at Kirjath-jearim; but the people being afflicted with emerods on account of it, returned it with divers preſents. It was afterwards placed in the temple.

The lid or covering of the ark was called the *propitiatory* or *mercy-ſeat*; over which were two figures placed called *Cherubims*, with expanded wings of a peculiar form. Here the Schechinah reſted both in the tabernacle and temple in a viſible cloud: hence were iſſued the divine oracles by an audible voice; and the high prieſt appeared before this mercy-ſeat once every year on the great day of expiation; and the Jews, wherever they worſhipped, turned their faces towards the place where the ark ſtood.

In the ſecond temple there was alſo an ark, made of the ſame ſhape and dimenſions with the firſt, and put in the ſame place, but without any of its contents and peculiar honours. It was uſed as a repreſentative of the former on the day of expiation, and a repoſitory of the original copy of the holy Scriptures, collected by Ezra and the men of the great ſynagogue, after the captivity. And in imitation of this, the Jews to this day have a kind of ark in their ſynagogues, wherein their ſacred books are repoſited. This they call *aron*. Leo of Modena gives a deſcription thereof in his Account of the Cuſtoms and Ceremonies of thoſe of his Nation. "The Jews (ſays he), in the eaſtern ſide of their ſynagogues, have an ark, or armory, called *aron*, in memory of the ark of the covenant. In this are preſerved the five books of Moſes, written on vellum, with ink made on purpoſe," &c. Some have ſuppoſed that the figure of this ark is ſtill remaining on the triumphal arch of Titus at Rome; though Villalpandus and others, with greater reaſon, are of opinion, that it is the table of ſhew-bread. *Prideaux's Con.* Vol. i. p. 209. Tertullian calls this ark *Armarium Judaicum*; whence the phraſe, *to be in the armory of the ſynagogue*, q. d. in the number of canonical writings.

A cheſt or coffer, very nearly reſembling the Jewiſh ark, and called the *houſe of the God*, was found in Huaheine, one of the iſlands in the ſouthern ſea. Mr Banks could obtain no other information concerning it than what the name imports. *Hawkeſworth's Account*, &c. Vol. ii. p. 252.

ARKLOW, a ſea-port town of Ireland, in the county of Wicklow, and province of Leinſter. W. Long. 6. 15. N. Lat. 52, 55.

ARLES, a city of Provence in France, ſeated on the eaſt ſide of the Rhone, on a hill whoſe declivity is towards the north. It is an archbiſhop's ſee; and is celebrated for its antiquities both within and without the city. Thoſe of which any remains are now to be ſeen are the amphitheatre, the obeliſk, the Elyſian Fields, the ſepulchres, columns with their capitals, buſts, pedeſtals, aqueducts, with ſome remains of the capitol, and the temples of their gods. The other ancient monuments are entirely deſtroyed. Under the amphitheatre, in 1651, they found the ſtatue of venus, which was worſhipped by this city; and has been ſince carried to the caſtle of Verſailles. It is a maſterpiece which will always be admired by connoiſſeurs.

The amphitheatre is one of the moſt remarkable pieces of antiquity. It was built by the Romans, but the time is unknown though ſome ſay by Julius Cæſar. It is of an oval form, and about 400 yards in circumference, and the front is 34 yards in height. The middle, called the *Arena*, is 142 yards wide and 104 broad. The porticos or piazzas are three ſtories, built with ſtone of a prodigious ſize. Each of them conſiſts of 60 arches, which ſtill remain; and the walls are of a ſurpriſing thickneſs, but gone to decay.

The obeliſk is the only one of this kind to be ſeen in France. It ſeems to be one of the forty brought from Egypt to Rome, becauſe it is of the ſame oriental granite with them. They are generally full of hieroglyphic characters; but this is quite ſmooth. In 1675, it was found in a private garden near the walls of the city, not far from the Rhone. It conſiſts of one piece; and is 52 feet high, and 7 in diameter at the baſe. It is now ſupported with four lions made of bronze; and on the top a blue ball is placed, with the arms of France, and over that a ſun.

The Pagans burying-place, called the *Elyſian Fields*, is without the city, upon an agreeable hill, divided into two parts. The firſt, called *Moulaires*, has very few tombs, they have been broken to build the walls of gardens, which are made in that place. The ſecond, called *Eliſcamp*, contains a great number. Thoſe of the Pagans have the letters D. M. which ſignifies *Diis Manibus*. Thoſe of the Chriſtians have a croſs. Pieces of coin of gold, ſilver, and bronze, are found here; as alſo urns, lamps, and cups without number.

Here is a royal academy of ſciences, conſiſting of thirty members, who muſt be natives, gentlemen, and inhabitants of the city. It enjoys the ſame privileges as that at Paris. Arles is ſurrounded with marſhy land which renders the air full of vapours, and makes it not very wholeſome. Long. 4. 48. E. Lat. 43. 40.

ARLEUX, an ancient town of the Netherlands, in Cambreſis, with a caſtle. It was taken by the French in 1645, and retaken by the allies in 1711, but the French got poſſeſſion again the ſame month. E. Long. 3. 16. N. Lat. 59. 17.

ARLON, an ancient town of the Netherlands, formerly a ſtrong place, but now diſmantled. It belongs to the houſe of Auſtria. E. Long. 15. 50. Lat. 49. 4.

ARM, a part of the human body, terminating at one end on the ſhoulder, and at the other in the hand. See ANATOMY, n° 48.

ARM, among ſportſmen, is applied to a horſe, when, by preſſing down his head he endeavours to defend himſelf againſt the bit, to prevent his being checked by it. The remedy is, to have a wooden ball covered with velvet, or other matter, put on his chaul, which will ſo preſs him between the jaw-bones as to prevent his bringing his head ſo near his breaſt.

ARM, in geography, is uſed for a branch of a ſea or river. Italy and Sicily are only parted by an arm of the ſea. St George's arm in the Mediterranean is the Thracian Boſphorus.

ARM is alſo uſed figuratively for power. The ſecular arm is the lay or temporal authority of a ſecular judge; to which recourſe is had for the execution of the ſentences paſſed by eccleſiaſtical judges.

The church ſheds no blood: even the judges of inquiſition, after they have found the perſon guilty, ſurrender him to the ſecular arm. The council of Antioch, held in 341, decrees, that recourſe be had to the ſecular arm to repreſs thoſe who refuſe obedience to the church: for ſecular arm, they here uſe exterior power.

ARM, in reſpect to the magnet. A loadſtone is ſaid to be armed, when it is capped, caſed, or ſet in iron or ſteel, in order to make it take up the greater weight, and alſo to diſtinguiſh readily its poles. See MAGNETISM

ARMACALES, a river of Babylon (Abydenus); called *Foſſa Regia*, the *Royal Trench* or *Cut* (Polybius); the *Royal River* (Ptolemy); *Almarchur* (Pliny); *Naarmalcha* (Ammian); a factitious channel or cut, made by Nabuchadonoſor, and a horn or branch of the Euphrates, (Abydenus). The Euphrates naturally divides into two channels, one paſſing through Babylon, the other through Seleucia, and then falls into the Tigris: the factitious channel between theſe two is the Royal River; which mixes with the Tigris, a great deal lower down than Seleucia, at Apamea, (Ptolemy).

ARMADA, a Spaniſh term, ſignifying a fleet of men of war. The armada which attempted to invade England in the time of Queen Elizabeth, is famous in hiſtory.

This armada, to which the Spaniards in confidence of ſucceſs, gave the name of *Invincible*, conſiſted of 150 ſhips, moſt of which were greatly ſuperior in ſtrength and ſize to any that had been ſeen before. It had on board near 20,000 ſoldiers and 8000 ſailors, beſides 2000 volunteers of the moſt diſtinguiſhed families in Spain. It carried 2650 great guns, was victualled for half a year, and contained ſuch a quantity of military ſtores, as only the Spaniſh monarch, enriched by the treaſures of the Indies and America, could ſupply. The troops on board were to be joined by 34,000 more which the Duke of Parma had aſſembled in the neighbourhood of Nieuport and Dunkirk. For tranſporting theſe, he had, with incredible labour, provided a great number of flatbottomed veſſels, and had brought ſailors to navigate them from the towns in the Baltic. Moſt of theſe veſſels had been built at Antwerp; and as he durſt not venture to bring them from thence by ſea to Nieuport, leſt they ſhould have been intercepted by the Dutch, he was obliged to ſend them along the Scheld to Ghent, from Ghent to Bruges by the canal which joins theſe towns, and from Bruges to Nieuport by a new canal which he dug on the preſent occaſion. This laborious undertaking, in which ſeveral thouſand workmen had been employed, was already finiſhed, and the Duke now waited for the arrival of the Spaniſh fleet; hoping, that as ſoon as it ſhould approach, the Dutch and Engliſh ſhips which cruiſed on the coaſt would retire into their harbours.

When the news reached England that this mighty fleet was preparing to ſail, terror and conſternation univerſally ſeized the inhabitants. A fleet of not above 30 ſhips of war, and thoſe very ſmall in compariſon, was all that was to oppoſe it by ſea. All the commercial towns of England, however, were required to furniſh ſhips for reinforcing this ſmall navy. The citizens of London, inſtead of fifteen veſſels, which they were commanded to equip, voluntarily fitted out double the number; and the gentry and nobility equipped 43 ſhips at their own charge. Lord Howard of Effingham was admiral; and under him ſerved Drake, Hawkins, and Frobiſher, all of them renowned as ſeamen of courage and capacity. The principal fleet was ſtationed at Plymouth. A ſmaller ſquadron, conſiſting of 40 veſſels, Engliſh and Flemiſh, was commanded by Lord Seymour ſecond ſon of protector Somerſet, and lay off Dunkirk in order to intercept the Duke of Parma.

The land-forces of England were more numerous than thoſe of the enemy, but inferior in diſcipline and experience. An army of 20,000 men was diſpoſed in different bodies along the ſouth coaſt, with orders to retire backwards and waſte the country, if they could not prevent the Spaniards from landing; 22,000 foot and 1000 horſe, under the command of the Earl of Leiceſter, were ſtationed at Tilbury, in order to defend the capital; and the principal army, conſiſting of 34,000 foot and 2000 horſe, commanded by Lord

Hunſdon, was reſerved for guarding the Queen's perſon, and appointed to march whitherſoever the enemy ſhould appear. Theſe armies, though all the Spaniſh forces had been able to land, would poſſible have been ſufficient to protect the liberties of their country. But as the fate of England, in that event, muſt depend on the iſſue of a ſingle battle, all men of ſerious reflection entertained the moſt awful apprehenſions of the ſhock of at leaſt 50,000 veterans, commanded by experienced officers, under ſo conſumate a general as the Duke of Parma. The Queen alone was undaunted. She iſſued all her orders with tranquillity, animated her people to a ſteady reſiſtance, and employed every reſource which either her domeſtic ſituation or her foreign alliances could afford her. She even appeared on horſeback in the camp at Tilbury; and riding through the lines, diſcovered a cheerful and animated countenance, exhorted the ſoldiers to remember their duty to their country and their religion, and profeſſed her intention, though a woman, to lead them herſelf into the field againſt the enemy, and rather periſh in battle than ſurvive the ruin and ſlavery of her people. "I know (ſaid ſhe, intrepidly) I have but the weak and feeble arm of a woman; but I have the heart of a king, and of a king of England too!" The heroic ſpirit of Elizabeth communicated itſelf to the army, and every man reſolved to die rather than deſert his ſtation.

The Spaniſh armada was ready in the beginning of May; but its ſailing was retarded by the death of the Marquis of Santa Croce the admiral, and that alſo of the vice-admiral the Duke of Paliano. The command of the expedition was therefore given to the Duke of Medina Sidonia, a man entirely unexperienced in ſea affairs. This promotion, in ſome meaſure, ſerved to fruſtrate the deſign, which was alſo rendered leſs ſucceſsful by ſome other accidents. Upon leaving the port of Liſbon, the armada next day met with a violent tempeſt, which ſunk ſome of the ſmalleſt of their ſhipping, and obliged the fleet to put back into the harbour. After ſome time ſpent in refitting, they put again to ſea. Being deſcried by Fleming, a Scottiſh pirate, who was roving in thoſe ſeas, he immediately ſailed towards the Engliſh fleet, and informed the admiral of their approach. Effingham had juſt time to get out of port when he ſaw the Spaniſh armada coming full ſail towards him, diſpoſed in the form of a creſcent, and ſtretching the diſtance of ſeven miles from the extremity of one diviſion to that of the other. The Engliſh admiral, conſidering that the Spaniards would probably be much ſuperior to him in cloſe fight, by reaſon of the ſize of their ſhips and the number of their troops, wiſely reſolved to content himſelf with haraſſing them in their voyage, and with watching attentively all the advantages which might be derived from ſtorms, croſs winds, and ſuch like fortuitous accidents. It was not long before he diſcerned a favourable opportunity of attacking the vice-admiral Recaldo. This he did in perſon; and on that occaſion diſplayed ſo much dexterity in working his ſhip, and in loading and firing his guns, as greatly alarmed the Spaniards for the fate of the vice-admiral. From that time they kept much cloſer to one another; notwithſtanding which, the Engliſh on the ſame day attacked one of the largeſt galeaſſes. Other Spaniſh ſhips came up in time to her relief; but in their hurry one of the principal galleons, which had a great part of the treaſure on board, ran foul of another ſhip, and had one of her maſts broken. In conſequence of this misfortune ſhe fell behind, and was taken by Sir Francis Drake; who on the ſame day took another capital ſhip, which had been accidentally ſet on fire.

Several other rencounters happened, and in all of them the Engliſh proved victorious, through the great advantage which they derived from the lightneſs of their ſhips, and the dexterity of the ſailors. The Spaniards in that age did not ſufficiently underſtand nautical mechanics, to be able to avail themſelves of the unuſual magnitude of their ſhips. The Engliſh ſailed round them, approached, or retired, with a velocity that filled them with amazement, and did infinitely greater execution with their cannon: for while every ſhot of theirs proved effectual, their ſhips ſufferd very little damage from the enemy, whoſe guns were planted too high, and generally ſpent their force in air.

The Spaniards, however, ſtill continued to advance till they came oppoſite to Calais; there the Duke de Medina having ordered them to caſt anchor, he ſent information to the Duke of Parma of his arrival, and intreated him to haſten the embarkation of his forces. Farneſe accordingly began to put his troops on board. But at the ſame time he informed Medina, that, agreeably to the King's inſtructions, the veſſels which he had prepared were proper only for tranſporting the troops, but were utterly unfit for fighting; and for this reaſon, till the armada were brought ſtill nearer, and the coaſt cleared of the Dutch ſhips which had blocked up the harbours of Nieuport and Dunkirk, he could not ſtir from his preſent ſtation, without expoſing his army to certain ruin, the conſequence of which would probably be the entire loſs of the Netherlands.

In compliance with this requeſt, the armada was ordered to advance; and it had arrived within ſight of Dunkirk, between the Engliſh fleet on the one hand, and the Dutch on the other, when a ſudden calm put a ſtop to all its motions. In this ſituation the three fleets remained one whole day. About the middle of the night a breeze ſprung up; and Lord Howard had recourſe to an expedient which had been happily deviſed on the day before. Having filled eight ſhips with pitch, ſulphur, and other combuſtible materials, he ſet fire to them, and ſent them before the wind againſt the different diviſions of the Spaniſh fleet.

When the Spaniards beheld theſe ſhips in flames approaching towards them, it brought to their remembrance the havock which had been made by the fire-ſhips employed againſt the Duke of Parma's bridge at the ſiege of Antwerp. The darkneſs of the night increaſed the terror with which their imaginations were overwhelmed, and the panic flew from one end of the fleet to the other. Each crew, anxious only for their own preſervation, thought of nothing but how to eſcape from their preſent danger. Some of them took time to weigh their anchors, but others cut their cables and ſuffered their ſhips to drive with blind precipitation, without conſidering whether they did not thereby expoſe themſelves to a greater danger than that which they were ſo ſolicitous to avoid. In this confuſion the ſhips ran foul of one another: the ſhock was dreadful, and ſeveral of them received ſo much damage as to be rendered unfit for future uſe.

When day-light returned, Lord Howard had the ſatisfaction to perceive that his ſtratagem had fully produced the deſired effect. The enemy were ſtill in extreme diſorder, and their ſhips widely ſeparated and diſperſed. His fleet had lately received a great augmentation by the ſhips fitted out by the nobility and gentry, and by thoſe under Lord Seymour, who had left Juſtin de Naſſau as alone ſufficient to guard the coaſt of Flanders. Being bravely ſeconded by Sir Francis Drake and all the other officers, he made haſte to improve the advantage which was now preſented to him, and attacked the enemy in different quarters at the ſame time with the utmoſt impetuoſity and ardour. The engagement began at four in the morning, and laſted till ſix at night. The Spaniards diſplayed in every rencounter the moſt intrepid bravery; but, from the cauſes already mentioned, they did very little execution againſt the Engliſh, while many of their own ſhips were greatly damaged, and twelve of the largeſt were either run aground, or ſunk, or compelled to ſurrender.

It was now evident that the purpoſe of the armada was utterly fruſtrated. The Spaniſh admiral, after many unſucceſsful rencounters, prepared therefore to make his way home; but as the winds were contrary to his return through the channel, he reſolved to take the circuit of the iſland. The Engliſh fleet followed him for ſome time; and had not their ammunition fallen ſhort through the negligence of the public offices in ſupplying them, they had obliged the armada to ſurrender at diſcretion. Such a concluſion of that vain-glorious enterprize would have been truly illuſtrious to the Engliſh, but the event was ſcarce leſs fatal to the Spaniards. The armada was attacked by a violent ſtorm in paſſing the Orkneys; and the ſhips, having already loſt their anchors, were obliged to keep at ſea, while the mariners, unaccuſtomed to hardſhips, and unable to manage ſuch unwieldy veſſels, allowed them to drive on the weſtern iſles of Scotland, or on the coaſt of Ireland, where they were miſerably wrecked. Not one half of the fleet returned to Spain, and a ſtill ſmaller proportion of the ſoldiers and ſeamen; yet Philip, whoſe command of temper was equal to his ambition, received with an air of tranquillity the news of ſo humbling a diſaſter. "I ſent my fleet (ſaid he) to combat the Engliſh, not the elements. God be praiſed that the calamity is not greater!" This calamity, however, was ſenſibly felt all over Spain, and there was ſcarcely a ſingle family of rank in the kingdom that did not go in mourning for the death of ſome near relation; inſomuch that Philip, dreading the effect which this univerſal face of ſorrow might produce upon the minds of the people, imitated the conduct of the Roman ſenate after the battle of Cannæ, and publiſhed an edict to abridge the time of public mourning.

ARMADILLA, in the Spaniſh America, denotes a ſquadron of men of war, to the number of ſix or eight, from twenty-four to fifty pieces of cannon, which the king maintains, to prevent foreigners from trading with the Spaniards and the Indians, both in time of war and peace.

The veſſels of this armadilla are thoſe that have been ſo much talked of under the name of *guarda coſtas*. They have even power to take all Spaniſh merchantſhips they meet with on the coaſts that have not licences from the king.

The South ſea has its armadilla as well as the North ſea. The ordinary abode of the former are at Calao, a port of Lima; that of the latter at Carthagena.

ARMADILLO, in zoology, a ſynonime of the daſypus. See DASYPUS.

ARMAGEDDON, a place ſpoken of in the Revelations (xvi. 16.), which literally ſignifies the mountain of Mageddon or Megiddo, a city ſituated in the great plain at the foot of mount Carmel, where king Joſiah received his mortal wound in the battle againſt Necho king of Egypt. At Armageddon, the three unclean ſpirits, coming out of the dragon's mouth, ſhall gather together the kings of the earth to the battle of the great day of God Almighty (Rev. xvi. 13,14). The word Armageddon, according to Mr Pool, does not ſignify any particular place, but is here an alluſion, as ſome think, to that of Megiddo, mentioned Judges v. 19. where Barak overcame Siſera with his great army, and where Joſiah was ſlain (2 Kings xxiii. 30). Others tranſlate this word, *the mountain of the goſpel*, and others *the mountain of apples or fruits*.

ARMAGH, a county of Ireland, bounded by Louth on the ſouth; Lough-neagh, on the north; Tyrone and Monaghan, on the weſt; and Down, in part, on the eaſt, from which it is ſeparated by the river Newry. It is in length 32 miles, in breadth 17; and is divided into five baronies, containing about 170,620 acres. Both the air and ſoil are good, eſpecially the latter, which is ſaid to be the richeſt in Ireland; only there is a certain tract in it called the *Fewes*, that is, *hilly* and *barren*. The members it ſends to parliament are ſix, viz. two for the city of Armagh, two for the county, and two for the borough of Charlemont.

Armagh, ſtanding near the river Kalin, gives name to the country, and is the ſee of the primate of all Ireland. It is ſaid to have been founded by St Patrick in the fifth century; and in 1142, it was conſtituted an archbiſhoprick, together with Dublin, Caſhel, and Tuam, by cardinal Papyreo, with the conſent of the king, dukes, biſhops, abbots, and ſtates of Ireland. This Papyreo was ſent into Ireland by Pope Eugenius, to reform the abuſes that had crept into the church-diſcipline of that country. Here was anciently a famous monaſtery built by St Columbo, or Columbanus, about the year 610. The cathedral was often burnt, but as often rebuilt and enlarged, and particularly by Patrick Scanlain, about 1262. His ſucceſſor Nicholas, ſon of Moliſſa, beſide books, rich eccleſiaſtical veſtments, and other things, beſtowed on it an annual penſion of twenty marks. He appropriated alſo to his ſee the manor of Dromyſkin. He died the 10th of May, 1303. This town was firſt ſubjected to the Engliſh by John de Courcy; but afterwards entirely deſtroyed by Tir Oen, or O'Neal, in Queen Elizabeth's time. However, it was afterwards recovered, rebuilt, and garriſoned by the Engliſh.

The ſee of Armagh is valued in the king's books, by an extent taken *anno* 30th Henry VIII. at L. 183, 17 : 5¾ Iriſh money *per annum*, which amounts to

L. 137 : 18 : 0¾ (the difference between Iriſh and Sterling money being at that time one-fourth). But by an extent returned in the 15th of James I. it is valued at L.400 Sterling *per annum*, and pays ſo much firſt fruits to this day. It is reputed to be worth annally L.8000. The chapter of Armagh is compoſed of five dignitaries and four prebendaries, who have voices in every capitular act. The dignitaries are thus ranked, viz. a dean, chapter, chancellor, treaſurer, and archdeacon. There are alſo eight vicars choral, and an organiſt, attendant on the ſervice of the cathedral. The vicars choral were anciently fewer; and of the number only one prieſt. Primate Marſh added another prieſt, but without increaſing the number of vicars. In the year 1720, Primate Lindſay obtained a new charter for enlarging the number of the ſaid vicars to eight, and laid out upwards of L.4000 on a purchaſe, in augmentation of the eſtate of the choir.

ARMAGNAC, a province of Guienne in France, 55 miles in length, and 40 in breadth; bounded on the eaſt by the river Garonne, on the ſouth by Bigorre and Bearn, and on the weſt by Gaſcony, and on the north by Condomois and Agenois: Auch is the capital town. It is fertile in corn and wine, and carries on a conſiderable trade in brandy, wool, and bonchretien pears, which are excellent.

ARMAMAXI, in antiquity, a kind of Scythian chariots or carriages, compoſed of two wheels, variouſly adorned with crowns, ſhields, breaſt-plates, and other ſpoils, carried in proceſſion after the images of the gods and great men.

ARMAMENT, a large body of forces, raiſed and provided with the furniture of war, either for land or ſea ſervice.

ARMATURA, in a general ſenſe, is the ſame with what we otherwiſe call armour.

ARMATURA is more particularly uſed in the ancient military art, for a kind of exerciſe, performed with miſſive weapons, as darts, ſpears, arrows, and the like. In this ſenſe, armatura ſtands contradiſtinguiſhed from palaria; the latter being the exerciſe of the heavy-armed, the former of the light-armed.

The armatura was practiſed with great diligence among the Romans: they had their *campidoctores*, on purpoſe to inſtruct the *tyrones* or young ſoldiers in it. Under it were included the throwing of the ſpear or javelin, ſhooting with bows and arrows, &c.

ARMATURA is alſo an appellation given to the ſoldiers who were light-armed.

ARMATURA is alſo a denomination given to the ſoldiers in the emperor's retinue. Of theſe we find two ſchools, mentioned in the *Notitia imperii*, called the *armaturæ ſeniores* and *armaturæ juniores*. Their commander was intitled *tribunus armaturarum*.

ARMED, in the ſea-language. A croſs-bar ſhot is ſaid to be armed, when ſome rope-yarn or the like is rolled about the end of the iron-bar, which runs thro' the ſhot.

ARMED, in heraldry, is uſed when the horns, feet, beak, or talons, of any beaſt or bird of prey, are of a different colour from the reſt of their body.

ARMED-Ship, a veſſel occaſionally taken into the ſervice of the government in time of war, and employed to guard ſome particular coaſt, or attend on a fleet. She is therefore armed and equipped in all reſpects like a ſhip of war, and commanded by an officer of the navy, who has the rank of maſter and commander. All ſhips of this ſort are upon the eſtabliſhment of the king's ſloops, having a lieutenant, maſter, purſer, ſurgeon, &c.

ARMENE, or ARMINA, anciently a hamlet of Paphlagonia, (Ptolemy). The inhabitants encompaſſed it with a wall, becauſe of the coldneſs of the place, imagining by that means to render it warmer. But this proving ineffectual, gave riſe to the proverb *Armenen muro cingere*, uſed to expreſs ſome egregious folly.

ARMENIA, a country of Aſia, anciently divided into Armenia Major and Minor. Armenia Major according to Strabo, was bounded on the ſouth, by mount Taurus, which ſeparated it from Meſopotamia; on the eaſt, by the two Medias; on the north, by Iberia and Albania, or rather that part of mount Caucaſus which ſurrounds them both; and on the weſt, by Armenia Minor, or the mountains of Paryadres, ſome Pontic nations, and the Euphrates. The moſt conſiderable cities were Artaxata, Tigranocerta, and Thedoſiopolis. —Armenia Minor was bounded on the eaſt, by the Euphrates; on the ſouth, by mount Taurus, which ſeparated it from Cilicia; on the weſt and north, by a long chain of mountains called in different places *Mons Scordiſcus*, *Amanus*, and *Antitaurus*, by which it was ſeparated from Cappadocia.

Whence this tract received the name of *Armenia* is not determined. The Greeks ſuppoſe it to be ſo called from one *Armenus*, who attended Jaſon in the Argonautic expedition, and afterwards ſettled in this country. Others, transforming Armenia into Aramia, derive its name from Aram the ſon of Shem, or from one of the kings of Armenia bearing that name. Bochart imagines it to be a contraction or compound of *Aar*, a Hebrew word ſignifying a "mountain," and *Mini* ſignifying "metal," and which was the name of a province of Armenia mentioned by the prophet Jeremiah.

Herodotus derives the ancient Armenians from the Phrygians, by reaſon that ſeveral Phrygian words were crept into the ancient Armenian language. But Strabo reckons them to have been originally Syrians, which Bochart looks upon to be the moſt probable opinion.

Armenia is ſaid to have been very early advanced to the honour of a kingdom. Beroſus makes one Sytha the firſt founder of this monarchy, whoſe ſucceſſor Bardanes, he ſays, was driven out by Ninus king of Aſſyria. Plutarch mentions one Araxes king of Armenia, who in a war with the Perſians, being aſſured of ſucceſs by an oracle, provided he ſacrificed his two daughters, cauſed the two daughters of one Mieſalcus, a nobleman of his court, to be ſacrificed in their ſtead, flattering himſelf that he thereby complied with the oracle. But Mieſalcus, did not fail to revenge the death of his own daughters by putting the king's two daughters to death, and purſued himſelf ſo cloſely, that he was drowned in attempting to ſwim acroſs the Araxes, which was then called *Helmus*.

The Armenians were in proceſs of time ſubdued by the Medes, to whom Aſtyages made them tributaries, but allowed them to be governed by their own kings; but on the diſſolution of the Median empire by Cyrus, the kingdom was reduced to the form of a province, and they were governed by Perſian prefects or lieutenants. On the deſtruction of the Perſian empire by

Alexander the Great, Armenia fell into the hands of the Macedonians; to whom it continued ſubject till the beginning of the reign of Antiochus the Great. This prince having appointed two prefects called *Zadriades* and *Artaxias* to govern Armenia, they excited the people to a revolt, and cauſed themſelves to be proclaimed kings of the provinces over which they preſided. Antiochus being then very young, they were attended with ſucceſs beyond their expectation; which encouraged them to attempt the enlargement of their territories. Accordingly, invading the neighbouring countries, they took from the Medes the provinces of Caſpiana, Phaunitis, and Baſoropida; from the Iberians, Chorzena and Gogorena on the other ſide of the Cyrus; from the Chalybes and Moſſynæci, the provinces of Pareneta and Herexena, which bordered on Armenia Minor.

On this occaſion, the abovementioned diviſion of the kingdom into Armenia Major and Minor firſt took place. Artaxias became king of Armenia Major, and Zadriades of Armenia Minor; and this diſtinction ſubſiſts even at this day.

By whom Artaxias was ſucceeded is not known; neither have we any account of the tranſactions of his reign, farther than that Antiochus led a powerful army againſt him and Zadriades, but without being able to recover a ſingle province. Upon this he concluded a peace, deſigning to fall upon them at a proper opportunity; but they having entered into alliance with the Romans, by that means ſecured themſelves in the poſſeſſion of their kingdom. After this, Artaxias was defeated and taken priſoner by Antiochus Epiphanes; but ſome how or other, ſeems to have been reſtored to his kingdom.

From this time we meet with a chaſm in the Armenian hiſtory for 70 years; during which all we know is, that Tigranes, the king's ſon, was delivered up as an hoſtage to the Parthians; from whence it is plain, that the Armenians had been carrying on an unſucceſsful war with that nation. On the news of his father's death, however, the Parthians ſet the young king at liberty, having firſt obliged him to give up a conſiderable part of his kingdom by way of ranſom.

Tigranes, being thus reſtored to his father's kingdom, was prevailed upon in the beginning of his reign to enter into an alliance with Mithridates Eupator againſt the Romans, whoſe power began to give jealouſy to all the princes of Aſia. One of the articles of this treaty was, that Mithridates ſhould have the cities and conquered countries, and Tigranes the captives and plunder. In conſequence of this, Tigranes was to invade Cappadocia, which he had lately been obliged, by a decree of the ſenate of Rome, to give up to Ariobarzanes. But before either of the princes took the field, a marriage was ſolemnized with all poſſible magnificence between Tigranes and Cleopatra the daughter of Mithridates.

Immediately after the nuptials, Tigranes ſet out on his intended expedition; and Ariobarzanes, on the firſt news of his march, abandoned his kingdom and fled to Rome. Thus Tigranes, without fighting a ſtroke, enriched himſelf with the booty, and then proclaimed Ariarathes, Mithridates's ſon, king of Cappadocia, to the univerſal ſatisfaction of the people.

In the mean time the Syrians being harraſſed with a long and inteſtine war of the Seleucidæ, invited Tigranes to come and take poſſeſſion of their country; which he accordingly did, and kept it for 18 years, till he was driven out by Pompey, and Syria reduced to the form of a Roman province. Encouraged by this ſucceſs, he next invaded Armenia Minor; defeated and killed king Artanes, who oppoſed him with a conſiderable army; and in one campaign made himſelf maſter of the whole kingdom. From Armenia Minor he marched againſt the Aſiatic Greeks, the Adiabenians, the Aſſyrians, and the Gordians, carrying all before him, and obliging the people wherever he came to acknowledge him ſovereign. From this ſecond expedition he returned home loaded with booty, which he ſoon after increaſed by the ſpoils of Cappadocia, invading that kingdom a ſecond time at the inſtance of Mithridates, who had been obliged by the Romans to withdraw his forces from thence. From Cappadocia, Tigranes, beſides other booty, brought back into Armenia, no fewer than 300,000 captives, having ſurrounded the country with his numerous forces in ſuch a manner that none could eſcape. Theſe, together with the priſoners he had taken in his two firſt expeditions he employed in building the city of Tigranocerta, which they afterwards peopled.

In the mean time Mithridates, who had concluded a peace with the Romans for no other end than to gain time, ſent a ſolemn embaſſy to Tigranes, inviting him to enter into a ſecond alliance againſt the common enemy. This he at firſt declined, but in the end was prevailed upon by his wife Cleopatra to ſend him conſiderable ſupplies, though he never came heartily into the war, not caring to provoke the Romans, who on their part kept fair with him, taking no notice for the preſent of the ſupplies he had ſent Mithridates. That unfortunate prince being ſoon after defeated by Lucullus, was forced to fly for ſhelter into Armenia, where he met with a very cold reception from his ſon-in-law, who would neither ſee him, treat with him, nor own him as his relation: however, he promiſed to protect his perſon, and allowed him in one of his caſtles a princely retinue, and a table ſuitable to his former condition.

Though this total overthrow of Mithridates might have opened the eyes of Tigranes, and made him oppoſe with all his might the growing power of the Romans, he fooliſhly left them to finiſh their conqueſt of Pontus, while he marched at the head of a very numerous army againſt the Parthians, with a deſign to recover from them the dominions they had formerly extorted from him before they ſet him at liberty. Theſe he eaſily retook; and, not ſatisfied with what formerly belonged to him, he added to them all Meſopotamia, the countries that lay about Ninus and Arbela, and the fruitful province of Migdonia; the Parthians, tho' at that time a mighty people, flying every where before him. From Meſopotamia Tigranes marched into Syria to quell a rebellion which had been raiſed by Cleopatra ſurnamed *Selene*; who, after the death of her huſband Antiochus Pius, reigned jointly with her ſons in that part of Syria which Tigranes had not ſeized on. The malcontents were quickly reduced; and the queen herſelf was taken priſoner, and confined to the caſtle of Seleucia, where ſhe was ſoon after put to death by the king's orders. From Syria Tigranes paſſed ed into Phœnice, which he ſubdued either entirely or in great part, ſpreading far and wide the terror of his arms, inſomuch that all the princes of Aſia, except thoſe who were in alliance with the Romans, either in perſon, or by their deputies, ſubmitted and paid homage to the conqueror.

The king, having now ſubdued all Syria to the borders of Egypt, and being elated with a long courſe of victories and proſperous events, began to look upon himſelf as far above the level of other crowned heads. He aſſumed the title of *King of kings*, and had many kings waiting upon him as menial ſervants. He never appeared on horſeback without the attendance of four kings dreſſed in livery, who run by his horſe; and when he gave anſwers to the nations that applied to him, the ambaſſadors ſtood on either ſide the throne with their hands claſped together, that attitude being of all others then accounted among the orientals the greateſt acknowledgment of vaſſalage and ſervitude. In the midſt of all this haughtineſs, however, he was unexpectedly viſited by an ambaſſador from Lucullus the Roman general, who without any ceremony told him, that he came to demand Mithridates king of Pontus, who had taken refuge in his dominions, and, in caſe of his refuſal, to declare war againſt him. Notwithſtanding his high opinion of himſelf, Tigranes returned a mild anſwer to this meſſage: in which, however, he refuſed to deliver up his father-in-law; and being highly provoked at Lucullus for not giving him the title of *King of kings* in his letter, he did not ſo much as beſtow upon him the title of *general* in his anſwer. In the mean time, being informed that Zarbienus king of the Gordians had entered into a private alliance with the Romans, he put him, his wife, and children, to death; and then, returning into Armenia, received with the greateſt pomp imaginable his father-in-law Mithridates, whom to that time he had not admitted into his preſence, though he had reſided a year and eight months in his dominions. They had ſeveral private conferences; and at laſt Mithridates was ſent back to Pontus with 10,000 horſe, to raiſe there what diſturbances he could.

Lucullus, on the other hand, hearing the king's reſolution to protect Mithridates, immediately began his march for Armenia, at the head of only two legions of foot and 3000 horſe, having left 6000 men in Pontus to keep that country quiet. Having paſſed the Euphrates without oppoſition, he detached two parties; one to beſiege a city where he heard that Tigrane's treaſure and concubines were kept; and the other under Sextilius, to block up Tigranocerta, in order to draw the king to a battle. But Tigranes, after having put to death the ſcout that brought him the firſt intelligence of the approach of the Romans, made towards Mount Taurus, which he had appointed for the place of the general rendezvous. The Roman general then diſpatched Muræna in purſuit of the king; who having overtaken him in a narrow paſs, defeated him, and, beſides all the baggage, carried off a great many priſoners, the king himſelf having fled in the beginning of the ſkirmiſh. After this, he ſent out ſeveral parties to ſcour the country, in order to prevent the innumerable forces of Tigranes from joining into one body. This, however, he was not able to effect: Tigranes was joined by ſuch numbers of Gordians, Medes, Adiabenians, Albanians, Iberians, &c. that, before he left Mount Taurus, his army conſiſted, according to Plutarch, of 150,000 foot armed cap-a-pee, 35,000 pioneers, 20,000 archers and ſlingers, and 55,000 horſe.

Lucullus was ſo far from being diſmayed at this formidable army, that the only fear he had was leſt the king ſhould follow the advice of Mithridates, which was not to engage the Romans, but, by ravaging the country, diſtreſs them for want of proviſions. In order to draw him to a battle, therefore, he formed the ſiege of Tigranocerta, imagining that Tigranes would never ſuffer that fine city to be taken without making any attempt to relieve it. The event fully anſwered his expectations: Tigranes having called a council of war, it was unanimouſly reſolved to attack the Romans; and Taxilis, whom Mithridates ſent to diſſuade the king from venturing a battle, was in danger of loſing his head on account of the advice he gave. The Roman general, finding Tigranes diſpoſed to come to an engagement, left Muræna with 6000 men to carry on the ſiege, while he himſelf marched againſt the king's vaſt army with only 10,000 men, according to ſome, and the higheſt computations make them no more than 18,000. The Romans were at firſt greatly diſheartened; but being encouraged by Lucullus, they immediately broke the Armenian army, who betook themſelves to flight almoſt at the firſt onſet. The Romans purſued them till night, making a moſt terrible ſlaughter. Plutarch informs us, that of the Armenians 100,000 foot were killed, and that very few of the cavalry eſcaped; whereas of the Romans only five men were killed and 100 wounded. Antiochus the philoſopher, mentioning this battle, ſays, that the ſun never beheld the like; and Livy, that the Romans never fought at ſuch a diſadvantage; the conquerors not amounting to a twentieth-part of the conquered. Tigranes in his flight having met with his ſon in as forlorn a condition as himſelf, reſigned to him his royal robes and diadem, deſiring him to ſhift for himſelf and ſave thoſe royal enſigns. The young prince delivered them to a truſty friend, who, being taken by the Romans, conſigned them to Lucullus.

While the king was making his eſcape after this terrible overthrow, he was met by Mithridates, who was marching to his aſſiſtance at the head of a conſiderable army. The king of Pontus cheered up his ſon-in-law as well as he could, and encouraged him to continue the war: adviſing him, inſtead of fruitleſsly bewailing the preſent diſaſter, to rally his troops, raiſe new ſupplies, and renew the war, not queſtioning but that in another campaign he might repair all the loſſes he had ſuſtained: but while the two kings were conſulting upon theſe matters, Lucullus made himſelf maſter of Tigranocerta. From this city he marched into the ſmall kingdom of Gordyene, where he celebrated, with the utmoſt pomp, the obſequies of king Zabienus, whom Tigranes had put to death, lighting the funeral-pile with his own hands. In this kingdom, beſides immenſe ſums of gold and ſilver, he met with ſuch ſtore of proviſions as enabled him to carry on the war without putting the republic to any charge.

The two kings, having levied new forces, appointed their troops to rendezvous in the ſpacious plains on the other ſide of Mount Taurus; whereupon Lucullus, leaving Gordyene, and paſſing by Mount Taurus, encamped cloſe by the enemy. Several ſkirmiſhes happened for ſome time between the two armies without any conſiderable advantage; but Lucullus could by no means draw them to a general engagement. Upon this he decamped, as if he deſigned to march to Artaxata and lay ſiege to that place, where Tigranes had left his wife and children, with great part of his treaſures. He had ſcarce formed his camp when the enemy appeared, and ſat down cloſe by him. Lucullus did not allow them to fortify their camp, but immediately attacked them, and having put them to flight after a faint reſiſtance, purſued them all night with great ſlaughter, took moſt of the chief officers priſoners, and returned the next day loaded with booty.

The Roman ſoldiers now, finding the cold very ſevere, though it was no later in the year than the autumnal equinox, requeſted their general to allow them to retire into winter-quarters. This requeſt he rejected with indignation; upon which they mutinied. Lucullus did all he could to perſuade them to continue in their duty; and prevailed ſo far that they conſented to lay ſiege to Niſibis in hopes of booty. This place they took; and Lucullus, to the great ſatisfaction of his troops, took up his winter-quarters there. The next year, however, his forces again mutinied, accuſing him of amaſſing immenſe wealth for himſelf; and throwing their empty purſes at his feet, told him, that as he enriched himſelf alone, he might carry on the war by himſelf. He endeavoured to appeaſe them as much as poſſible; but the ſedition being fomented by a party who favoured Pompey the great, at that time aſpiring to the command of Lucullus's army, the latter found himſelf obliged to ſit ſtill and ſee Mithridates and Tigranes over-run Cappadocia, and recover all Armenia and great part of Pontus. They would have gained much greater advantages, had not a ſon of Tigranes taken arms againſt his father, and obliged him to divide his troops. The father and ſon coming to a pitched battle, the latter was defeated, and forced to ſave himſelf in Parthia, where he perſuaded Phrahates, king of that country, to aſſiſt him with a numerous army againſt his father. Phrahates having laid ſiege to Artaxata, Tigranes the elder was obliged to hide himſelf in the mountainous parts of his kingdom; upon which the king of Parthia returned home. Of this Tigranes the father being appriſed, he immediately abandoned the faſtneſſes of the mountains; and, falling upon his ſon at Artaxata, diſperſed the rebels with great ſlaughter; and entered his metropolis in triumph. Tigranes the ſon firſt fled to Mithridates; but finding him reduced to great ſtraits, having been overcome a few days before, with the loſs of 40,000 men, by Pompey, he went over to the Romans, and led them into Armenia againſt his father as an ally of Mithridates.

Tigranes, being now quite diſpirited, and unable to make head againſt the Romans, reſolved at once to ſubmit. Accordingly he waited on Pompey in his camp, and having delivered his ſword to two lictors, proſtrated himſelf before him, and laid his diadem at his feet. Pompey, however, gave him a gracious reception, reſtored him the kingdom of Armenia, but fined him of 6000 talents for making war on the Roman people without cauſe. As the king had appealed to the Roman general for juſtice againſt his ſon, Pompey heard both parties the next day, and made the ſon governor of Gordyene and Sophene; but the treaſures that were kept in the latter he adjudged to the father, becauſe without them he could not pay the fine. The ſon, being thus diſappointed, endeavoured firſt to make his eſcape, and afterwards, by private meſſengers, ſolicited the inhabitants not to deliver up the treaſures to his father. This being taken very much amiſs by Pompey, he cauſed him to be kept in irons; and even then he found means to ſtir up Phrahates king of Parthia, whoſe daughter he had married, againſt the Romans, and to form a conſpiracy againſt his father's life, whereupon Pompey ſent him in chains to Rome, where he was kept priſoner in the houſe of L. Flavius a ſenator, till the tribuneſhip of P. Clodius, who, being bribed with a large ſum of money, ſet him at liberty in ſpite of Pompey and the ſenate.

Tigranes being now thoroughly humbled, willingly yielded to the Romans Cappadocia, Syria Cilicia, and that part of Phœnice which he poſſeſſed, contenting himſelf with his paternal kingdom; and not only paid the fine laid upon him, but made large preſents to Pompey, and all the officers of his army, which procured him the title of *the friend and ally of the Roman people*. He afterwards entered into a war with Phrahates king of Parthia, by whom he was overcome, and would have been driven out of his kingdom, had not a peace been brought about by the mediation of Pompey. He ever after cultivated a ſtrict friendſhip with the Romans; inſomuch that he not only refuſed to receive Mithridates, who fled to him after he had been routed by Pompey near Mount Stella, but even offered a reward of 100 talents to any one that would put him to death. His ſecond ſon alſo, by name Sariaſter, took up arms againſt him; but, by the aſſiſtance of the Romans, that rebellion was ſoon quelled. He died in the 85th year of his age; and was ſucceeded by his ſon Artuaſdes, called by Joſephus *Artabazes*, by Oroſius *Artabanes*, and by others *Artoadiſtes*.

From this time to the time of Trajan Armenia was governed by its own kings; but as they were plainly vaſſals to the Romans, though they did not take that title till the reign of the emperor Nero, their hiſtory falls to be conſidered under that of the Romans.

By Trajan the kingdom of Armenia Major was reduced to the form of a Roman province; but it ſoon recovered its liberty, and was again governed by its own kings in the reigns of Conſtantine the Great, and his ſucceſſor, to whom the kings of Armenia were feudatories. In the reign of Juſtin II. the Saracens ſubdued and held till the irruption of the Turks, who poſſeſſed themſelves of this kingdom, and gave it the name of *Turcomania*. The Turks, after the reduction of Armenia, invaded Perſia, and other countries ſubject to the emperors of the eaſt; which gave the Armenians an opportunity of ſhaking off the Turkiſh yoke, and ſetting up kings of their own, by whom they were governed till the country was again ſubdued by Occadan, or, as ſome ſtyle him, *Heccata*, the ſon of Cingis, and firſt cham of the Tartars. Neither was the conqueſt of Armenia by the Tartars ſo abſolute as to extirpate the race of their kings; ſeeing we read of Haithon, ſurnamed the *Armenian*, reigning ſome time after, and going in perſon to treat with Mungo, the great cham of Tartary, of the concerns of his kingdom; and in our chronicles we find mention made of

Leo king of Armenia, who, in the reign of Richard II. came into England to ſue for aid againſt the Turks, by whom he had been driven from his kingdom. In the year 1472 of the Chriſtian æra, Uſſan Caſſanes king of Armenia ſucceeding to the crown of Perſia, made Armenia a province of that empire; in which ſtate it continued till the year 1522, when it was ſubdued by Selim II. and made a province of the Turkiſh empire. Some ſay that Selim I. reduced it on his return from Perſia, where he had gained a complete victory over the great Sophi Iſmael. But Sanſovin aſſures us, that in the reign of Selim I. who died in 1520, both the Leſſer and Greater Armenia had their own kings; and adds, that Selim cauſed the head of the king of the Leſſer Armenia to be cut off and ſent to Venice as a mark of his victory. We read no where elſe of any kings of Armenia after it became a province of Perſia. Be that as it will, the Turkiſh annals cited by Calviſius inform us, that Selim II. conquered Armenia in 1522, ſince which time it has ever continued ſubject to the Turks, except the eaſtern part, which the Perſians are maſters of to this day.

Concerning Armenia Minor we find very little recorded, except what has been already mentioned, and what falls under the Roman hiſtory. It was made a Roman province by Veſpaſian, continued ſo till the diviſion of the empire, when it was ſubjected to the emperors of the eaſt; and, on the decline of their power, was ſubdued firſt by the Perſians, and afterwards by the Turks, who gave it the name of *Genech*, and have kept it ever ſince.

This country is ſtill divided into the Great and Small. Great Armenia comprehends what is now called *Turcomania*. It has Georgia on the north, from which it is ſeparated by high mountains; the river Euphrates on the weſt; Diarbeker, Curdiſtan, and Aderbijan, on the ſouth; and Shirvan on the eaſt. The chief towns in that part of Armenia belonging to Turky are, Arzum the capital, near the ſprings of the Euphrates, a large city, and a great thoroughfare for the caravans between Turky and Perſia; Kara, a ſtrong city, head of the government of the ſame name; Bayazid, a republic of Hurds, near mount Ararat: Baha, another republic of the ſame; and Van or Wan, on the lake Van, the head of a government of the ſame name; with other towns of leſs note. That part of Armenia ſubject to Perſia is chiefly contained in the province of Aran, in which are ſeveral fine towns; as, Erivan or Rivan, the capital of the whole; Ganjals, one of the fineſt cities in Perſia, in the north of the province, near the Kur; Kapan, on the ſouth ſide, near the Aras; beſides Nakchivan, Aſtabad Sulſa, Ordabad, Baylakan or Pilkan, on the Aras; Berdah and Shilkah on the Kur.

The country in general is full of mountains and valleys, lakes, and rivers; particularly the country about the three churches, near Erivan, is admirably fine, being full of rivulets, which render it extremely fruitful. Beſides great quantities of all ſorts of grain, here are fields of a prodigious extent covered with tobacco: but it is not a native of the place, though ſuppoſed by ſome to be the terreſtrial paradiſe; for it all came originally from America. The reſt of the country produces rice, cotton, flax, melons, and grapes: in ſhort, there is nothing wanting but olives; which is by ſome thought to prove that the ark could not reſt on mount Ararat, becauſe the dove brought an olive branch in her mouth, and this tree never leaves a place where it once grew. It ſeems, however, to have been otherwiſe anciently; for Strabo tells us, that the olive grew in Gogarene, a province of Armenia. They got oil to burn from the ricinus, and uſe linſeed oil in the kitchen. The water-melons are as cool as ice in the hotteſt day, and melt in the mouth: the beſt are produced in the ſalt-lands, near the three churches and the river Aras. After rain, the ſea-ſalt lies in cryſtals upon the fields, and even crackles under the feet. About ten miles from the three churches, in the road to Teflis, there are pits or quarries of foſſile ſalt, which yield enough to ſupply all Perſia, without being exhauſted: they cut it into large pieces like ſtone, and each buffalo carries two of them; the mountain from whence it is dug is nothing but a maſs of ſalt, which appears like a rock of ſilver, when the ſun ſhines, on the places not covered with earth.

This country has been remarkable for its extreme cold from the remoteſt antiquity: Sir John Chardin tells us, that he found ice in the rivulets in the mornings even of the month of July. In many places, alſo, if they had not the convenience of watering their grounds, they would be almoſt entirely barren.

The Armenians are an honeſt, civil, polite people, ſcarce troubling themſelves about any thing elſe but trade, which they carry on in moſt parts of the world, by which means they have ſpread themſelves over the eaſt, and alſo great part of Europe; and wherever they come, commerce is carried on with ſpirit and advantage.

The religion of the Armenians is the Chriſtian, of the Eutychian ſect: that is, they own but one nature in Jeſus Chriſt; and when they ſpeak of the hypoſtatical union, that he is perfect God and perfect man without mixture. They have a high eſteem for a book they call the *Little Goſpel*, which treats of the Infancy of Jeſus, and ſays that the Virgin Mary being pregnant, her ſiſter Salome accuſed her of having proſtituted herſelf; to which the Virgin anſwered, that ſhe needed only to lay her hand on her belly, and ſhe would know how ſhe came to be with child; this Salome accordingly did, and fire came out of her belly, which conſumed the half of her arm; upon which ſhe acknowledged her fault, and drew it back: after which it was healed by putting it to the ſame place.

The Armenian clergy conſiſt of patriarchs, archbiſhops, doctors, ſecular prieſts, and monks. The ſecular prieſts are not allowed to marry a ſecond time; and therefore they take care to chooſe young healthy wives: they maintain themſelves and families by following ſome occupation, inſomuch that they have hardly time to perform their eccleſiaſtical functions: they lie in the churches on the vigils of thoſe days they are obliged to officiate.

The Armenian monks are of the order of St Baſil; and every Wedneſday and Friday they eat neither fiſh nor eggs, nor oil, nor any thing made of milk, and during Lent they live upon nothing but roots: they are allowed wine only on the Saturday in the Holy Week, and meat on the Eaſter Sunday. Beſides the great Lent, they have four others of eight days each, which are inſtituted to prepare for the four great feſtivals of the Nativity, the Aſcenſion, the Annunciation, and of St George; in which times they muſt not ſo much as ſpeak of eggs, fiſh, oil, or butter.

The Armenians have ſeven ſacraments; baptiſm, confirmation, penance, the euchariſt, extreme unction, orders and matrimony. In baptiſm, the child is plunged three times into the water, and the ſame form of words that is uſed with us is repeated every time; the prieſt then puts a ſmall cord made with ſilk and cotton on the neck of the infant, and anoints his forehead, chin, ſtomach, arm-pits, hands, and feet, making the ſign of the croſs on each part. When the child is baptized, he is carried home by the godfather with the ſound of drums and trumpets. The women do not go to church till forty days after their delivery; and they obſerve many Jewiſh cuſtoms.

At the communion, to which infants of two or three months old are admitted, the prieſts give a piece of the conſecrated hoſt ſoaked in the conſecrated wine. The elements are covered with a great veil, and placed in a cup-board near the altar, on the ſide of the goſpels. When the prieſt takes the chalice and pattin, he is followed by his deacons and ſubdeacons, with flambeaux and plates of copper furniſhed with bells: in this manner, with a cenſer before him, he goes in proceſſion round the ſanctuary; he then ſets them on the altar, pronounces the words of conſecration, and turns himſelf to the people, who fall down, kiſs the earth, and beat their breaſts: then, after taking it himſelf, he diſtributes the hoſt ſoaked in wine to the people.

The Armenians ſeem to place the chief part of their religion in faſtings and abſtinences: and among the clergy, the higher the degree the lower they muſt live; inſomuch that it is ſaid the archbiſhops live on nothing but pulſe. They conſecrate holy water but once a-year; at which time every one fills a pot and carries it home, which brings in a conſiderable revenue to the church.

ARMENICA. See PRUNUS.

ARMENIAN, ſomething belonging to or produced in Armenia: thus we ſay, *Armenian bole*, *Armenian ſtone*, &c. See BOLE and *ARMENUS Lapis*.

ARMENTIERS, a ſmall handſome town of the Netherlands, in the county of Flanders, and diſtrict of Ypres. It was taken by Lewis XIV. in 1667, who diſmantled it; and it now belongs to the French. It is ſeated on the river Lis. E. Long. 3. 3. N. Lat. 50. 40.

ARMENUS LAPIS, *Armenian ſtone*, in natural hiſtory, a mineral ſubſtance, which is but improperly called a *ſtone*; being no other than an ocherous earth, and properly called *blue ochre*. It is a very valuable ſubſtance in painting, being a bright and lively blue. It was in ſo high eſteem as paint among the ancients, that counterfeits were continually attempted to ſerve in its place. Theophraſtus has recorded it as a thing judged worthy a place in the Egyptian annals, which of their kings had the honour of inventing the factitious kind; and he tells us the genuine native ſubſtance was a thing of that value, that preſents were made of it to great perſons, and that the Phœnicians paid their tribute in it.—It is a very beautiful earth, of an even and regular texture; and of a fine blue, ſometimes deeper, ſometimes paler, and frequently mixed with green. It is ſoft, tender, and light; of an even, but ſomewhat duſty, ſurface; it adheres firmly to the tongue, and is dry, but not harſh to the touch. It eaſily breaks between the fingers, and does not ſtain the hands. It is of a brackiſh diſagreeable taſte, and does not ferment with acids. It is a very ſcarce foſſil; but is found very pure, though in but ſmall quantities, in the mines at Göſſelaer in Saxony. It is frequently found ſpotted with green, and ſometimes with black; and very often is mixed among the green ochre, called *berggruen* by the Germans, which has thence been erroneouſly called by its name. See further the article BICE.

AMIERS, a town of Hainhault, in the French Netherlands, ſeated on the river Samber. E. Long. 3. 45. N. Lat. 50. 15.

ARMIGER, a title of dignity, belonging to ſuch gentlemen as bear arms: and theſe are either by curteſy, as ſons of noblemen, eldeſt ſons of knights, &c.; or by creation, ſuch as the king's ſervants, &c. See ESQUIRE.

ARMILLARY, in a general ſenſe, ſomething conſiſting of rings or circles.

ARMILLARY Sphere, an artificial ſphere compoſed of a number of circles of the mundane ſphere, put together in their natural order, to eaſe and aſſiſt the imagination in conceiving the conſtitution of the heavens, and the motions of the celeſtial bodies. The armillary ſphere revolves upon its axis within a ſilvered horizon, which is divided into degrees, and moveable every way upon a braſs ſupporter. The other parts are the equinoctial, zodiac, meridian, the two tropics, and the two poplar circles. See GEOGRAPHY.

ARMILUSTRIUM, in Roman antiquity, a feaſt held among the Romans, in which they ſacrificed, armed to the ſound of trumpets.

ARMINIANS, a religious ſect, or party, which aroſe in Holland, by a ſeparation from the Calviniſts. They followed the doctrine of Arminus (ſee the next article); who, thinking the doctrine of Calvin, with regard to free-will, predeſtination, and grace, too ſevere, began to expreſs his doubts concerning them in the year 1591; and upon further inquiry adopted ſentiments more nearly reſembling thoſe of the Lutherans than of the Calviniſts. After his appointment to the theological chair at Leyden, he thought it his duty to avow and vindicate the principles which he had embraced; and the freedom with which he publiſhed and defended them expoſed him to the reſentment of thoſe that adhered to the theological ſyſtem of Geneva, which then prevailed in Holland; but his principal opponent was Gomar, his colleague. The controverſy which was thus begun, became more general after the death of Arminius, in the year 1609, and threatened to involve the United Provinces in civil diſcord. The Arminian tenets gained ground under the mild and favourable treatment of the magiſtrates of Holland, and were adopted by ſeveral perſons of merit and diſtinction. The Calviniſts, or Gomariſts, as they were now called, appealed to a national ſynod: accordingly the ſynod of Dort was convened by order of the States General, in 1618, and was compoſed of eccleſiaſtical deputies from the United Provinces, as well as from the reformed churches of England, Heſſia, Bremen, Switzerland, and the Palatinate. The principal advocate in favour of the Arminians was Epiſcopius, who at that time was profeſſor of divinity at Leyden. It was firſt propoſed to diſcuſs the principal ſubjects in diſpute, and that the Arminians ſhould be allowed to ſtate and vindicate the grounds on which their opinions were founded: but ſome difference ariſing as to the proper mode of conducting the debate, the Arminians were excluded from the aſſembly; their caſe was tried in their abſence; and they were pronounced guilty of peſtilential errors, and condemned as corrupters of the true religion. In conſequence of this deciſion, they were treated with great ſeverity; they were deprived of all their poſts and employments; their miniſters were ſilenced, and their congregations were ſuppreſſed. However, after the death of prince Maurice, who had been a violent partizan in favour of the Gomariſts, in the year 1625, the Arminian exiles were reſtored to their former reputation and tranquillity; and under the toleration of the ſtate, they erected churches and founded a college at Amſterdam, appointing Epiſcopius to be the firſt theological profeſſor. The Arminian ſyſtem has very much prevailed in England ſince the time of archbiſhop Laud, and its votaries in other countries are very numerous.

The diſtinguiſhing tenets of the Arminians may be compriſed in the following five articles; relating to predeſtination, univerſal redemption, the corruption of man, converſion, and perſeverance.

1. With reſpect to the firſt, they maintained, “That God, from all eternity, determined to beſtow ſalvation on thoſe who he foreſaw would perſevere unto the end in their faith in Chriſt Jeſus; and to inflict everlaſting puniſhments on thoſe who ſhould continue in their unbelief; and reſiſt unto the end his divine ſuccours: ſo that election was conditional, and reprobation in like manner the reſult of foreſeen infidelity and perſevering wickedneſs.”

2. On the ſecond point, the Arminians taught, “That Jeſus Chriſt by his ſufferings and death, made an atonement for the ſins of all mankind in general, and of every individual in particular; that, however, none but thoſe who believe in him can be partakers of their divine benefit.”

3. On the third article, they held, “That true faith cannot proceed from the exerciſe of our natural faculties and powers, nor from the force and operation of free will; ſince man, in conſequence of his natural corruption, is incapable either of thinking or doing any good thing; and that therefore it is neceſſary, in order to his converſion and ſalvation, that he be regenerated and renewed by the operation of the Holy Ghoſt, which is the gift of God through Jeſus Chriſt.”

4. “That this divine grace, or energy of the Holy Ghoſt, begins and perfects every thing that can be called good in man, and conſequently all good works are to be attributed to God alone; that, nevertheleſs, this grace is offered to all, and does not force men to act againſt their inclination, but may be reſiſted and rendered ineffectual by the perverſe will of the impenitent ſinner.” Some modern Arminians interpret this and the laſt article with a greater latitude.

5. “That God gives to the truly faithful, who are regenerated by his grace, the means of preſerving themſelves in this ſtate;” and though the firſt Arminians made ſome doubt with reſpect to the cloſing part of this article, their followers uniformly maintain, “that the regenerate may loſe true juſtifying faith, forfeit their ſtate of grace, and die in their ſins.”

The modern ſyſtem of Arminianiſm likewiſe, founded on a comprehenſive plan projected by Arminius himſelf, as appears from a paſſage in his laſt will, extends the limits of the Chriſtian Church, and relaxes the bonds of fraternal communion in ſuch a manner, that Chriſtians of all ſects and denominations, whatever their ſentiments and opinions may be, papiſts excepted, may be formed into one religious body, and live together in brotherly love and concord. But, in order to avoid the reproach of being altogether unconnected by any common principles, Epiſcopius drew up a confeſſion of faith, expreſſed for the moſt part in words and phraſes of Holy Scripture, which the Arminians have generally adopted, though not enjoined upon them by any authoritative obligation. The Arminians are alſo called *Remonſtrants*, from an humble petition intitled their *Remonſtrance*, which, in the year 1610, they addreſſed to the States of Holland. Their principal writers are, Arminius, Epiſcopius, Vorſtius, Grotius, Curcellæus, Limborch, Le Clerc, and Wetſtein, not to mention many others of more modern date.

ARMINIUS (James), whoſe real name in Low Dutch was James Harmanni, a famous proteſtant divine, from whom the modern ſect of Arminians (ſee the preceding article) take their name, was born at Oude-water, in Holland, in 1560. He was ordained miniſter at Amſterdam on the 11th of Auguſt 1588; when he ſoon diſtinguiſhed himſelf by his ſermons, which were remarkable for their ſolidity and learning, and gained him univerſal applauſe: but Martin Lydias, profeſſor of divinity at Franker, judging him a fit perſon to refute a writing in which Beza's doctrine of predeſtination had been attacked by ſome miniſters of Delft, Arminius at his intreaties undertook the taſk; but upon thoroughly examining the reaſons on both ſides, he came into the opinions he propoſed to deſtroy, and afterwards went ſtill farther than the miniſters of Delft had done. In 1600, he oppoſed thoſe who maintained that miniſters ſhould ſubſcribe the confeſſion and catechiſm every year. In 1602, a peſtilential diſeaſe raged at Amſterdam, during which he acted with the greateſt reſolution and courage, in aſſiſting the poor, and comforting the ſick; and Lucas Treclatius and Francis Junius dying of that diſeaſe at Leyden, the curators of that univerſity choſe Arminius profeſſor of divinity there, and he was afterwards made doctor of divinity. Diſputes upon grace were ſoon after kindled in that univerſity; and he was at length engaged in a new conteſt, occaſioned by a diſputation of his concerning the divinity of the Son. Theſe conteſts, his continual labour, and the concern of ſeeing his reputation blaſted by a multitude of ſlanders in relation to his opinions, impaired his health, and threw him into a fit of ſickneſs, of which he died on the 19th of October 1609. Arminius was eſteemed an excellent preacher: his voice was low, but very agreeable; and his pronunciation admirable: he was eaſy and affable to perſons of all ranks, and facetious in his converſation amongſt his friends. His great deſire was, that Chriſtians would bear with one another in all controverſies which did not affect the fundamentals of their religion; and when they perſecuted each other for points of indifference, it gave him the utmoſt diſſatisfaction. The curators of the univerſity of Leyden had ſo great a regard for him, that they ſettled a penſion upon his wife and children. He left ſeveral works, viz. 1. "Diſputationes de diverſis Chriſtianæ religionis capitibus. 2. Orationes itemque tractatus inſigniores aliquot. 3. Examen modeſti libelli Gulielmi Perkinſii de predeſtinationis modo et ordine, itemque de amplitudine gratiæ divinæ. 4. Analyſis capitis noni ad Romanos. 5. Diſſertatio de vero et genuino ſenſu capitis ſeptimi epiſtolæ ad Romanos. 6. Amica collatio cum D. Franciſco Junio de prædeſtinatione per literas habita. 7. Epiſtola ad Hippolytum a collibus."

ARMIRO, a town of Macedonia, in European Turky, ſeated on the Gulph de Velo. E. Long. 23. 40. N. Lat. 38. 34.

ARMISTICE, in military affairs, a temporary truce or ceſſation of arms for a very ſhort ſpace of time. The word is Latin, *armiſtitium;* and compounded of *arma,* "arms," and *ſto*", to ſtand, or ſtop."

ARMOISIN, a ſilk ſtuff, or kind of taffety, manufactured in the Eaſt-Indies, at Lyons in France, and at Lucca in Italy. That of the Indies is ſlighter than thoſe made in Europe.

ARMONIAC. See Ammoniac.

ARMONICA. See Harmonica.

ARMORIAL, ſomething relating to arms, or coats of arms. See Arms and Heraldry.

ARMORIC, or Aremoric, ſomething that belongs to the province of Bretagne, or Britanny, in France. The name *Armorica* was antiently given to all the northern and weſtern coaſt of Gaul, from the Pyreneans to the Rhine; under which name it was known even in Cæſar's time. The word is of Bas Breton origin, and denotes as much as *maritime;* compounded, according to M. Menage, of *ar,* "upon," and *more,* "ſea."

ARMORIST, a perſon ſkilled in the knowledge of armory.

ARMORUM concussio, the claſhing of armour practiſed by the Roman armies previous to an engagement, and intended to ſtrike a panic into their enemies: It always followed the Claſſicum and the Barritus. See Classicum and Barritus.

ARMOUR, a defenſive habit, wherewith to cover and ſecure the body from the attacks of an enemy. In ancient ſtatutes this is frequently called *harneſs.*—Parts of armour are, the buckler, cuiraſs, helmet, coat of mail, gantlet, &c.

A complete armour anciently conſiſted of a caſque or helm, a gorget, cuiraſs, gantlets, taſſes, braſſets, cuiſhes, and covers for the legs, to which the ſpurs were faſtened. This they called *armour cape-a-pie;* and was the wear of the cavaliers and men at arms.—The infantry had only part of it; viz. a pot or headpiece, a cuiraſs, and taſſes; but all light. Laſtly, the horſes themſelves had their armour, wherewith to cover the head and neck.—Of all this furniture of war, ſcarce any thing is now retained except the cuiraſs; the gorget or neck piece, worn by officers, being at preſent only a badge of honour, and of no defence.

The gallantry of going to the battle naked, without any defenſive armour, prevailed ſo far, that the French, during the reign of Lewis XIV. were obliged to be continually iſſuing ordinances to reſtrain it; in conſequence of which the general officers, and thoſe of the cavalry, were obliged to reſume the cuiraſs, which yet has been but ill obſerved.

Armour, Coat, is the eſcutcheon of any perſon, or family, with its ſeveral charges, and other furniture; as mantling, creſt, ſupporters, motto, &c.—Thus we ſay, a gentleman of coat-armour; meaning one who bears arms.

ARMOURER, a maker of arms, or armour.—The Roman armourers were diſpoſed in certain places in the empire, it being forbid either to ſell, or buy, or make arms elſewhere. They were exempt from all offices and taxes, and received a ſalary from the public.

When once they had taken the employment on themſelves, neither they, nor their children, were allowed to quit it. To prevent this, they had a kind of note, or ſtigma, impreſſed on the arm, whereby they might be known. If any of them fled, or ſecreted their ware, the reſt were obliged to anſwer for him; on account of which, the effects of ſuch as died without a legal heir went to the college.—There were 15 armamentaries, or repoſitories of arms, in the Eaſtern empire, placed near the frontiers, and 19 in the Weſtern.

Armourer of a ſhip, a perſon whoſe office is to take care that the arms be in a condition fit for ſervice.

ARMOURY, a ſtore-houſe of arms, or a place wherein military habiliments are kept, to be ready for uſe. There are armouries in the Tower of London, and in all arſenals, citadels, caſtles, &c.

Armoury is alſo uſed for a branch of heraldry; being the knowledge of coat-armours, as to their blazons, and various intendments.

ARMOZA, or Harmozia, a town in Carmania, at the mouth of the Anamis, which falls into the Perſian gulph, (Arrian); *Armuza,* (Ptolemy); and from this the neighbouring iſland, and a ſmall kingdom, take the modern name of *Ormus.* E. Long. 56. 17. N. Lat. 27. 20.

ARMS, Arma, in a general ſenſe, includes all kinds of weapons, whether for defence or offence. Nicod derives the word from the Latin phraſe *quod operiant armos,* becauſe they cover the ſhoulders or ſides; but Varro derives *arma, ab arcendo, eo quod arceant hoſtes.* It is ſuppoſed that the firſt artificial arms were of wood, and were only employed againſt beaſts; and that Belus, the ſon of Nimrod, was the firſt that waged war: whence, according to ſome came the appellation *bellum.* Diodorus Siculus takes Belus to be the ſame with Mars, who firſt trained ſoldiers up to battle.—Arms of ſtone, and even of braſs, appear to have been uſed before they came to iron and ſteel. Joſephus aſſures us, that the patriarch Joſeph firſt taught the uſe of iron arms in Egypt, arming the troops of Pharoah with a caſque and buckler.

What contributed moſt to render the Romans maſters of the world, was, that having ſucceſſively warred againſt all nations, they conſtantly renounced their own methods, arms, &c. whenever they met with better. Thus Romulus during his war with the Sabins, a bold and warlike nation, adopted their broad buckler in lieu of the ſmall Argian buckler, which he had uſed till that time.

The principal arms of the ancient Britons were hatchets, ſcythes, lances, ſwords, and bucklers: the Saxons, &c. brought in the halbard, bow, arrows, arbalets, &c. By the ancient laws of England, every man was obliged to bear arms; except the judges and clergy. Under Henry VIII. it was expreſsly enjoined on all perſons to be regularly inſtructed, even from their their tender years, in the exerciſe of the arms then in uſe: viz. the long bow and arrows; and to be provided with a certain number of them. 33 H. VIII.

ARMS, *Arma*, in law, are extended to any thing which a man takes in his hand in his wrath, to caſt at, or ſtrike another

By the common law, it is an offence for perſons to go or ride armed with dangerous weapons: but gentlemen may wear common armour, according to their quality, &c. 3d Inſt. The king may prohibit force of arms, and puniſh offenders according to law; and herein every ſubject is bound to be aiding. Stat. 7. Edw. I. None ſhall come with force and arms before the king's juſtices, nor ride armed in affray of the peace, on pain to forfeit their armour, and to ſuffer impriſonment, &c. 2 Ed. III. c. 3.

The importation of arms and ammunition are prohibited by 1 Jac. II. c. 8. and by 1 W. and M. ſtat. 2. c. 2. Proteſtant ſubjects may have arms for their defence. So likewiſe arms, &c. ſhipped after prohibition, are forfeited by 29 Geo. I. c. 16. ſec. 2.

Arms of offence in uſe among us at preſent are, the ſword, piſtol, muſket, bayonet, pike, &c.

The arms of the Highlanders are, the broad ſword, target, poignard, and whinyar or durk, &c. There are ſeveral acts of parliament for diſarming the Highlanders; ſee 1 Geo. I. c. 54.; 11 Geo. I. c. 26.; 19 Geo. II. c. 39.; 21 Geo. II. c. 34.; 26 Geo. II. c. 22. and 29.

Fire-Arms are thoſe charged with powder and ball: ſuch are cannon, mortars, and other ordnance; muſkets, carabines, piſtols, and even bombs, granadoes, carcaſſes, &c. In the hiſtory of the Royal Academy for the year 1707, we have an account of ſome experiments made with fire-arms differently loaded by M. Caſſini. Among other things he obſerves, that by loading the piece with a ball which is ſomewhat leſs than the calibre, and only laying a little gunpowder below the ball and a good deal above it, it will yield a vehement noiſe, but have no ſenſible effect or impulſe on the ball. This he takes to have been all the ſecret of thoſe people who pretended to ſell the art of rendering one's ſelf invulnerable or ſhot-proof.

Arms, paſs of, was a kind of combat in uſe among the ancient cavaliers.

Arms, ſtand of. A ſtand of arms ſignifies a muſket, a bayonet, a ſword, belt, and cartridge-box.

Arms of parade, or *courteſy,* were thoſe uſed in the ancient juſts and tournaments; which were commonly unſhod lances, ſwords without edge or point, wooden ſwords, and even canes.

ARMS denote the natural weapons, or parts of defence, of beaſts: as claws, teeth, tuſks of elephants, beaks of birds, &c.

ARMS are alſo uſed figuratively for the profeſſion of a ſoldier. Thus we ſay, he was bred to arms.

ARMS, or *Armories,* are alſo uſed in heraldry for marks of dignity and honour, regularly compoſed of certain figures and colours, given or authoriſed by ſovereigns, and borne in banners, ſhields, coats, &c. for the diſtinction of perſons, families, and ſtates; and paſſing by deſcent to poſterity. They are called *arms,* in regard they are borne principally on the buckler, cuiraſs, banners, and other apparatus of war. They are alſo called *coats of arms, coat armour,* &c. becauſe anciently embroidered on ſur-coats, &c. See HERALDRY. Some will have the name to have been firſt occaſioned by the ancient knights, who in their juſts and tournaments bore certain marks (which were frequently their miſtreſs's favours) in their armour, i. e. their helms or ſhield, to diſtinguiſh them from each other.

ARMS, at preſent, follow the nature of titles, which being made hereditary, theſe are alſo become ſo, being the ſeveral marks for diſtinguiſhing of families and kindreds, as names are of perſons and individuals.

ARMS are variouſly diſtinguiſhed by the *Heralds.*

Arms of alliance, are thoſe which families or private perſons join to their own, to denote the alliances which they have contracted by marriage.

Arms, aſſumptive, are ſuch as a man has a right to aſſume of himſelf, in virtue of ſome gallant action.

As, if a man who is no gentleman of blood, nor has coat armour, takes a gentleman, lord, or prince, priſoner, in any lawful war; he becomes intitled to bear the ſhield of ſuch priſoner, and enjoy it to him and his heirs. The foundation hereof is that principle in military law, that the dominion of things taken in lawful war paſſes to the conqueror.

Arms, canting, are thoſe wherein the figures bear an alluſion to the name of the family. Such are thoſe of the family of La Tour in Auvergne, who bear a tower; that of the family of Prado in Spain, whoſe field is a meadow. Moſt authors hold theſe the moſt noble and regular, and is ſhown by an infinity of inſtances produced by Father Varenne and Menetrier. They are much debaſed, when they come to partake of the *Rebus.*

Arms, charged, are ſuch as retain their ancient integrity and value, with the addition of ſome new honourable charge or bearing, in conſideration of ſome noble action.

Arms of community, are thoſe of biſhoprics, cities, univerſities, and other bodies corporate.

Arms of conceſſion, or augmentation of honour, are either entire arms, or elſe one or more figures given by princes, as a reward for ſome extraordinary ſervice.

Arms of dominion, are thoſe which emperors, kings, and ſovereign ſtates bear; being annexed to the territories which they poſſeſs. Thus the three lions are the arms of England; the fleurs de lys thoſe of France, &c.

Arms of family, or *paternal arms,* are ſuch as belong to a particular family, and which no other perſon has a right to aſſume.

Arms, full, or *entire,* are ſuch as retain their primitive purity, integrity, or value; without any alterations, diminutions, abatements, or the like. It is a rule, that the ſimpler and leſs diverſified the arms, the more noble and ancient they are. For this reaſon Garcias Ximenes, firſt king of Navarre, and his ſucceſſors for ſeveral ages, bore only gules, without any figure at all.

The arms of princes of the blood, of all younger ſons, and junior families, are not pure and full; but diſtinguiſhed and diminiſhed by proper differences, &c.

Arms of patronage, are thoſe which governors of provinces, lords of manors, &c. add to their family arms, in token of their peculiar ſuperiority and juriſdiction.

Arms of pretenſion, are thoſe of ſuch kingdoms or territories to which a prince or lord has ſome claim, and which he adds to his own, though the kingdoms or territories be poſſeſſed by a foreign prince or other lord. Thus the kings of England have quartered the arms of France with their own, ever ſince the claim of Edward III. to that kingdom, in 1330.

Arms of ſucceſſion, are aſſumed by thoſe who inherit eſtates, manors, &c. by will, entail, or donation, and which they either impale or quarter with their own arms.

Arms are alſo ſaid to be *parted*, *couped*, *quartered*, &c.

Arms are ſaid to be *falſe* and *irregular*, when there is ſomething in them contrary to the eſtabliſhed rules of heraldry. As, when metal is put on metal, or colour on colour, &c.

The laws and other affairs of arms, with the cognizance of offences committed therein, belong to the marſhals and colleges of arms.

Arms in falconry, denote the legs of an hawk, from the thigh to the foot. See Falconry.

ARMSTRONG (Dr John), an eminent phyſician, poet, and miſcellaneous writer, was born in Caſtleton pariſh, Roxburghſhire, where his father and brother were miniſters; completed his education in the univerſity of Edinburgh, where he took his degree in phyſic. Feb. 4, 1732, with much reputation; and publiſhed his theſis, as the forms of that univerſity require; the ſubject was, *De tabe purulenta*. In 1735 he publiſhed a little humourous fugitive pamphlet in 8vo, entitled, "An Eſſay for abridging the ſtudy of Phyſic; to which is added a Dialogue betwixt Hygeia, Mercury, and Pluto, relating to the Practice of Phyſic, as it is managed by a certain illuſtrious Society. As alſo an Epiſtle from Uſbek the Perſian to Joſhua Ward, Eſq." This piece contains much fun and drollery: in the dialogue he has caught the very ſpirit of Lucian. In 1737 he publiſhed A Synopſis of the Hiſtory and Cure of the Venereal Diſeaſes, 8vo. This was ſoon followed by the *Oeconomy of Love*; a poem which has much merit: but it muſt be confeſſed it is too ſtrongly tinctured with the licentiouſneſs of Ovid. It is ſaid, however, that his maturer judgment expunged many of the luxuriances of youthful fancy, in an edition "reviſed and corrected by the author" in 1768. It appears by one of the caſes on literary property, that Mr Millar paid 50 guineas for the copyright of this poem, which was intended as a burleſque on ſome dictatic writers. It has been obſerved of Dr Armſtrong, that his works have great inequalities, ſome of them being poſſeſſed of every requiſite to be ſought after in the moſt perfect compoſition, while others can hardly be conſidered as ſuperior to the productions of mediocrity. *The Art of preſerving Health*, his beſt performance, which was publiſhed in 1744, will tranſmit his name to poſterity as one of the firſt Engliſh writers, has been honoured with the following teſtimony of a reſpectable critic. On this work we ſhall alſo tranſcribe a beautiful elogium from an eminent phyſician†: "Of all the poetical performances on this ſubject that have come to my hands. Dr Armſtrong's Art of preſerving health is by far the beſt. To quote every charming deſcription and beautiful paſſage of this poem, one muſt tranſcribe the whole. We cannot, however, expect new rules, where the principal deſign was to raiſe and warm the heart into a compliance with the ſolid precepts of the ancients, which he has enforced with great ſtrength and elegance. And upon the whole, he has convinced us by his own example, that we ought not to blame antiquity for acknowledging

One power of phyſic, melody, and ſong."

In 1746 Dr Armſtrong was appointed one of the phyſicians to the hoſpital for lame and ſick ſoldiers behind Buckingham houſe. In 1751 he publiſhed his poem on Benevolence, in folio; and in 1753, "Taſte, an epiſtle to a young Critic." In 1758 appeared, "Sketches, or Eſſays on various ſubjects, by Launcelot Temple, Eſq; in two parts." In this production, which poſſeſſes much humour and knowledge of the world, and which had a remarkably rapid ſale, he is ſuppoſed to have been aſſiſted by Mr Wilkes. In 1760 he had the honour of being appointed phyſician to the army in Germany, where in 1761 he wrote a poem called "Day, an Epiſtle to John Wilkes of Ayleſbury, Eſq;" In this poem, which is not collected in his works, he wantonly hazarded a reflection on Churchill, which drew on him the ſerpent-toothed vengeance of that ſevereſt of ſatiriſts, whoſe embalming or corroſive pen could deify or lampoon any man, according as he acquieſced with, or diſſented, from his political principles. In 1770 Dr Armſtrong publiſhed a collection of "Miſcellanies in 2 vols.; containing, 1. The Art of preſerving Health. 2. Of Benevolence, an Epiſtle to Eumenes. 3. Taſte, an Epiſtle to a youg critic, 1753. 4. Imitations of Shakeſpeare and Spencer. 5. The Univerſal Almanac, by Noureddin Ali. 6. The Forced Marriage, a tragedy. 7. Sketches." In 1771 he publiſhed "A ſhort ramble through ſome parts of France and Italy, by Launcelot Temple: and in 1773, in his own name, a quarto pamphlet, under the title of *Medical Eſſays*; towards the concluſion of which, he accounts for his not having ſuch extenſive practice as ſome of his brethren, from his not being qualified to employ the uſual means, from a tickliſh ſtate of ſpirits, and a diſtempered exceſs of ſenſibility. He complains much of the behaviour of ſome of his brethren, of the herd of critics, and particularly of the reviewers. He died in Sept. 1779; and to the no ſmall ſurpriſe of his friends, left behind him more than L.300 ſaved out of a very moderate income, ariſing principally from his half-pay.

ARMUYDEN, a ſea-port town of the United provinces, in the iſland of Walcherin, formerly very flouriſhing; but now inconſiderable, the ſea having ſtopped up the harbour. The ſalt-works are its chief reſource. E. Long. 3. 40. N. Lat. 51 30.

ARMY, a large number of ſoldiers, conſiſting of horſe and foot, completely armed, and provided with artillery, ammunition, proviſions, &c. under the command of one general, having lieutenant-generals, major-generals, brigadiers, and other officers, under him. An army is compoſed of ſquadrons and battalions; and is uſually divided into three corps, and formed into three lines: the firſt line is called the *van-guard*, the ſecond the *main-body*, and the third the *rear-guard* or

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† Dr Mackenzie's Hiſtory of Health.

body of reſerve. The middle of each line is poſſeſſed by the foot; the cavalry form the right and left wing of each line; and ſometimes they place ſquadrons of horſe in the intervals between the battalions. When the army is drawn up in order of battle, the horſe are placed at five feet diſtance from each other, and the foot at three. In each line the battalions are diſtant from each other 180 feet, which is nearly equal to the extent of their front; and the ſame holds of the ſquadrons, which are about 300 feet diſtant, the extent of their own front. Theſe intervals are left for the ſquadrons and battalions of the ſecond line to range themſelves againſt the intervals of the firſt, that both may more readily march through theſe ſpaces to the enemy: the firſt line is uſually 300 feet diſtant from the ſecond, and the ſecond from the third, that there may be ſufficient room to rally when the ſquadrons and battalions are broken. See the article WAR.

This is to be underſtood of a land-army only. A naval or ſea-army is a number of ſhips of war, equipped and manned with ſailors and mariners, under the command of an admiral, with other inferior officers under him. See *Naval TACTICS.*

It has been obſerved, that in Europe a prince with a million of ſubjects cannot keep an army of above 10,000 men, without ruining himſelf. It was otherwiſe in the ancient republics: the proportion of ſoldiers to the reſt of the people, which is now as about 1 to 100, might then be as about 1 to 8. The reaſon ſeems owing to that equal portion of lands which the ancient founders of commonwealths made among their ſubjects; ſo that every man had a conſiderable property to defend, and means to defend it with: whereas, now, the lands and riches of a nation being ſhared among a few, the reſt have no way of ſubſiſting but by trade, arts, and the like: and have neither any free property to defend, nor means to enable them to go to war in defence of it, without ſtarving their families. A large part of our people are either artiſans or ſervants, and ſo only miniſter to the luxury and effeminacy of the great. While the equality of lands ſubſiſted, Rome, though only a little ſtate, being refuſed the ſuccours which the Latins were obliged to furniſh after the taking of the city in the conſolate of Camillus, preſently raiſed ten legions within its own walls; which was more, Livy aſſures us, than they were able to do in his time, tho' maſters of the greateſt part of the world. A full proof, adds the hiſtorian, that we are not grown ſtronger; and that what ſwells our city is only luxury, and the means and effects of it.

Armies anciently were a ſort of militia, compoſed chiefly of the vaſſals and tenants of the lords. When each company had ſerved the number of days or months enjoined by their tenure, or the cuſtoms of the fees they held, they returned home. The armies of the empire conſiſted of divers bodies of troops furniſhed by the ſeveral circles. The groſs of the French armies, under the Merovingian race, conſiſted of infantry. Under Pepin and Charlemagne, the armies conſiſted almoſt equally of cavalry and foot: but ſince the declenſion of the Carlovingian line, the fees being become hereditary, the national armies, ſays Le Gendre, are chiefly cavalry.

A well-regulated ſtanding army is greatly ſuperior to a militia; although a militia, it is to be obſerved, after ſerving two or three campaigns, may become equal to a ſtanding army, and in every reſpect a match for veteran troops. See MILITIA.

One of the firſt ſtanding armies of which we have any diſtinct account, in any well authenticated hiſtory, is that of Philip of Macedon. His frequent wars with the Thracians, Illyrians, Theſſalians, and ſome of the Greek cities in the neighbourhood of Macedon, gradually formed his troops, which in the beginning were probably militia, to the exact diſcipline of a ſtanding army. When he was at peace, which he was very ſeldom, and never for any long time together, he was careful not to diſband that army. It vanquiſhed and ſubdued, after a long and violent ſtruggle, indeed, the gallant and well exerciſed militias of the principal republics of ancient Greece; and afterwards, with very little ſtruggle, the effeminate and ill-exerciſed militia of the great Perſian empire. The fall of the Greek republics and of the Perſian empire, was the effect of the irreſiſtible ſuperiority which a ſtanding army has over every ſort of militia. It is the firſt great revolution in the affairs of mankind of which hiſtory has preſerved any diſtinct or circumſtantial account.

The fall of Carthage, and the conſequent elevation of Rome, is the ſecond. All the varieties in the fortune of thoſe two famous republics may very well be accounted for from the ſame cauſe.

From the end of the firſt to the beginning of the ſecond Carthaginian war, the armies of Carthage were continually in the field, and employed under three great generals, who ſucceeded one another in the command; Amilcar, his ſon-in-law Aſdrubal, and his ſon Annibal; firſt in chaſtiſing their own rebellious ſlaves, afterwards in ſubduing the revolted nations of Africa; and, laſtly, in conquering the great kingdom of Spain. The army which Annibal led from Spain into Italy muſt neceſſarily, in thoſe different wars, have been gradually formed to the exact diſcipline of a ſtanding army. The Romans, in the mean time, tho' they had not been altogether at peace, yet they had not, during this period, been engaged in any war of very great conſequence; and their military diſcipline, it is generally ſaid, was a good deal relaxed. The Roman armies which Annibal encountered at Trebia, Thraſymenus, and Cannæ, were militia oppoſed to a ſtanding army. This circumſtance, it is probable, contributed more than any other to determine the fate of thoſe battles.

The ſtanding army which Annibal left behind him in Spain, had the like ſuperiority over the militia which the Romans ſent to oppoſe it, and in a few years under the command of his brother the younger Aſdrubal, expelled them almoſt entirely from that country.

Annibal was ill ſupplied from home. The Roman militia, being continually in the field, became in the progreſs of the war a well-diſciplined and well-exerciſed ſtanding army; and the ſuperiority of Annibal grew every day leſs and leſs. Aſdrubal judged it neceſſary to lead the whole, or almoſt the whole, of the ſtanding army which he commanded in Spain, to the aſſiſtance of his brother in Italy. In this march he is ſaid to have been miſled by his guides; and in a country which he did not know, was ſurpriſed and attacked by another ſtanding army, in every reſpect equal or ſuperior to his own, and was entirely defeated.

When Aſdrubal had left Spain, the great Scipio found nothing to oppoſe him but a militia inferior to his own. He conquered and ſubdued that militia; and in the courſe of the war, his own militia neceſſarily became a well-diſciplined and well-exerciſed ſtanding army. That ſtanding army was afterwards carried to Africa, where it found nothing but a militia to oppoſe it. In order to defend Carthage it became neceſſary to recall the ſtanding army of Annibal. The diſheartened and frequently defeated African militia joined it, and at the battle of Zama compoſed the greater part of the troops of Annibal. The event of that day determined the fate of the two rival republics.

From the end of the ſecond Carthagenian war till the fall of the Roman republic, the armies of Rome were in every reſpect ſtanding armies. The ſtanding army of Macedon made ſome reſiſtance to their arms. In the height of their grandeur, it coſt them two great wars, and three great battles, to ſubdue that little kingdom; of which the conqueſt would probably have been ſtill more difficult, had it not been for the cowardice of its laſt king. The militias of all the civilized nations of the ancient world, of Greece, of Syria, and of Egypt, made but a feeble reſiſtence to the ſtanding armies of Rome. The militias of ſome barbarous nations defended themſelves much better. The Scythian or Tartar militia, which Mithridates drew from the countries north of the Euxine and Caſpian ſeas, were the moſt formidable enemies whom the Romans had to encounter after the ſecond Carthaginian war. The Parthian and German militias too were always reſpectable, and upon ſeveral occaſions gained very conſiderable advantages over the Roman armies. In general, however, and when the Roman armies were well commanded, they appear to have been very much ſuperior.

Many different cauſes contributed to relax the diſcipline of the Roman armies. Its extreme ſeverity was, perhaps, one of thoſe cauſes. In the days of their grandeur, when no enemy appeared capable of oppoſing them, their heavy armour was laid aſide as unneceſſarily burthenſome, their laborious exerciſes were neglected as unneceſſarily toilſome. Under the Roman emperors beſides, the ſtanding armies of Rome, thoſe particularly which guarded the German and Pannonian frontiers, became dangerous to their maſters, againſt whom they uſed frequently to ſet up their own generals. In order to render them leſs formidable, according to ſome authors, Diocleſian, according to others Conſtantine, firſt withdrew them from the frontier, where they had always before been encamped in great bodies, generally of two or three legions each, and diſperſed them in ſmall bodies through the different provincial towns, from whence they were ſcarce ever removed, but when it became neceſſary to repel an invaſion. Small bodies of ſoldiers quartered in trading and manufacturing towns, and ſeldom removed from thoſe quarters, became themſelves tradeſmen, artificers, and manufacturers. The civil came to predominate over the military character; and the ſtanding armies of Rome gradually degenerated into a corrupt, neglected, and undiſciplined militia, incapable of reſiſting the attack of the German and Scythian militias, which ſoon afterwards invaded the weſtern empire. It was only by hiring the militia of ſome of thoſe nations to oppoſe to that of others, that the emperors were for ſome time able to defend themſelves. The fall of the weſtern empire is the third great revolution in the affairs of mankind, of which ancient hiſtory has preſerved any diſtinct or circumſtantial account. It was brought about by the irreſiſtible ſuperiority which the militia of a barbarous has over that of a civilized nation; which the militia of a nation of ſhepherds has over that of a nation of huſbandmen, artificers, and manufactures. The victories which have been gained by militias have generally been not over ſtanding armies, but over other militias in exerciſe and diſcipline inferior to themſelves. Such were the victories which the Greek militia gained over that of the Perſian empire; and ſuch too were thoſe which in later times the Swiſs militia gained over that of the Auſtrians and Burgundians.

The military force of the German and Scythian nations, who eſtabliſhed themſelves upon the ruins of the weſtern empire, continued for ſome time to be of the ſame kind in their new ſettlements as it had been in their original country. It was a militia of ſhepherds and huſbandmen, which in time of war took the field under the cammand of the ſame chieftans whom it was accuſtomed to obey in peace. It was therefore tolerably well exerciſed and tolerably well diſciplined. As arts and induſtry advanced, however, the authority of the chieftans gradually decayed, and the great body of the people had leſs time to ſpare for military exerciſes. Both the diſcipline and the exerciſe of the feudal militia, therefore, went gradually to ruin, and ſtanding armies were gradually introduced to ſupply the place of it. When the expedient of a ſtanding army, beſides, had once been adopted by one civilized nation, it became neceſſary that all its neighbours ſhould follow the example. They ſoon found that their ſafety depended upon their doing ſo, and that their own militia was altogether incapable of reſiſting the attack of ſuch an army.

The ſoldiers of a ſtanding army, though they may never have ſeen an enemy, yet have frequently appeared to poſſeſs all the courage of veteran troops, and the very moment that they took the field, to have been fit to face the hardieſt and moſt experienced veterans. In a long peace the generals perhaps may ſometimes forget their ſkill; but where a well-regulated ſtanding army has been kept up, the ſoldiers ſeem never to forget their valour.

When a civilized nation depends for its defence upon a militia, it is at all times expoſed to be conquered by any barbarous nation which happens to be in its neighbourhood. The frequent conqueſts of all the civilized countries in Aſia by the Tartars, ſufficiently demonſtrates the natural ſuperiority which the militia of a barbarous has over that of a civilized nation. A well-regulated ſtanding army is ſuperior to every militia. Such an army, as it can be beſt maintained by an opulent and civilized nation, ſo it can alone defend ſuch a nation againſt the invaſion of a poor and barbarous neighbour. It is only by means of a ſtanding army, therefore, that the civilization of any country can be perpetuated, or even preſerved for any conſiderable time.

As it is only by means of a well-regulated ſtanding army that a civilized country can be defended, ſo it is only by means of it that a barbarous country can be ſuddenly and tolerably civilized. A ſtanding army eſtabliſhes, with an irreſiſtible force, the law of the ſovereign through the remoteſt provinces of the empire, and maintains ſome degree of regular government in countries which could not otherwiſe admit of any. Whoever examines with attention the improvements which Peter the Great introduced into the Ruſſian empire, will find that they almoſt all reſolve themſelves into the eſtabliſhment of a well-regulated ſtanding army. It is the inſtrument which executes and maintains all his other regulations. That degree of order and internal peace which that empire has ever ſince enjoyed, is altogether owing to the influence of that army.

Men of republican principles have been jealous of a ſtanding army as dangerous to liberty. It certainly is ſo, wherever the intereſt of the general and that of the principal officers are not neceſſarily connected with the ſupport of the conſtitution of the ſtate. The ſtanding army of Cæſar deſtroyed the Roman republic; the ſtanding army of Cromwell turned the long parliament out of doors. But where the ſovereign is himſelf the general, and the principal nobility and gentry of the country the chief officers of the army; where the military force is placed under the command of thoſe who have the greateſt intereſt in the ſupport of the civil authority, becauſe they have themſelves the greateſt ſhare of that authority; a ſtanding army can never be dangerous to liberty: on the contrary, it may in ſome caſes be favourable to liberty. The ſecurity which it gives to the ſovereign renders unneceſſary that troubleſome jealouſy which in ſome modern republics ſeems to watch over the minuteſt actions, and to be at all times ready to diſturb the peace of every citizen. Where the ſecurity of the magiſtrate, though ſupported by the principal people of the country, is endangered by every popular diſcontent; where a ſmall tumult is capable of bringing about in a few hours a great revolution; the whole authority of government muſt be employed to ſuppreſs and puniſh every murmur and complaint againſt it. To a ſovereign, on the contrary, who feels himſelf ſupported not only by the natural ariſtocracy of the country, but by a well-regulated ſtanding army, the rudeſt, the moſt groundleſs, and the moſt licentious remonſtrances, can give little diſturbance. He can ſafely pardon or neglect them, and his conſciouſneſs of his own ſuperiority naturally diſpoſes him to do ſo. That degree of liberty which approaches to licentiouſneſs can be tolerated only in countries where the ſovereign is ſecured by a well-regulated ſtanding army. It is in ſuch countries only that the public ſafety does not require that the ſovereign ſhould be truſted with any diſcretionary power for ſuppreſſing even the impertinent wantonneſs of this licentious liberty.

ARNALL (William), a noted political writer in defence of Sir Robert Walpole, was originally an attorney's clerk; but being recommended to Walpole, he employed him for a courſe of years in writing the *Free, Briton* and other papers in defence of his adminiſtration. By the report of the ſecret committee, he appears to have received, in the ſpace of four years, no leſs than L. 10,997 : 6 : 8 out of the treaſury for his writings! but ſpending his money as faſt as it came, and his ſupplies ſtopping on Sir Robert's reſignation, he died broken-hearted and in debt, in the 26th year of his age. His invention was ſo quick, that his honourable employer uſed to ſay, no man in England could write a pamplet in ſo little time as Arnall.

ARNAUD DE MEYRVEILH, or MEREUIL, a poet of Provence, who lived at the beginning of the 13th century. He wrote a book intitled *Las recaſtenas de ſa comteſſe*, and a collection of poems and ſonnets. He died in the year 1220. Petrarch mentions him in his Triumph of Love.

ARNAUD DE VILLA NOVA, a famous phyſician, who lived about the end of the 13th and beginning of the 14th century. He ſtudied at Paris and Montpelier, and travelled through Italy and Spain. He was well acquainted with languages, and particularly with the Greek, Hebrew, and Arabic. He was at great pains to gratify his ardent deſire after knowledge; but this paſſion carried him rather too far in his reſearches: he endeavoured to diſcover future events by aſtrology, imagining this ſcience to be infallible; and upon this foundation he publiſhed a prediction, that the world would come to an end in the middle of the 14th century. He practiſed phyſic at Paris for ſome time: but having advanced ſome new doctrines, he drew upon himſelf the reſentment of the univerſity; and his friends, fearing he might be arreſted, perſuaded him to retire from that city. Upon his leaving France, he retired to Sicily, where he was received by king Frederic of Arragon with the greateſt marks of kindneſs and eſteem. Some time afterwards, this prince ſent him to France, to attend Pope Clement in an illneſs; and he was ſhipwrecked on the coaſt of Genoa, about the year 1313. The works of Arnaud, with his life prefixed, were printed in one volume in folio, at Lyons, in 1520; and at Baſil in 1585, with the notes of Nicholas Tolerus.

ARNAUD D'ANDILLY (Robert), the ſon of a celebrated advocate of the parliament of Paris, was born in 1588; and, being introduced young at court, was employed in many conſiderable offices, all which he diſcharged with great integrity and reputation. In 1644 he quitted buſineſs, and retired into the convent of Port Royal des Champs, where he paſſed the remainder of his days in a continued application to works of piety and devotion; and enriched the French language with many excellent tranſlations of different writers, as well as with religious compoſitions of his own. He died in 1674, and his works are printed in 8 vols folio.

ARNAUD (Anthony), brother of the preceding, and a doctor of the Sorbonne, was born in 1612. He publiſhed, in 1643, *A treatiſe on frequent communion*, which highly diſpleaſed the Jeſuits; and the diſputes upon grace, which broke out about this time in the univerſity of Paris, and in which he took a zealous part with the Janſeniſts, helped to increaſe the animoſity between him and the Jeſuits. But nothing raiſed ſo great a clamour againſt him as the two letters he wrote on *Abſolution*; in the ſecond of which the faculty of divinity found two propoſitions which they condemned, and M. Arnaud was expelled the ſociety. Upon this he retired; and during a retreat which laſted near 25 years, he compoſed that great variety of works which are extant of his, on grammar, geometry, logic, metaphyſics,

taphyſics, and theology. In 1679, he withdrew from France, living in obſcurity in the Netherlands, and died in 1694. His heart, at his own requeſt, was ſent to be depoſited in the Port Royal. Arnaud had a remarkable ſtrength of genius, memory, and command of his pen; nor did theſe decay even to the laſt year of his life. Mr Bayle ſays, he had been told by perſons who had been admitted into his familiar converſation, that he was a man very ſimple in his manners; and that unleſs any one propoſed ſome queſtion to him, or deſired ſome information, he ſaid nothing that was beyond common converſation, or that might make one take him for a man of great abilities; but when he ſet himſelf to give an anſwer to ſuch as propoſed a point of learning, he ſeemed as it were transformed into another man: he would then deliver a multitude of fine things with great perſpicuity and learning, and had a particular talent at making himſelf intelligible to perſons of not the greateſt penetration.

ARNAY-LE-DUC, a town of France, in the duchy of Burgundy, which carries on a pretty good trade. It is ſeated on the Auxois, in a valley near the river Aroux. E. Long. 4. 26. N. Lat. 47. 7.

ARNDT (John), a famous Proteſtant divine of Germany, born at Ballenſtad, in the duchy of Anhalt, in the year 1555. At firſt he applied himſelf to the ſtudy of phyſic: but falling into a dangerous ſickneſs, he made a vow to change his profeſſion for that of divinity, if he ſhould be reſtored to health; which he accordingly did upon his recovery. He was miniſter firſt at Quedlinburg and then at Brunſwick. He met with great oppoſition in this laſt city: his ſucceſs as a preacher raiſed the enmity of his brethren, who became his bitter enemies. In order to ruin his character, they aſcribed a variety of errors to him; and perſecuted him to ſuch a degree, that he was obliged to leave Brunſwick, and retire to Iſleb, where he was miniſter for three years. In 1611, George Duke of Lunenburg, who had a high opinion of his integrity and ſanctity, gave him the church of Zell, and appointed him ſuperintendant of all the churches in the duchy of Lunenburg; which office he diſcharged for 11 years, and died in 1621. It is reported that he foretold his death, having ſaid to his wife, upon his return home after his laſt ſermon, that now he had preached his funeral ſermon. He wrote in High Dutch *A treatiſe on true Chriſtianity*, which has been tranſlated into ſeveral languages.

ARNE (Dr Thomas Auguſtine), diſtinguiſhed by his ſkill in muſic, was the ſon of Mr Arne an upholſterer in Covent Garden, whom Addiſon is ſuppoſed to have characteriſed in N° 155 and N° 160 of The Tatler; and brother of Mrs Cibber the player. He was early devoted to muſic, and ſoon became eminent in his profeſſion. July 6. 1759, he had the degree of doctor of muſic conferred on him at Oxford. His compoſitions are univerſally applauded, and he was alſo particularly ſkilful in inſtructing vocal performers. He died March 5. 1778, having written the following pieces: *Artaxerxes*, 1762; *The Guardian outwitted*, 1764; *The Roſe*, 1778; all of them operas.

ARNHEIM, a town of the Low Countries, in the province of Guelderland, capital of Veluive. It is adorned with ſeveral fine churches, particularly that of St Walburg and of St Euſebius: which laſt has a very high tower. The town has five gates, and ſeveral fine ramparts, part of which are waſhed by the Rhine, and the other parts have wide and deep ditches before them. There is a canal made between this place and Nimeguen, at the expence of both towns, on which boats paſs backwards and forwards to carry on a trade between them. The air is very healthful; on which account it is inhabited by perſons of diſtinction. E. Long. 5. 55. N. Lat. 52. 0.

ARNICA, LEOPARDS BANE, in botany: A genus of the polygamia ſuperflua order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ diſcoides*. The receptacle is naked; the pappus is ſimple; and the filaments are five, without antheræ. The

Species are ſeven, all natives of Ethiopia, except the two following: 1. The montana, with oval leaves, grows naturally on the Alps, and alſo upon many of the high mountains in Germany, and other cold parts of Europe. The roots of this ſpecies, when planted in a proper ſoil and ſituation, ſpread very far under the ſurface, and put out many entire oval leaves, from between which the flower-ſtems ariſe, which grow about a foot and an half high. The top is terminated by a ſingle yellow flower, compoſed of many florets, like thoſe of the dandelion. Theſe are ſucceeded by oblong ſeeds, which are covered with down. 2. The ſcorpioides, with ſawed leaves growing alternately, is a native of Bohemia and Siberia. The roots of this ſort are much jointed, and divide into many irregular fleſhy off-ſets, which are variouſly contorted; from whence ſome ſuperſtitious perſons have imagined that they would expel the poiſon of ſcorpions, and cure the wounds made by the ſting of that animal.

Culture. The firſt ſpecies delights in a moiſt ſhady ſituation: it may be propagated by parting the roots in autumn when the ſtalks begin to decay; or by the ſeeds ſown in autumn ſoon after they are ripe, for thoſe ſown in the ſpring often fail. The ſecond ſort is to be propagated in the ſame manner. Both are very hardy, and require no other care than to be keept free from weeds.

Medicinal Uſes. The montana has an acrid bitter taſte, and when bruiſed, emits a pungent odour, which excites ſneezing. On this account the country people in ſome parts of Germany uſe it in ſnuff, and ſmoke it like tobacco. It was formerly repreſented as a remedy of great efficacy againſt effuſions and ſuffuſions of blood, from falls, bruiſes, or the like; and it was then alſo mentioned as a remedy in jaundice, gout, nephritis, &c. but in theſe affections it is now very little, if at all, employed.

Of late it has been principally recommended in paralytic affections, and in caſes where a loſs or diminution of ſenſe ariſes from an affection of the nerves, as in inſtances of amauroſis. In theſe it has chiefly been employed under the form of infuſion. From a dram to half an ounce of the flowers has been directed to be infuſed in a pint of boiling water, and taken in different doſes in the courſe of the day: ſometimes it produces vomiting, ſometimes ſweating, ſometimes diureſis; but frequently its uſe is attended with no ſenſible operation, unleſs it can be conſidered as ſuch, that in ſome caſes of paralyſis, the cure is ſaid to be preceded by a peculiar prickling, and by ſhooting pains in the affected parts.

Beſides being employed in paralytic affections, it has alſo been of late repreſented as a very powerful antiſpaſmodic; and it is ſaid to have been ſucceſsfully employed in fevers, particularly thoſe of the intermittent kind, and likewiſe in caſes of gangrene. In thoſe diſeaſes it has been ſaid to prove as efficacious as the Peruvian bark, when employed under the form of a pretty ſtrong decoction taken in ſmall dozes frequently repeated, or under the form of an electuary with honey.

But as theſe alleged virtues have not been confirmed by any trials made in Britain, its real influence ſtill remains to be determined by future obſervations. It is, however, one of thoſe active ſubſtances from which ſomething may be expected.

ARNISÆUS (Henningus), a philoſopher and phyſician of great reputation, about the beginning of the 17th century. He was born at Halberſtad in Germany, and was profeſſor of phyſic in the univerſity of Helmſtad. His political works are much eſteemed. The moſt remarkable of them is his book *De authoritate principum in populum ſemper inviolabili*, printed at Francfort, in 1612. In this he maintains that the authority of princes ought not to be violated. He wrote alſo upon the ſame doctrine his three books *De jure majeſtatis*, printed at the ſame place in 1610; and his *Reflectiones politicæ*, printed at Francfort in 1615. Having received an invitation to go to Denmark, he went thither, and was made counſellor and phyſician to the King. He travelled into France and England, and died in November 1635. Beſides the pieces already mentioned, he wrote ſeveral philoſophical, medicinal and political treatiſes.

ARNOBIUS, profeſſor of rhetoric at Sicca, in Numidia, towards the end of the third century. It was owing to certain dreams which he had that he became deſirous of embracing Chriſtianity. For this purpoſe he applied to the biſhops to be admitted into the church. But they, remembering the violence with which he had always oppoſed the true faith, had ſome diſtruſt him; and, before they would admit him, inſiſted on ſome proofs of his ſincerity. In compliance with this demand, he wrote againſt the Gentiles; wherein he has refuted the abſurdities of their religion, and ridiculed their falſe gods. In this treatiſe he has employed all the flowers of rhetoric, and diſplayed great learning: but from an impatience to be admitted into the body of the faithful, he is thought to have been in too great a hurry in compoſing his work, and thence it is that there does not appear in this piece ſuch an exact order and diſpoſition as could be wiſhed; and not having a perfect and exact knowledge of the Chriſtian faith, he publiſhed ſome very dangerous errors. Mr Bayle remarks, that his notions about the origin of the ſoul, and cauſe of natural evil, and ſeveral other important points, are highly pernicious. St Jerom, in his epiſtle to Paulinus, is of opinion that his ſtyle is unequal and too diffuſe, and that his book is written without any method; but Dr Cave thinks this judgment too ſevere, and that Arnobius wants neither elegance nor order in his compoſition. Voſſius ſtyles him *the Varro of the eccleſiaſtical writers.* Du Pin obſerves that his work is written in a manner worthy of a profeſſor of rhetoric: the turn of his ſentiments is very oratorical; but his ſtyle is a little African, his expreſſions being harſh and inelegant. We have ſeveral editions of this work of Arnobius againſt the Gentiles, one publiſhed at Rome in 1542, at Baſil in 1546 and 1560, at Paris in 1570, at Antwerp in 1582, and one at Hamburgh in 1610, with notes by Gebhard Elmenhorſtius, beſides many others. He wrote alſo a piece intitled *De rhetoricæ inſtitutione*; but this is not extant.

ARNOLD, of Breſcia, in Italy, diſtinguiſhed himſelf by being the founder of a ſect which oppoſed the wealth and power of the Romiſh clergy. He went into France, where he ſtudied under the celebrated Peter Abelard. Upon his return to Italy, he put on the habit of a monk, and opened his invectives in the ſtreets of Breſcia. The people crowded round him. He told them he was ſent to reform abuſes, to pull down the proud and to exalt the humble. He then pointed his declamation againſt the biſhops, againſt the clergy, againſt the monks, and finally againſt the Roman pontiff himſelf: to the laity only he was indulgent. Churchmen, ſaid he, who hold benefices, biſhops who have domains, and monks that have poſſeſſions, will all be damned. His hearers ſhouted approbation. Theſe things, continued he, belong to the prince; he may give them to whom he pleaſes, but he muſt give them to the laity. It is on their tithes, and the voluntary contributions of the people, that thoſe ſons of God muſt live: they muſt be frugal, continent, and mortified.

The church of Breſcia was ſoon thrown into the greateſt confuſion, and the people, already prejudiced againſt their miniſters threatened to overturn their altars. The ſacred writings he urged in ſupport of his aſſertions, and from thenm he denounced the vengeance of Heaven againſt the violators of the law. Indeed, nothing could be more glaringly offenſive than the oſtentatious parade of the biſhops and great abbots, and the ſoft and licentious lives of the monks and clergy.

In 1139 was celebrated a grand council at Rome. Arnold was cited to appear before it. His accuſers were the biſhop of Breſcia, and many others, whom he had ridiculed and inſulted. Nor from his judges could he look for much indulgence. He was found guilty, and ſentenced to perpetual ſilence. Upon this he left Italy, croſſed the Alps, and found a refuge in Zurich.

Though Arnold had quitted Italy, yet had his opinions taken deep root, and Rome itſelf was infected by them. Irritated by the conduct of their maſter Innocent II. the Roman people aſſembled in the Capitol. It was propoſed that the power of the pontiff, which they called exorbitant, ſhould be reſtrained: this was carried: when ſuddenly, inſpired as it were by the genius of the place, they moved that the ſenate, which for years had been aboliſhed, ſhould be reſtored. The propoſition was received with the loudeſt acclamations. Innocent in vain oppoſed the bold deſign; there was a magic in it which ſpread irreſiſtibly, and for a moment ſeemed to rouſe the fallen ſpirit of the nation. The pope viewed with horror the reverſe of fortune which threatened the tiara; to be ſhorn of his mighty power, and to become the mere ſhepherd of the Chriſtian people, was a thought too afflicting: he fell ſick and died.

Under his two immediate ſucceſſors Celeſtin and Lucius, whoſe reigns were but of a few months, the Romans purſued their darling object. They waited on the latter, and, in an imperious tone, demanded the reſtitution of all the honours and civil rights which had been uſurped from the people. The prince of the ſenate, ſaid they, whom we have choſen, will beſt adminiſter the important truſt: the tithes and offerings of the faithful will ſufficiently anſwer all the exigencies of your holineſs: it was thus that our ancient biſhops lived.—Lucius ſurvived this event but a few days. His ſucceſſor was Eugenius III. the friend and diſciple of the renowned Bernard. The night before his conſecration the ſenators aſſembled, and it was agreed, that either he ſhould ſolemnly confirm all their proceedings, or they would annul his election. This reſolution was notified to him. He called together his friends; and it was their advice, that he ſhould neither accede to the extravagant demand, nor expoſe himſelf, by a refuſal, to the fury of the populace. He therefore ſilently withdrew from Rome, and retired to a neighbouring fortreſs. Here the ceremony of his conſecration was performed.

Arnold, who in baniſhment had contemplated the effect of his admonitions on the minds of the Romans, and the ſucceſs which ſeemed to follow their exertions, was now informed that the pope had retired, and that the gates of the capital were open to receive him: it was likewiſe ſuggeſted to him, that his preſence was more than ever neceſſary, to give energy to their reſolves, form to their plans, and ſtability to their undertakings. Arnold took fire at the news; an unuſual ſwell of enthuſiaſm filled his breaſt; and he fancied that, like Junius Brutus, he was called at once to give liberty to Rome. At his appearance a new ſtream of vigour animated the citizens; they called him their friend and deliverer. The Breſcian walked amongſt them; his deportment was humble, his countenance emaciated, his addreſs affable, and he ſpoke to them of moderation, of ſubmiſſion, of obedience. With the the nobles and new ſenators he held another language; though to them alſo he was mild and diffident, ſpeaking much of virtue and of reſpect for religion and the laws. But no ſooner was he ſenſible of his own real influence, and ſaw the lengths to which the revolters had already carried their deſigns, than he threw aſide the maſk, and appeared in his own character, daring, impetuous, ſelf-ſufficient, vain. He harangued the people; he talked of their forefathers the ancient Romans, who, by the wiſdom of their ſenate and the valour of their armies, had conquered nations and ſubdued the earth. He dwelt on the names and the atchievements of the Bruti, the Gracchi, and the Scipios; and of theſe men, ſaid he, are you not the children? He adviſed, that the capital be inſtantly repaired; that the equeſtrian order be reſtored; that the people have their tribunes; that dignity attend the ſenate; and that the laws, which had been ſilent and neglected, be revived in all their vigour. He ſpoke of the pope as of a depoſed and baniſhed tyrant: "But ſhould you again be diſpoſed (continued he) to admit him within theſe walls; firſt fix your own rights and determine his. He is but your biſhop: let him therefore have his ſpiritual juriſdiction. The government of Rome, its civil eſtabliſhments, and its territories, belong to you. Theſe you will keep if you have the ſpirit of men and the hearts of Romans." Fired by this harangue, the people, headed by the moſt diſaffected of the nobles, publicly attacked the few cardinals and churchmen who remained in the city; they ſet fire to the palaces; and they compelled the citizens to ſwear obedience to the new government. Moderate men, who ſaw the folly of the attempt, were ſhocked at theſe exceſſes of popular phrenzy; but it was in vain to oppoſe the torrent: they ſubmitted, looking forward, with ſome curioſity, to the termination of an event which had begun in extravagance, and muſt end in diſappointment.

Eugenius till now had viewed with ſome concern, the wild derangement of his people: but when it ſeemed that their eyes opened to their own exceſſes, he could be inactive no longer. He excommunicated the ringleaders of the faction; and at the head of his troops, who were chiefly compoſed of Tiburtini, a people always hoſtile to the Romans, he marched againſt the enemy. His friends within the walls, who were numerous, co-operated with his deſigns, and in a few days overtures for peace were made to the pontiff. He acceded to them, but on condition that they ſhould annul the arrangements they had made, and if they would have ſenators, that they ſhould acknowledge all their power was from him. The people were ſatisfied, and they threw open the gates, through which Eugenius entered, among the acclamations of a fawning and inconſtant multitude.—Before this event, Arnold had retired; but he left behind him many friends ſtrongly attached to his perſon and principles. Of himſelf we hear little more till the reign of Adrian; when, on account of freſh tumults, he and his adherents were excommunicated, and Rome was threatened with an interdict unleſs they expelled the whole party from their walls. This they did. The Arnoldiſts retired with their champion into Tuſcany, where he was received as a prophet and honoured as a ſaint. His enemies, however, prevailed: he was made priſoner, and conducted under a ſtrong eſcort to Rome. In vain was great intereſt made to ſave his life; he was condemned and executed, and his aſhes thrown into the Tiber, leſt the people ſhould collect his remains and venerate them as the relics of a ſainted martyr.

"Such was Arnold of Breſcia; a man (ſays Mr Berington[*]), whoſe character, whoſe principles, and whoſe views, we perhaps ſhould be diſpoſed to admire, had his life been recorded by unprejudiced hiſtorians, and not brought down to us drawn in the blackeſt colours which party, bigotted zeal, and enthuſiaſm, could lay on. He was raſh, miſjuding, and intemperate, or never would he have engaged in ſo unequal a conteſt.—The view of ſuch a phenomenon in the 12th century excites a pleaſing admiration. To attack the Roman pontiff and his clergy in the very centre of their power, required a more than common ſhare of fortitude; to adopt a ſettled ſcheme of reſtoring to its priſtine glory the republic of Rome, demanded a ſtretch of thought comprehenſive and enterpriſing; and to forego the eaſe and indulgence of a diſſipated age, for the reformation of manners and the ſuppreſſion

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[*] *Hiſt. of the Lives of Abelard and Heloiſa.*

ſion of what he thought uſurped dominion, argued a character of mind diſintereſted, generous, and benevolent. But Arnold, like other reformers, went too far; and paſſion ſoon vitiated undertakings which were begun perhaps with motives the moſt laudable.—The readineſs with which the Roman people embraced this plan of lowering the juriſdiction of the pontiff, and reſtraining it within thoſe bounds which the true ſpirit of Chriſtianity had fixed, at once ſhows that they could reaſon juſtly, and that they conſidered the unbounded ſway of the triple crown, to which reluctantly they ſubmitted, as an aſſumed prerogative, to which violence or miſconſtruction, and not Chriſtian right, had given efficacy."

ARNOLDISTS, in church-hiſtory, a ſect ſo called from their leader Arnold of Breſcia. See the preceding article.

ARNOLDUS (Gothofredus), paſtor and inſpector of the churches of Perleberg, and hiſtoriographer to the king of Pruſſia, was born at Annaburg in the mountains of Miſnia in 1666. He was a zealous defender of Pietiſts, a ſect among the German Proteſtants, and compoſed a great number of religious works; particularly an *Eccleſiaſtical Hiſtory*, which expoſed him to the reſentment of the divines; and another giving an account of the doctrines and manners from the firſt ages, in which he frequently animadverts upon Cave's primitive Chriſtianity. He died in 1714. Various are the opinions concerning Arnoldus in Germany; ſome of his own countrymen and profeſſion extolling him to the ſkies as a ſaint of the laſt century, and ſetting an ineſtimable value upon his works; while others pronounce damnation upon him as an arch-heretic, and condemn his writings as heterodox.

ARNON (anc. geog.), a brook running between the borders of the Moabites and Ammonites on the other ſide Jordan (Moſes, Joſhua): Joſephus calls it a river, riſing on the borders of Arabia, and at length falling into the Dead Sea. It is alſo called the river of Gad, as appears 2 Sam. xxv. 5. compared with 2 Kings x. 33.

ARNOT, in botany, the Engliſh name of the bunium. See BUNIUM.

ARNOTTO. The ſame with Anotta. See ANOTTA and BIXA.

ARNSTADE, a town of Germany, in Thuringia, on the river Gera. E. Long. 11. 3. N. Lat. 50. 54.

ARNULPH, or ERNULPH, biſhop of Rocheſter in the reign of Henry I. He was born in France, where he was ſometime a monk of St Lucian de Beauvais. The monks led moſt irregular lives in this monaſtery; for which reaſon he reſolved to quit it, but firſt took the advice of Lanfranc archbiſhop of Canterbury, under whom he had ſtudied in the abbey of Becc, when Lanfranc was prior of that monaſtery. This prelate invited him over to England, and placed him in the monaſtery of Canterbury, where he lived a private monk till Lanfranc's death. When Anſelm came to the archiepiſcopal ſee, Arnulph was made prior of the monaſtery of Canterbury, and afterwards abbot of Peterborough. In 1115, he was conſecrated biſhop of Rocheſter, which ſee he held nine years, and died in March 1124, aged 84.

Arnulph wrote, 1. A piece in Latin concerning the foundation, endowment, charters, laws, and other things relating to the church of Rocheſter: it is generally known by the title of *Textus Roffenſis*, and is preſerved in the archives of the cathedral church of Rocheſter. 2. An Epiſtle in Anſwer to ſome Queſtions of Lambert abbot of Munſter; and, 3. An Epiſtle on inceſtuous Marriage.

ARNUS, now *Arno*, a very rapid river of Tuſcany, which it divides, and in its courſe waſhes Florence and Piſa; riſing in the Apennine, to the eaſt of Florence, near a village called *S. Maria della Gratie*, on the borders of Romagna, 15 miles to the weſt of the ſources of the Tiber; and then turning ſouthward towards Arretium, it is there increaſed by the lakes of the Clanis; after which it runs weſtward, dividing Florence into two parts, and at length waſhing Piſa, falls eight miles below it into the Tuſcan Sea.

ARNWAY (John), a clergyman diſtinguiſhed by his benevolence and loyalty to King Charles I. was deſcended from a very good family in the county of Salop, from which he inherited a conſiderable eſtate. He was educated at Oxford; and, having received holy orders, obtained the rectories of Hodnet and Ightfield, where he diſtinguiſhed himſelf by his piety and exemplary charity: for it was his cuſtom to clothe annually 12 poor people, and every Sunday to entertain as many at his table, not only plentifully, but with intimacy and reſpect. The civil war breaking out, he preached againſt rebellion, and raiſed and clothed eight troopers for the ſervice of King Charles I. upon which his houſe was plundered by the parliament's army. He then went to Oxford to ſerve the king in perſon, which ſubjected him to a new train of misfortunes: for his eſtate was ſoon after ſequeſtered, and himſelf impriſoned till the king's death; after which, he went to the Hague, where he publiſhed, 1. The Tablet, or the Moderation of Charles I. the Martyr; and, 2. An Alarm to the Subjects of England. He at laſt went to Virginia, where he died in 1653.

AROBE. See ARROBAS.

AROLEO, an American weight, equal to 25 of our pounds.

AROMA PHILOSOPHORUM, denotes either ſaffron, or the aroph of Paracelſus; as *aroma germanicum* denotes elecampane. See AROPH.

AROMATA (anc. geog.), a town of Lydia, famous for its generous wines; and hence the appellation (Strabo). Alſo the name of a trading town, and promontory of Ethiopia, at the termination of the Sinus Avalites of the red Sea (Arrian).

AROMATIC, an appellation given to ſuch plants as yield a briſk fragrant ſmell, and a warm taſte; as all kinds of ſpices, &c. See MATERIA MEDICA.

ARONA, a town of Italy, in the duchy of Milan, with a ſtrong caſtle. It ſtands on the lake Maggiore. E. Long. 8. 25. N. Lat. 45. 41.

ARONCHES, a town of Portugal in Alantejo, on the confines of Spain, ſeated on the river Caro. It is well fortified, and has about 500 inhabitants. W. Long. 5. 16. N. Lat. 14. 39.

AROOL, a town of the empire of Ruſſia, in the Ukrain, ſeated on the river Occa. E. Long. 38. 15. N. Lat. 51. 48.

AROPH, a contraction of *aroma philoſophorum*; a name given to ſaffron.

AROPH Paracelſi, a name given to a kind of chemical flowers, probably of the ſame nature with the Ens Veneris, elegantly prepared by ſublimation from equal quantities of lapis hæmatitis and ſal ammoniac.

Aroph is alſo a term uſed frequently by Paracelſus in a ſenſe ſynonimous with *lithontriptic*.

AROSBAY, a town of the Eaſt Indies, on the coaſt of the iſland of Madura, near Java. E. Long. 14. 30. N. Lat. 9. 30.

AROURA, a Grecian meaſure of 50 feet. It was more frequently uſed for a ſquare-meaſure of half the plethron. The Egyptian aroura was the ſquare of 100 feet.

ARPAD (anc. geog.), is thought to have been a city of Syria. It was always placed with Hamath (2 Kings xviii. 34. xix. 13. Iſai. x. 9. xxxvi. 19. xxxvii. 13. Jerem. xlix. 23.) Sennacherib boaſts of having reduced Arpad and Hamath, or of having deſtroyed the gods of theſe two places. Hamath is known to be the ſame with Emeſa ; and it is thought that Arpad is the ſame with Arad or Arvad, as it is ſometimes called in Hebrew. See Arad.

ARPAGIUS, or harpagius, among the ancients, a perſon who died in the cradle, at leaſt in early youth. The word is formed from the Greek αρπαζω, *I ſnatch*. The Romans made no funerals for their *arpagii*. They neither burnt their bodies, nor made tombs, monuments, or epitaphs for them ; which occaſioned Juvenal to ſay,

> ——*Terra clauditur infans*
> *Et minor igne rogi.*

In after times it became the cuſtom to burn ſuch as had lived to the age of 40 days, and had cut any teeth ; and theſe they called Αρπακτοι, or Αρπαγμενοι, q. d. *rapti, raviſhed*. The uſage ſeems to have been borrowed from the Greeks ; among whom, Euſtathius aſſures us, it was the cuſtom never to bury their children either by night or full day, but at the firſt appearance of the morning ; and that they did not call their departure by the name of *death*, but by a ſofter appellation, Ημερας αρπαγη, importing that they were raviſhed by Aurora, or taken away to her embraces.

ARPENT, ſignifies an acre or furlong of ground ; and, according to the old French account in domeſday-book, 100 perches make an arpent. The moſt ordinary acre, called *l'arpent de France*, is 100 perches ſquare : but ſome account it but half an acre.

ARPHAXAD, the ſon of Shem and father of Salah. Arphaxad was born in the year of the world 1658, a year after the deluge, and died in the year of the world 2096, at the age of 438 years, (Geneſ. xi. 12, &c.)

ARPI. See *Argos Hippium*.

ARPINAS, or Arpino, (Joſeph Cæſar), a famous painter, born in the year 1560, at the caſtle of Arpinas, in the kingdom of Naples. He lived in great intimacy with Pope Clement VIII. who conferred upon him the honour of knighthood, and beſtowed on him many other marks of his friendſhip. In the year 1600, he went to Paris with cardinal Aldobrandin, who was ſent legate to the French court on the marriage of Henry IV. with Mary of Medicis. His Chriſtian majeſty gave Arpinas many conſiderable preſents, and created him a knight of St. Michael. The colouring of this painter is thought to be cold and inanimate ; yet there is ſpirit in his deſigns, and his compoſitions have ſomewhat of fire and elevation. The touches of his pencil being free and bold, give therefore pleaſure to connoiſſeurs in painting ; but they are generally incorrect. What he painted of the Roman hiſtory is the moſt eſteemed of all his works. The French king has in his collection the following pieces of this maſter, viz. the nativity of our Saviour, Diana and Acteon, the rape of Europa, and a Suſanna. He died at Rome in 1640.

ARPINUM, a town of the Volſci, a little to the eaſt of the confluence of the rivers Liris and Fibrenus, in the Terra di Lavora ; now decayed, and called *Arpino*. It was the native place of Cicero, and of C. Marius, (Salluſt).

ARQUA, a town of Italy, in the Paduan, and territory of Venice, remarkable for the tomb of Petrarch. E. Long. 11. 43. N. Lat. 45. 43.

ARQUEBUS. See Harquebus.

ARQUES, a town of Normandy, in France, ſeated on a ſmall river of the ſame name. E. Long. 1. 30. N. Lat. 49. 54.

ARRACHEE, in heraldry, a term applied to the repreſentations of plants torn up by the roots.

ARRACHIS, in botany. See Arachis.

ARRACK. See Arack.

ARRAGON, a province of Spain, bounded on the north by the Pyrenæan mountains, which ſeparate it from France ; on the weſt, by Navarre and the two Caſtiles ; on the ſouth, by Valencia ; and on the eaſt, by Catalonia. It is in length about 180 miles, and in breadth 149 ; but the land is mountainous, dry, ſandy or ſtony, badly cultivated, and worſe peopled. However it does not want rivers : for beſides the Ebro, which croſſes it in the middle, there are the Xalo, the Cinea, the Galego, and the Arragon. The air is pure and wholeſome ; and there are mines of iron, and ſome ſay of gold. The moſt fertile parts are about the rivers : for there the land produces corn, wine, oil, flax, hemp, various fruits, and a ſmall quantity of ſaffron, beſides large flocks of ſheep, and plenty of game in the woods.

The Arragoneſe have the character of being bold, courageous, and well-bred ; but poſitive in their opinions, and bigotted in their religion. Theſe were the firſt of the Spaniards that threw off the Mooriſh yoke. Saragoſſa is the capital of this province ; and the other chief towns are Balbaſtro, Jaca, Sarazona, Haeſca, Calatajud, Albarrazin, Trevel, Daroca, and Boria.

ARRAIGNMENT, in law, the arraigning or ſetting a thing in order, as a perſon is ſaid to arraign a writ of novel diſſeiſin, who prepares and fits it for trial.

Arraignment is moſt properly uſed to call a perſon to anſwer in form of law upon an indictment, &c.

When brought to the bar, the criminal is called upon by name to hold up his hand ; which, though it may ſeem a trifling circumſtance, yet is of this importance, that by the holding up of his hand *conſtat de perſona*, and he owns himſelf to be of that name by which he is called. However it is not an indiſpenſable ceremony ; for, being calculated merely for the purpoſe of identifying the perſon, any other acknowledgement will anſwer the purpoſe as well : therefore, if the priſoner obſtinately and contemptuouſly refuſes to hold up in his hand, but confeſſes he is the perſon named, it is fully ſufficient.

Then the indictment is to be read to him diſtinctly in the Engliſh tongue (which was law, even while all other proceedings were in Latin), that he may fully underſtand his charge. After which it is to be demanded of him, whether he be guilty of the crime whereof he ſtands indicted, or not guilty?

When a criminal is arraigned, he either ſtands mute, or confeſſes the fact, or elſe he pleads to the indictment.

1. If he ſays nothing, the court ought *ex officio* to impanel a jury to enquire whether he ſtands obſtinately mute, or whether he be dumb *ex viſitatione Dei*. If the latter appears to be the caſe, the judges of the court (who are to be of counſel for the priſoner, and to ſee that he hath law and juſtice) ſhall proceed to the trial, and examine all points as if he had pleaded not guilty. But whether judgment of death can be given againſt ſuch a priſoner, who hath never pleaded, and can ſay nothing in arreſt of judgment, is a point yet undetermined.

If he be found to be obſtinately mute (which a priſoner hath been held to be that hath cut his own tongue), then, if it be on an indictment of high treaſon, it hath long been clearly ſettled, that ſtanding mute is equivalent to conviction, and he ſhall receive the ſame judgment and execution.

The Engliſh judgment of penance for ſtanding mute was as follows: That the priſoner be remanded to the priſon from whence he came, and put into a low, dark chamber; and there be laid on his back, on the bare floor, naked, unleſs where decency forbids; that there be placed upon his body as great a weight of iron as he could bear, and more; that he have no ſuſtenance, ſave only, on the firſt day, three morſels of the worſt bread; and, on the ſecond day, three draughts of ſtanding water that ſhould be neareſt to the priſon door; and in this ſituation this ſhould be alternately his daily diet, *till he died*, or, as anciently the judgment ran, *till he anſwered*.

It hath been doubted whether this puniſhment ſubſiſted at the common law, or was introduced in conſequence of the ſtatute Weſtm. 1. 3 Edw. I. c. 12. which ſeems to be the better opinion. For not a word of it is mentioned in Glanvil or Bracton, or in any ancient author, caſe, or record (that hath yet been produced), previous to the reign of Edward I.; but there are inſtances on record in the reign of Henry III. where perſons accuſed of felony, and ſtanding mute, were tried in a particular manner, by two ſucceſſive juries, and convicted,; and it is aſſerted by the judges in 8 Henry IV. that, by the common law before the ſtatute, ſtanding mute on an appeal amounted to a conviction of the felony. This ſtatute of Edward I. directs ſuch perſons, "as will not put themſelves upon inqueſts of felonies before the judges at the ſuit of the king, to be put into hard and ſtrong priſon (*ſoient mys en la priſone fort et dure*), as thoſe which refuſe to be at the common law of the land." And, immediately after this ſtatute, the form of the judgment appears in Fleta and Britton to have been only a very ſtrait confinement in priſon, with hardly any degree of ſuſtenance; but no weight is directed to be laid upon the body, ſo as to haſten the death of the miſerable ſufferer: and indeed any ſurcharge of puniſhment on perſons adjudged to penance, ſo as to ſhorten their lives, is reckoned by Horne in the Mirror as a ſpecies of criminal homicide. It alſo clearly appears, by a record of 31ſt Edw. III. that the priſoner might then poſſibly ſubſiſt for forty days under this lingering puniſhment. It is therefore imagined that the practice of loading him with weights, or, as it is uſually called, *preſſing him to death*, was gradually introduced between 31 Edward III. and 8 Henry IV. at which laſt period it firſt appears upon the books; being intended as a ſpecies of mercy to the delinquent, by delivering him the ſooner from his torment: and hence it is alſo probable, that the duration of the penance was then firſt altered; and inſtead of continuing *till he anſwered*, it was to continue *till he died*, which muſt very ſoon happen under an enormous preſſure.

The uncertainty of its original, the doubts that were conceived of its legality, and the repugnance of its theory (for it rarely was carried into practice) to the humanity of the laws of England, all concurred to require a legiſlative abolition of this cruel proceſs, and a reſtitution of the ancient common law; whereby the ſtanding mute in felony, as well as in treaſon as in treſpaſs, amounted to a confeſſion of the charge.

2. If the priſoner made a ſimple and plain confeſſion, the court hath nothing to do but to award judgment: but it is uſually very backward in receiving and recording ſuch confeſſion, out of tenderneſs to the life of the ſubject; and will generally adviſe the priſoner to retract it, and,

3. Plead to the indictment; as to which, ſee the article *PLEA of Indictment*.

ARRAN, an iſland of Scotland, in the Frith of Clyde, between Kintyre and Cunningham. Of this iſland the beſt deſcription we have is that given by Mr Pennant, in his Tour through Scotland, Vol. II. 172. —184.

"Arran, or properly *Arr-inn*, or 'the iſland of mountains,' ſeems not to have been noticed by the ancients, notwithſtanding it muſt have been known to the Romans, whoſe navy, from the time of Agricola, had its ſtation in the *Glota Æſtuarium*, or the Frith of Clyde. Camden indeed makes this iſland the Glota of Antonine, but no ſuch name occurs in his itinerary: it therefore was beſtowed on Arran by ſome of his commentators. By the immenſe cairns, the vaſt monumental ſtones, and many relics of Druidiſm, this iſland muſt have been conſiderable in very ancient times. Here are ſtill traditions of the hero Fingal, or Fin-mac-coul, who is ſuppoſed here to have enjoyed the pleaſures of the chace; and many places retain his name: but I can diſcover nothing but oral hiſtory that relates to the iſland till the time of Magnus the Barefooted, the Norwegian victor, who probably included Arran in his conqueſts of Kintyre, if he did not conquer that iſland, it was certainly included among thoſe that Donald-bane was to cede; for it appears that Acho, one of the ſucceſſors of Magnus, in 1263 laid claim to Arran, Bute and the Cumrays, in conſequence of that promiſe: the two firſt he ſubdued, but the defeat he met with at Largs ſoon obliged him to give up his conqueſts. Arran was the property of the crown. Robert Bruce retired thither during his diſtreſſes, and met with protection from his faithful vaſſals. Numbers of them followed his ſortunes; and after the battle of Bannock-burn he rewarded ſeveral, ſuch as the Mac-cooks, Mac-kinnons, Mac-brides, and Mac-louis, or Fullerton's, with different charters of lands in their native country. All theſe are now abſorbed by this great family, except the Fullerton's, and a Stewart, deſcended from a ſon of Robert III. who gave him a ſettlement here. In the time of the Dean of the Iſles, his deſcendant poſſeſſed Caſtle Douan; and *he and his bluid*, ſays the Dean, *are the beſt men in that countrey.* About the year 1334, this iſland appears to have formed part of the eſtate of Robert Stewart, great ſteward of Scotland, afterwards Robert II. At that time they took arms to ſupport the cauſe of their maſter; who afterwards, in reward, not only granted at their requeſt an immunity from their annual tribute of corn, but added ſeveral new privileges, and a donative to all the inhabitants that were preſent. In 1456, the whole iſland was ravaged by Donald Earl of Roſs and Lord of the Iſles. At that period, it was ſtill the property of James II.; but in the reign of his ſucceſſor James III. when that monarch matched his ſiſter to Thomas Lord Boyd, he created him Earl of Arran, and gave him the iſland as a portion. Soon after, on the diſgrace of that family, he cauſed the counteſs to be divorced from her unfortunate huſband; and beſtowed both the lady and iſland on Sir James Hamilton, in whoſe family it continues to this time, a very few farms excepted.

“ Arran is of great extent, being 23 miles from Sgreadan point north to Beinnean ſouth; and the number of inhabitants are about 7000, who chiefly inhabit the coaſts; the far greater part of the country being uninhabited by reaſon of the vaſt and barren mountains. Here are only two pariſhes, Kilbride and Kilmore; with a ſort of chapel of eaſe to each, founded in the laſt century, in the golden age of this iſland, when it was bleſſed with Anne Ducheſs of Hamilton, whoſe amiable diſpoſition and humane attention to the welfare of Arran render at this diſtant time her memory dear to every inhabitant. The principal mountains of Arran are, Goatfield, or Gaoilbheinn, or “ the mountain of the winds, of a height equal to moſt of the Scottiſh Alps, compoſed of immenſe piles of moorſtone, in form of wool-packs, clothed only with lichens and moſſes, inhabited by eagles and ptarmigans; Beinbharrain, or, “ the ſharp-pointed;” Ceum-na-caillich, “ the ſtep of the carline or old hag; and Grianan-Athol, that yields to none in ruggedneſs. The lakes are, Loch-jorſa, where ſalmon come to ſpawn; Loch-tana; Loch-nah-jura, on the the top of a high hill; Loch-mhachrai; and Loch-knoc-a-charbeil, full of large eels. The chief rivers are, Abhan-mhor, Moina-mhor, Slondrai-machrei, and Jorſa; the two laſt remarkable for the abundance of ſalmon.

“ The quadrupeds are very few; only otters, wild-cats, ſhrew-mice, rabbits and bats: the ſtags which uſed to abound, are reduced to about a dozen. The birds are, eagles, hooded-crows, wild-pigeons, ſtares, black game, grous, ptarmigans, daws, green plovers, and curlews. It may be remarked, that the partridge at preſent inhabits this iſland, a proof of the advancement of agriculture.

“ The climate is very ſevere: for beſides the violence of wind, the cold is very rigorous; and ſnow lay here in the valley for 13 weeks of the laſt winter. In ſummer, the air is remarkably ſalubrious; and many invalids reſort here on that account, and to drink the whey of goats milk.

“ The principal diſeaſe here is the pleuriſy: ſmall-pox, meaſles, and chincough, viſit the iſland once in ſeven or eight years. The practice of bleeding twice every year ſeems to have been intended as a preventative againſt the pleuriſy: but it is now performed with the utmoſt regularity at ſpring and fall. The duke of Hamilton keeps a ſurgeon in pay; who at thoſe ſeaſons makes a tour of the iſland. On notice of his approach, the inhabitants of each farm aſſemble in the open air; extend their arms and are bled into a hole made in the ground, the common receptacle of the vital fluid. In burning fevers, a tea of *wood ſorrel* is uſed with ſucceſs, to allay the heat. An infuſion of *ramſons*, or *allium urſinum*, in brandy, is eſteemed here a good remedy for the gravel.

“ The men are ſtrong, tall, and well made; all ſpeak the Erſe language, but the ancient habit is entirely laid aſide. Their diet is chiefly potatoes and meal; and during winter ſome dried mutton or goat is added to their hard fare. A deep dejection appears in general through the countenances of all: no time can be ſpared for amuſement of any kind; the whole being given for procuring the means of paying their rent, or laying in their fuel, or getting a ſcanty pittance of meat and clothing.

“ The leaſes of farms are 19 years, the ſucceeding tenants generally find the ground little better than a *caput mortuum*: and for this reaſon; Should they at the expiration of the leaſe leave the lands in a good ſtate, ſome avaricious neighbours would have the preference in the next ſetting, by offering a price more than the perſon who had expended part of his ſubſtance in enriching the farm could poſſibly do. This induces them to leave it in the original ſtate. The method of ſetting a farm is very ſingular; each is commonly poſſeſſed by a number of ſmall tenants; thus a farm of 40*l*. a year is occupied by 18 different people, who by their leaſes are bound, conjunctly and ſeverally, for the payment of the rent to the proprietor. Theſe live in the farm in houſes cluſtered together, ſo that each farm appears like a little village. The tenants annually divide the arable land by lot; each has his ridge of land to which he puts his mark, ſuch as he would do to any writing: and this ſpecies of farm is called *run-rig*, i. e. ridge. They join in ploughing; every one keeps a horſe or more; and the number of thoſe animals conſume ſo much corn as often to occaſion a ſcarcity; the corn and peas raiſed being (much of it) deſigned for their ſubſiſtence, and that of the cattle during the long winter. The paſture and moor-land annexed to the farm is common to all the poſſeſſors. All the farms are open. Incloſures of any form, except in two or three places, are quite unknown: ſo that there muſt be a great loſs of time in preſerving their corn, &c. from treſpaſs. The uſual manure is ſea-plants, coral, and ſhells. The run-rig farms are now diſcouraged: but ſince the tenements are ſet by roup or auction, and advanced by an unnatural force to above double the old rent, without any allowance for incloſing, any example ſet in agriculture, any ſecurity of tenure by lengthening the leaſes, affairs will turn retrograde, and the farms relapſe into their old ſtate of rudeneſs;

migration will increaſe (for it has begun), and the rents be reduced even below their former value: the late rents were ſcarce 1200l. a-year; the expected rents 3000l.

"The produce of the iſland is oats; of which about 5000 bolls, each equal to nine Wincheſter buſhels, are ſown; 500 of beans, a few peas, and above 1000 bolls of potatoes, are annually ſet: notwithſtanding this, 500 bolls of oat-meal are annually imported, to ſubſiſt the natives.

"The live ſtock of the iſland is 3183 milch-cows; 2000 cattle, from one to three years old; 1058 horſes; 1500 ſheep; and 500 goats: many of the two laſt are killed at Michaelmas, and dried for winter-proviſion, or ſold at Greenock. The cattle are ſold from 40 to 50s. per head, which brings into the iſland about 1200l. per annum: I think that the ſale of horſes alſo brings in about 300l. Hogs were introduced here only two years ago. The herring-fiſhery round the iſland brings in 300l. the ſale of herring-nets 100l. and that of thread about 300l. for a good deal of flax is ſown here. Theſe are the exports of the iſland; but the money that goes out for mere neceſſaries is a melancholy drawback.

"The women manufacture the wool for the cloathing of their families; they ſet the potatoes, and dreſs and ſpin the flax. They make butter for exportation, and cheeſe for their own uſe.

"The inhabitants in general are ſober, religious, and induſtrious; great part of the ſummer is employed in building or repairing their houſes, for the badneſs of the materials requires annual repairs: before and after harveſt; they are buſied in the herring-fiſhery; and during winter the men make their herring-nets; while the women are employed in ſpinning their linen and woollen yarn. The light they often uſe is that of lamps. From the beginning of February to the end of May, if the weather permits, they are engaged in labouring their ground: in autumn they burn a great quantity of fern, to make kelp. So that, excepting at new year's day, at marriages, or at the two or three fairs in that iſland, they have no leiſure for any amuſements: no wonder then at their depreſſion of ſpirits.

"Arran forms part of the county of Bute, and is ſubject to the ſame ſort of government: but, beſides, juſtice is adminiſtered at the baron's baily-court, who has power to fine as high as 20s.; can decide in matters of property not exceeding 40s.; can impriſon for a month; and put delinquents into the ſtocks for three hours, but that only during day-time."

In this iſland there are many of thoſe rude antiquities or monuments called *cairns*, ~~*druidical circles*~~, &c. See CAIRNS.

ARRANGEMENT, or RANGEMENT, the diſpoſition of the parts of a whole, in a certain order.

The modern philoſophy ſhows us, that the diverſity of the colours of bodies depends entirely on the ſituation and arrangement of the parts, which reflect the light differently; the diverſity of taſtes and ſmells on the different arrangements of the pores, which render them differently ſenſible; and the general diverſity of bodies on the different arrangement of their parts. The happy arrangement of words makes one of the greateſt beauties of diſcourſe.

ARRAS, the capital city of Artois, a province in the French Netherlands. It is ſeated on a mountain; and the parts about it are full of quarries, where they get ſtone for building. It is divided into two parts, the town and the city. The abbe of St Vaaſt is lord of the town, and the biſhop of Arras of the city, which is the leaſt part. They are divided by a ſtrong wall, a large foſſe, and the little river Chrinchron, which 100 paces below falls into the Scarp. They are both well fortified, incloſed by high ramparts, and by double deep foſſes, which in ſeveral places are cut out of the rock. It has four gates; and ſince the French are become maſters of it, has a ſtrong citadel with five baſtions. The moſt remarkable places are, the great ſquare where the principal market is kept; this is full of fine buildings, with piazzas all round it like thoſe of Covent-garden. Not far from this is the leſſer market, which contains the town-houſe, a very noble ſtructure, with a high tower covered with a crown, on the top of which is a brazen lion which ſerves for a vane. In the midſt of this market is the chapel of the Holy Candle, which the papiſts pretend was brought by the Virgin Mary herſelf above 600 years ago, when the city was afflicted with divers diſeaſes, and every one that touched the candle was cured; it is kept in a ſilver ſhrine. This chapel has a ſpire-ſteeple, adorned with ſeveral ſtatues. The cathedral church of Notre-Dame ſtands in the city: it is a very large Gothic building, extremely well adorned; the tower is very high, and has a fine clock embelliſhed with little figures in bronze, which repreſent the paſſion of Jeſus Chriſt; they paſs before the bell to ſtrike the hours and half hours. In this church there is a ſilver ſhrine, enriched with pearls and diamonds, which contains a ſort of wool, which they call *manna*; that they ſay fell from heaven in the time of a great drought, almoſt 1400 years ago: they carry it very ſolemnly in proceſſion when they want rain. The abbey-church of St Vedaſt is the greateſt ornament of Arras, it being adorned with a fine ſteeple, and ſeats for the monks of admirable workmanſhip; the pulpit is of braſs, faſhioned like a tree, ſupported by two bears of the ſame metal, ſitting on their hind legs; there are little bears in different poſtures coming to climb up the tree. The chimes are remarkable for the different tunes which they play. There are 11 pariſh churches, and a great many convents of men and women. It is from this city that the tapeſtry called *arras hangings* takes its denomination. E. Long. 2. 56. N. Lat. 50. 17.

ARRAS, or *Araxes*, is alſo the name of a river of Georgia, which diſcharges itſelf into the Caſpian ſea.

ARRAY, in law, the ranking or ſetting forth of a jury, or inqueſt of men impanelled on a cauſe.

Battle-ARRAY, the order or diſpoſition of an army, drawn up with a view to engage the enemy. See ARMY.

ARRAYERS, or ARRAGERS, ARRAITORES, is uſed, in ſome ancient ſtatutes, for ſuch officers as had care of the ſoldiers armour, and ſaw them duly accoutred in their kinds. In ſome reigns, commiſſioners have been appointed for this purpoſe. Such were the commiſſioners of array appointed by king Charles I. in the year 1642.

ARREARS, the remainder of a ſum due, or money remaining in the hands of an accountant. It likewiſe ſignifies the money due for rent, wages, &c. or what remains unpaid of penſions, taxes, &c.

ARRENTATION, in the foreſt laws, implies the licenſing the owner of lands in a foreſt to incloſe them with a low hedge and a ſmall ditch, in conſideration of a yearly rent.

ARREST, in Engliſh law (from the French word *arreſter*, to *ſtop* or *ſtay*), is the reſtraint of a man's perſon, obliging him to be obedient to the law; and is defined to be the execution of the command of ſome court of record or office of juſtice. An arreſt is the beginning of impriſonment; where a man is firſt taken, and reſtrained of his liberty, by power or colour of lawful warrant.

Arreſts are either in *civil* or *criminal* caſes.

1. An arreſt in a *civil cauſe* is defined to be the apprehending or reſtraining one's perſon by proceſs in execution of the command of ſome court.

An arreſt muſt be by corporal ſeiſing or touching the defender's body; after which the bailiff may juſtify breaking open the houſe in which he is, to take him: otherwiſe he has no ſuch power; but muſt watch his opportunity to arreſt him. For every man's houſe is looked upon by the law to be his caſtle of defence and aſylum, wherein he ſhould ſuffer no violence. Which principle is carried ſo far in the civil law, that, for the moſt part, not ſo much as a common citation or ſummons, much leſs an arreſt, can be executed upon a man within his own walls. Peers of the realm, members of parliament, and corporations, are privileged from arreſts; and of courſe from outlawries. And againſt them the proceſs to inforce an appearance muſt be by ſummons and diſtreſs *infinite*, inſtead of a *capias*. Alſo clerks, attorneys, and all other perſons attending the courts of juſtice (for attorneys, being officers of the court, are always ſuppoſed to be there attending), are not liable to be arreſted by the ordinary proceſs of the court, but muſt be ſued by bill (called uſually a *bill of privilege*) as being perſonally preſent in court. Clergymen performing divine ſervice, and not merely ſtaying in the church with a fraudulent deſign, are for the time privileged from arreſts, by ſtatute 50 Edw. III. c. 5. and 1 Rich. II. c. 86.; as likewiſe members of convocation actually attending thereon, by ſtatute 1 Hen. VI. c. 1. Suitors, witneſſes, and other perſons, neceſſarily attending any courts of record upon buſineſs, are not to be arreſted during their actual attendance, which includes the neceſſary coming and returning. Seamen in the king's ſervice are privileged from arreſts for debts under L.20. (1 Geog. II. c. 14. and 14 Geo. II. c. 38.); and ſoldiers or marines are not liable to arreſts for a debt of leſs than L.10. (30 Geo. II. c. 6, 11.) And no arreſt can be made in the king's preſence, nor within the verge of his royal palace, nor in any place where the king's juſtices are actually ſitting. The king hath moreover a ſpecial prerogative (which indeed is very ſeldom exerted), that he may by his *writ of protection* privilege a defendant from all perſonal, and many real, ſuits, for one year at a time, and no longer, in reſpect of his being engaged in his ſervice out of the realm. And the king alſo by the common law might take his creditor into his protection, ſo that no one might ſue or arreſt him till the king's debt was paid: but by the ſtatute 25 Edw. III. c. 19. notwithſtanding ſuch protection, another creditor may proceed to judgment againſt him, with a ſtay of execution, till the king's debt be paid; unleſs ſuch creditor will undertake for the king's debt, and then he ſhall have execution for both. And, laſtly, by ſtatute 29 Car. II. c. 7. no arreſt can be made, nor proceſs ſerved, upon a Sunday, except for treaſon, felony, or breach of the peace.

2. An arreſt in *criminal cauſe* is the apprehending or reſtraining one's perſon, in order to be forthcoming to anſwer an alleged crime. To this arreſt all perſons whatſoever are, without diſtinction, equally liable; and doors may be broken open to arreſt the offender: but no man is to be arreſted, unleſs charged with ſuch a crime as will at leaſt juſtify holding him to bail when taken. There is this difference alſo between arreſts in civil and criminal caſes, that none ſhall be arreſted for debt, treſpaſs, or other cauſe of action, but by virtue of a precept or commandment out of ſome court; but for treaſon, felony, or breach of the peace, any man may arreſt with or without warrant or precept. But the king cannot command any one by word of mouth to be arreſted; for he muſt do it by writ, or order of his courts, according to law: nor may the king arreſt any man for ſuſpicion of treaſon, or felony, as his ſubjects may; becauſe, if he doth wrong, the party cannot have an action againſt him.

Arreſts by private perſons are in ſome caſes commanded. Perſons preſent at the committing of a felony muſt uſe their endeavours to apprehend the offender, under penalty of fine and impriſonment; and they are alſo, with the utmoſt diligence, to purſue and endeavour to take all thoſe who ſhall be guilty thereof out of their view, upon a hue and cry levied againſt them. By the vagrant act 17 Geo. II. c. 5. every perſon may apprehend beggars and vagrants; and every private perſon is bound to aſſiſt an officer requiring him to apprehend a felon.

In ſome caſes likewiſe arreſts by private perſons are rewarded by law. By the 4 and 5 William and Mary, c. 8. perſons apprehending highwaymen, and proſecuting them to a conviction, are intitled to a reward of L.40, and if they are killed in the attempt, their executors, &c. are intitled to the like reward. By the 6 and 7 William III. c. 17. perſons apprehending counterfeiters and clippers of the coin, and proſecuting them to conviction, are intitled to L.40.

By 5 Ann, c. 31. perſons who ſhall take any one guilty of burglary, or the felonious breaking and entering any houſe in the day-time, and proſecute them to conviction, ſhall receive the ſum of L.40 within one month after ſuch conviction.

With regard to arreſts by public officers, as watchmen, conſtables, &c. they are either made by their own authority, which differs but very little from the power of a private perſon; or they are made by a warrant from a juſtice of peace. See WARRANT.

ARREST of Judgment, in law, the aſſigning juſt reaſon why judgment ſhould not paſs: as, Want of notice of the trial; a material defect in the pleading; when the record differs from the deed impleaded; when perſons are miſnamed; where more is given by the verdict than is laid in the declaration, &c. This may be done either in criminal or civil caſes.

ARRESTMENT, in Scots law, ſignifies the ſecuring of a criminal till trial, or till he find caution to ſtand trial, in what are called *bailable crimes*. In civil caſes, it ſignifies either the detaining of ſtrangers or natives *in meditatione fugæ*, till they find caution *judicio ſiſti*, or the attaching the effects of a ſtranger in order to found juriſdiction. But, in the moſt general acceptation of the word, it denotes that diligence by which a creditor detains the goods or effects of his debtor in the hands of third parties till the debt due to him be either paid or ſecured. See LAW, Part III. Nº clxxviii.

ARRESTO FACTO SUPER BONIS, &c. a writ brought by a denizen againſt the goods of aliens found within the kingdom, as a recompence for goods taken from him in a foreign country.

ARRESTS, in farriery, mangy tumors upon a horſe's hinder-legs, between the ham and the paſtern.

ARRETIUM, (Cicero, Cæſar); *Arrhetium*, (Ptolemy); *Urbs Arrhetinorum*, (Polybius); one of the twelve ancient towns of Tuſcany, near the Arnis and Clanis, ſituated in a pleaſant valley. Now *Arezzo*, 42 miles eaſt of Florence. E. Long. 13. 18. Lat. 43. 15.

ARRHABONARII, a ſect of Chriſtians, who held that the Euchariſt is neither the real fleſh or blood of Chriſt, nor yet the ſign of them; but only the pledge or earneſt thereof.

ARRHEPHORIA, a feaſt among the Athenians, inſtituted in honour of Minerva, and Herſe, daughter of Cecrops. The word is compoſed of αρρητον, *myſtery*, and φερω, *I carry*; on account of certain myſterious things which were carried in proceſſion at this ſolemnity.—Boys, or, as ſome ſay, girls, between ſeven and twelve years of age, were the miniſters that aſſiſted at this feaſt, and were denominated αρρηφοροι. This feaſt was alſo called *Herſiphoria*, from the daughter of Cecrops, already mentioned.

ARRIAN, a famous philoſopher and hiſtorian under the emperor Hadrian and the two Antonines, was born at Nicomedia in Bithynia. His great learning and eloquence procured him the title of *The ſecond Xenophon*; and raiſed him to the moſt conſiderable dignities at Rome, even the conſulſhip itſelf. We have four books of his *Diſſertations upon Epictetus*, whoſe ſcholar he had been; and his *Hiſtory of Alexander the Great*, in ſeven books, is greatly admired by the beſt judges.

ARRIERE, the hinder or poſterior part of any thing.

ARRIERE Ban, in the French cuſtoms is a general proclamation, whereby the king ſummons to the war all that hold of him, both his vaſſals, i. e. the nobleſſe, and the vaſſals of his vaſſals.

ARRIERE Fee, or *Fief*, is a fee dependent on a ſuperior one. Theſe fees commenced, when the dukes and counts, rendering their governments hereditary in their families, diſtributed to their officers parts of the royal domains which they found in their reſpective provinces, and even permitted thoſe officers to gratify the ſoldiers under them in the ſame manner.

ARROBAS, or AROBAS, a weight uſed in Spain, Portugal, and the foreign dominions of both. The Arrobas of Portugal is alſo called *Arata*, and contains thirty-two Liſbon pounds; that of Spain contains twenty-five Spaniſh pounds. In Peru it is called *Arroue*.

ARROE, a ſmall iſland of Denmark, in the Baltic Sea, a little ſouth of the iſland of Funen. It is eight miles in length, and about two in breadth; and produces corn, anniſeed, black cattle, and horſes. It has three pariſhes, the moſt conſiderable of which is Koping. It ſtands at the ſouth-ſide of the iſland, in the bottom of a bay, and has a port with ſome trade. E. Long. 9. 40. N. Lat. 55. 20.

ARROJO, DE ST SERVAN, a town in Spain, in Eſtramadura. W. Long. 5. 20. N. Lat. 38. 40.

ARRONDEE, in heraldry, a croſs, the arms of which are compoſed of ſections of a circle, not oppoſite to each other, ſo as to make the arms bulge out thicker in one part than another; but the ſections of each arm lying the ſame way, ſo that the arm is every where of an equal thickneſs, and all of them terminating at the edge of the eſcutcheon like the plain croſs.

ARROW, a miſſive weapon of offence, ſlender, pointed and barbed, to be caſt or ſhot with a bow. See ARCHERY.

ARROW-Makers are called *fletchers*; and were formerly, as well as bowyers, perſons of great conſequence in the commonwealth.

Arrow-heads and quarrels were to be well boched or braſed, and hardened at the points with ſteel: the doing of which ſeems to have been the buſineſs of the arrow-ſmith.

ARROW-Head, in botany. See SAGITTARIA.

ARROW-Root. See MARANTA.

ARSACES, otherwiſe MITHRIDATES, a king of the Parthians, ſpoken of in the firſt book of Maccabees, xiv. 2. He conſiderably enlarged the kingdom of Parthia by his good conduct and valour. See PARTHIA.

ARSCHIN, in commerce, a long meaſure uſed in China to meaſure ſtuffs. Four arſchins made three yards of London.

ARSENAL, a royal or public magazine, or place appointed for the making or keeping of arms, neceſſary either for defence or aſſault. Some derive this word from *arx*, *a fortreſs*; others from *ars*, denoting a *machine*; others again from *arx* and *ſenatus*, becauſe this was the defence of the ſenate: but the more probable opinion derives it from the Arabic *darſenaa*, which ſignifies *arſenal*.

The arſenal of Venice is the place where the galleys are built and laid up. The arſenal of Paris is that where the cannon or great guns are caſt. It has this inſcription over the gate:

> *Ætna hæc Henrico vulcania tela miniſtrat,*
> *Tela Gigantæos debellatura furores.*

There are arſenals, or ſtore-houſes, appropriated to naval furniture and equipments. At Marſeilles is the arſenal for the galleys; and at Toulon, Rochefort, and Breſt, are thoſe for the men of war.

ARSENIC, in mineralogy and chemiſtry, an heavy opake ſubſtance, uſually ſold in white maſſes, which, when broken, diſcover a ſemi-tranſparency ſomewhat reſembling that of ſal ammoniac, but by expoſure to the air become white and opake like the outſide of the original maſs. By various chemical proceſſes it may be be made to aſſume the appearance either of an acid ſalt or metal, at the pleaſure of the operator; and therefore has been conſidered both as a ſaline ſubſtance and as a ſemi-metal. It is not known at what time this mineral was diſcovered; though as it abounds in many different kinds of ores, it is probable that the pernicious properties it manifeſts would very ſoon make it be taken notice of by metallurgiſts. Ariſtotle makes mention of a ſubſtance called Σανδαρακη; and his diſciple Theophraſtus makes mention of one named Αρρενικος, which by Dioſcorides and others was called Αρσενικος, about the beginning of the Chriſtian æra. By this, however, it appears, that they only meant the ſubſtances now called *Sandarach* and *orpiment*; and Avicenna, who lived in the 11th century, is the firſt who expreſsly mentions white arſenic, as well as its ſublimate. It is not known by whom arſenic was firſt reduced to a metallic form. Paracelſus aſſerts that arſenic, ſublimed with egg-ſhell lime becomes like ſilver; and, in 1675, M. Lemeri makes mention of a method of ſubliming arſenic with fixed alkali and ſoap.

1
Is not mentioned till the time of Avicenna.

The true nature of arſenic being thus ſo little known, it is no wonder to find chemiſts differing very much as to the claſs of natural bodies in which it ought to be placed. Avicenna and a great number of others claſs it with the ſulphurs; Albertus Magnus and his followers, among the ſalts. Becher conſiders it as a kind of ſoap, or ſaline ſuphureous body. Later experiments, however, have made it evident, that white arſenic conſiſts of an acid united to phlogiſton; and that by diminiſhing the latter, the acid becomes more and more apparent; while, on the contrary, by augmenting the quantity of phlogiſtic matter, the arſenic aſſumes the metallic form. With reſpect to the ſulphureous nature of arſenic, it appears indeed that the regulus itſelf, as well as orpiment and realgar, are inflammable ſubſtances; but it is not ſo with white arſenic. This inflammability, therefore, which arſenic in a certain ſtate has in common with zinc and ſeveral other ſubſtances, will not denominate it ſulphureous, any more than thoſe of other bodies which poſſeſs the common property of inflammability can be denominated *ſulphurs*.

2
Compoſed of an acid and phlogiſton.

3
Is not to be conſidered as a ſubſtance by which other metals are mineralized.

It is commonly ſaid that arſenic mineralizes metals; and therefore, ſays Mr Bergman, it is conſidered as a ſulphur by ſome, who yet extend the idea of mineralization ſo far, as under it to comprehend all mixtures of which metals make a part. But if we examine this ſignification a little more accurately, we ſhall ſee that it is extended too far; for if this be admitted, we muſt at the ſame time allow, that no native metal is to be found. Thus the gold called *native*, is ſeldom if ever found pure, but more or leſs mixed with copper or ſilver; and ſo with other metals. If, therefore, arſenic, which, unleſs in its reguline ſtate, never diſſolves other metals, be conſidered as a mineralizing ſubſtance, what hinders us from ſaying that gold is mineralized by ſilver or copper, and in general every metal mineralized by ſome other? It is much more natural to ſuppoſe that thoſe metals are mineralized which are actually diſſolved and concealed by a menſtruum. Sulphur is the chief agent employed by nature for this purpoſe; and though the acids of vitriol, phoſphorus, nitre, and ſometimes even the aërial acid, occaſion the metals to put on an appearance foreign to their nature, yet the number of theſe is ſo ſmall, that, compared with the ſulphurated minerals, they almoſt vaniſh.

4
Sulphur the chief mineralizer of metals.

5
An arſenical principle erroneouſly ſuppoſed neceſſary for the perfection of metals.

This mineral, ſo troubleſome to the mineralogiſt, occaſioned the alchemiſts to ſuſpect the exiſtence of a certain arſenical principle indiſpenſibly neceſſary to the perfection of every metal. Even as late as 1773 a queſtion to this purpoſe was propoſed by the Royal Academy of Sciences at Berlin: the prize was adjudged to M. Monnet, who, in his anſwer conſidered arſenic as a ſemi-metal of a peculiar kind, which is ſo far from conſtituting any eſſential part of metals, that its preſence is always attended with inconveniences, either by carrying off the metal as it flies away, or ſpoiling the maſs in which it remains. Theſe conſiderations, however, do not hinder us from aſſerting that the acid of arſenic, like others, is a mineralizing ſubſtance, if at any time it happens to meet with metals in the bowels of the earth, and to unite with it in that form.

6
Acid of arſenic a mineralizing ſubſtance.

7
Poiſonous qualities of arſenic and its acid.

Arſenic in its pure ſtate is well known to be a moſt deſtructive and deadly poiſon, for which the art of medicine has ſcarcely as yet afforded a cure. Mr Bergman is of opinion that it acts as an highly corroſive acid, even when applied externally. He alſo tells us, that the dry acid is more deſtructive than white arſenic; the regulus and realgar leſs ſo. From an experiment of Mr. Scheele, however, in which eight grains of arſenic were given to a cat, it does not appear that it acts more violently than white arſenic. The extreme danger attending this ſubſtance when taken into the human body, ariſes from its inſolubility, and the difficulty of decompounding it; for there can but little danger ariſe from a liquid, unleſs, like corroſive acids, it ſhould at once burn the ſubſtance of the ſtomach like fire: or, like laurel-water ſuſpend the action of the nervous ſyſtem. Corroſive ſublimate, ſolutions of mercury in aquafortis, &c. will as certainly poiſon as arſenic; but they are much leſs difficult to cure, becauſe any alkaline ſubſtance will certainly decompound them and deſtroy their deleterious efficacy. Arſenic, on the contrary, cannot be decompounded, nor united with any known ſubſtance, at leaſt in ſuch a ſhort time as the exigence of the caſe we ſpeak of would require, without a conſiderable degree of heat. It therefore remains in the ſtomach, continually exerting its miſchievous qualities, unleſs it can be diſcharged by vomiting.

8
Why it is more dangerous than other.

9
Symptoms attending the ſwallowing of arſenic.

The ſymptoms attending arſenic when ſwallowed are, nauſea, ſickneſs, and retching to vomit, about half an hour after it is taken. Theſe are followed by violent vomitings, hiccups, and pains in the ſtomach and bowels. Convulſions and palſies of the limbs preſently ſucceed, with intenſe heats, cold ſweats, palpitation of the heart, extreme anxiety, proſtration of ſtrength, thirſt and dryneſs of the mouth and throat, loſs of reaſon, and at laſt death. If the quantity taken was conſiderable, the patient dies in ſeven or eight hours after taking it; and the ſtomach and inteſtines are found, upon diſſection, to be corroded and perforated. When this is not the caſe, violent putrefactive ſymptoms ſoon enſue after arſenic is ſwallowed; for the bodies of thoſe who are poiſoned by it generally have abundance of red or purple ſpots even before death. It remarkably inflames the coats of the ſtomach, and the putrefaction

faction is ſaid particularly to take place in the genitals of men. Mr Bergman relates, that in the body of a man who was poiſoned with arſenic and diſſected in the anatomical theatre at Upſal, the putrefaction had been ſo ſtrong that the mineral was deprived of part of its phlogiſton, and emitted the garlic ſmell, that peculiar characteriſtic of arſenic when in this ſituation.

10
Antidotes ineffectually propoſed.

Many antidotes have been propoſed againſt this dreadful poiſon by authors of the higheſt reputation; but it is to be feared without that ſucceſs which the confidence of thoſe who propoſed them ſeemed to enſure. Indeed, previous to any great hope of ſucceſs in this reſpect, it ought to be ſhown that theſe antidotes are able to effect ſome conſiderable change on arſenic when out of the body; and that not in ſolution, but when in a powder not very fine, as is the caſe with arſenic when it is uſually taken. Mr Bergman, recommends alkalies in diſeaſes occaſioned by arſenic: Nay he tells us, that "ſince phlogiſton and alkalies are the moſt powerful correctors of acid acrimony, it will *readily occur*, how it may be mitigated, and its deleterious effects obviated." But the many fatal accidents conſequent on taking this mineral, ſhow that none of thoſe are to be depended upon. Bergman himſelf indeed cautions us againſt truſting to phlogiſton correctors alone; and perhaps the ſolution of hepar ſulphuris, which contains the united powers of both the alkaline and phlogiſtic antidotes united, might prove more efficacious than either of them ſingly. Oils, fats, milk, warm fat broths, freſh butter, &c. have all been recommended; and, no doubt, in ſuch deplorable caſes, are thoſe remedies to which we can moſt readily have recourſe: but even here it is evident that their efficacy muſt be exceedingly dubious, whatever their intrinſic virtues may be; and for this plain reaſon, that the arſenic is already in contact with the ſtomach, and tho' the remedies might have prevented its action had they been *firſt* ſwallowed, their operation muſt be much leſs powerful after the poiſon has had acceſs to the ſtomach and begun to exert its pernicious effects.

11
Arſenic recommended as a medicine both internally and externally.

Notwithſtanding theſe dreadful effects of arſenic when taken in large quantity, attempts have not been wanting to introduce it into the materia medica. The diſeaſe indeed in which they have been recommended (the cancer) is of a very incurable nature, at leaſt by ordinary medicines. M. le Febure, a French phyſician, ſome time ago publiſhed a treatiſe, in which he recommended pure white arſenic as a ſpecific in that diſtemper. The doſe was four French grains, equal to $3\frac{1}{2}$ Engliſh, diſſolved in a French pint (32 troy ounces) of diſtilled water. A table-ſpoonful of this ſolution is to be taken with an equal quantity of milk, and half an ounce of ſyrup of poppies, every morning faſting, and taking care to taſte nothing for an hour after. This courſe muſt be continued eight days; after which a doſe is to be taken twice every day in the ſame manner, one in the morning and another about eight at night. At the end of a fortnight three doſes may be exhibited daily, the third being taken at mid-day. Thus people of a weakly conſtitution may continue till the cure is completed; but ſuch as are more robuſt may gradually augment the doſe till two table-ſpoonfuls are taken at each time with as much milk, and half an ounce of ſyrup of poppies. Children muſt on no account take more than three tea-ſpoonfuls a day, with a proportional quantity of ſyrup of poppies. For adults, the ſtrength of the ſolution, as well as the quantity, is to be augmented; ſix grains being put into the ſecond bottle and eight into the third; and a purgative, compoſed of manna, rhubarb, and ſal ſeignette, is to be given every eight or twelve days. An iſſue he conſiders as uſeful in every caſe. The tumor, if not ulcerated, ought to be waſhed with a ſolution of arſenic in the proportion of eight grains to a pint; and he adviſes the following cataplaſm. "Take of carrot juice one pound, of ſugar of lead half an ounce, of arſenic, diſſolved in diſtilled vinegar, half an ounce, of liquid laudanum a dram and an half; form the whole into a maſs with as much powder of hemlock as is ſufficient for the purpoſe. The tumor is to be covered to a moderate thickneſs with this cataplaſm, which is to be kept on by a diachylon plaſter." When the cancer is of the ulcerated kind, he directs the ichorous ſeroſity to be taken away by means of dry *charpee* at each dreſſing, and the ſore to be fomented with the arſenical ſolution with the chill taken off it, and having about a third-part of red wine added to it. When the ſore is of a very bad kind, he propoſes the arſenic to be diſſolved in decoction of bark for the purpoſe of fomentation; after which the cataplaſm and plaſter are to be applied, and this is to be renewed every twelve hours.

Mr Le Febure aſſerts, that the arſenic, when taken with the precautions juſt mentioned, is not attended with any bad conſequences, nor has it a diſagreeable taſte. Its action is ſcarcely perceived on any of the ſecretions or excretions; though ſome diſcharge their urine more freely than uſual, and with ſome the belly is more looſe. In ſome the perſpiration is more copious; but theſe effects are neither regular nor conſtant. He does not conſider it as an infallible cure for the diſtemper in every poſſible ſtage; but thinks that the diſeaſe is incurable, when, in its progreſs, it has eroded a blood-veſſel, and occaſioned a conſiderable hemorrhagy; alſo when the patient is of a hectic or phthiſical habit of body. With reſpect to regimen, he directs whey, with twelve grains of nitre to the bottle, or a weak decoction of althea with an equal quantity of nitre; and to abſtain from wine and fermented liquors. Broth made with beef, veal, or chicken, is alſo proper.

12
Mr Bergman's opinion.

Mr Bergman informs us, that "it can hardly be doubted but arſenic may be applied to valuable purpoſes in medicine, and experiments have long ago put that out of doubt; but with reſpect both to its doſe and preparation, the utmoſt caution is neceſſary."

13
The internal exhibition of arſenic diſapproved by Dr Black.

Dr Black, however, has ſeen the internal exhibition of arſenic, in thoſe caſes where it is recommended by foreign phyſicians, attended with very dangerous conſequences, ſuch as hectics, &c. He has likewiſe known obſtinate ulcers healed by it. Yet though the external uſe of arſenic has proved ſucceſsful in ſome caſes, it has often, even in this way, produced very terrible conſequences: ſo that the Doctor, far from recommending the internal uſe of it, reprobates it even in external applications.

As phyſicians are often called in caſes where it is ſuſpected that people have died from the effects of ar-

Arſenic.

Lectures on Chemiſtry.

ſenic taken internally, Doctor Black gives the following directions to the phyſician who happens to be thus employed.

14
Directions to a phyſician how to act when called in caſes of arſenic being ſwallowed.

“ He ſhould anſwer every queſtion put to him with caution, as the lives and reputations of many often depend on his opinions.

“ The firſt queſtion uſually put is, Whether, from the ſymptoms of the patient, or the appearance of the body after death, he imagines the deceaſed died by being poiſoned with arſenic? The ſymptoms attending the taking of arſenic are, in about a quarter of an hour, ſickneſs at ſtomach, ſucceeded by vomiting, purging, burning pain in the bowels, heat and thirſt, pains and cramps in the legs and thighs, ſyncope, and death. When the body is examined, the inteſtines appear inflamed and corroded; nay, ſome ulcerations appear about the anus even before death. But we muſt take care not to be deceived by eroſions of the ſtomach occaſioned by the gaſtric juice, which has a power of diſſolving the ſtomach after death. The difference is, that the arſenic occaſions inflammation and blackneſs, whereas none appears in the other caſe. If the perſon eſcapes, he is in danger of being afflicted by maraſmus, paralytic affections of the limbs, great debility, &c.

“ The ſecond queſtion generally aſked is, Whether any arſenic has been found in the inteſtines? The method of diſcovering this is as follows. The contents of the ſtomach and inteſtines ſhould be taken out and waſhed in water; and any powder it contains ſuffered to ſeparate. If any arſenic be mixed with it, it will fall to the bottom, and muſt then be examined by the following methods.

“ 1. By laying it on a red hot iron. If it be arſenic, it will evaporate, without melting, in a thick white vapour; and this may be ſhown by the 40th part of a grain.

“ 2. We may mix ſome of it with charcoal; in which ſtate, if it be arſenic, it will emit an odour very like garlic; but this will not be perceived unleſs it be mixed with charcoal or ſome inflammable matter.

“ 3. We may incloſe the powder with ſome charcoal, between two poliſhed bits of copper, the edges of which are moiſtened with a lute made of two parts of fine ſand and one of pipe-clay. The plates being then bound together with a wire, and the whole made red hot, the arſenical powder will thus be metallized, and, penetrating the copper, a blackiſh ſkin will firſt appear upon it; which being rubbed off, the parts which the arſenical vapour has touched will appear of a whitiſh or lead colour.

“ 4. We may metallize or reduce the arſenic in a glaſs tube by means of the black flux. This is eaſily done by mixing two or three parts of the flux with one of the powder. This mixture being put into a ſmall glaſs tube, and a heat applied ſufficient for volatalizing the arſenic, the greateſt part of it will be metallized. One end of the tube is to be left open at firſt, and then ſtopped with lint or wool; the other made red hot; and if the tube be then broken, the arſenic is found metallized. One grain of arſenic will be ſufficient for all thoſe experiments.”

Arſenic.

The firſt ſymptoms which enſue on the taking of arſenic ſhow that it is of a highly inflammatory, cauſtic, and corroſive nature with regard to the ſyſtem in general, and the inteſtines in particular: the pulſe becomes extremely weak and irritable, and this is attended with a kind of paralytic affection of the limbs, maraſmus, &c. Milk and oil have been recommended as antidotes; but the milk may curdle, and the oil will not mix with the fluids in the inteſtines. It is therefore adviſable, when the phyſician is called to a patient who has ſwallowed arſenic, to make uſe of mucilages. A friend of Dr Black's, who had no mucilage at hand, thought of the whites of eggs, and ſucceeded. After the violence of the firſt attack is over, a milk diet, opiates, &c. are proper; and ſome time after, electricity has been found of great ſervice. Some have adviſed to exhibit hepar ſulphuris, as already noticed: but this is founded, not on experience, but theory; and it cannot be ſuppoſed that ſuch a quantity can enter the ſyſtem as will be ſufficient for neutralizing the arſenic, and converting it into orpiment, which is the deſign of exhibiting it.

Edinburgh New Diſpenſatory.

The following account of the uſe of arſenic in medicine is given by Dr Duncan. “ Notwithſtanding, however, the very violent effects of arſenic, it has been employed in the cure of diſeaſes, both as applied externally and as taken internally. Externally, white arſenic has been chiefly employed in caſes of cancer; and as uſed in this way, it is ſuppoſed that its good effects depend on its acting as a peculiar corroſive: and it is imagined, that arſenic is the baſis of a remedy long celebrated in cancer, which, however, is ſtill kept a ſecret by a family of the name of *Plunket* in Ireland. According to the beſt conjectures, their application conſiſts of the powder of ſome vegetables, particularly the ranunculus flammeus and cotula fœtida, with a conſiderable proportion of arſenic and flower of ſulphur intimately mixed together. This powder, made into a paſte with the white of an egg, is applied to the cancerous part which it is intended to corrode; and being covered with a piece of thin bladder, ſmeared alſo with the white of an egg, it is ſuffered to lie on from 24 to 48 hours; and afterwards the eſchar is to be treated with ſoftening digeſtive, as in other caſes.

“ Arſenic, in ſubſtance, to the extent of an eight of a grain for a doſe, combined with a little of the flowers of ſulphur, has been ſaid to be employed internally in ſome very obſtinate caſes of cutaneous diſeaſes, and with the beſt effect. But of this we have no experience.

“ Of all the diſeaſes in which white arſenic has been uſed internally, there is no one in which it has been ſo frequently and ſo ſucceſsfully employed as in the cure of intermittent fevers. It has long been uſed in Lincolnſhire, and ſome other of the fenny countries, under the name of the *arſenic drop*, prepared in different ways: And it is conjectured, that an article, which has had a very extenſive ſale, under the title of the *taſteleſs ague-drop*, the form of preparing which, however, is ſtill kept a ſecret, is nothing elſe but a ſolution of arſenic. But whether this be the caſe or not, we have now the moſt ſatisfactory information concerning this article in the “ Medical Reports, of the effects of Arſenic in the cure of agues, remitting fevers, and periodic headachs,” by Dr Fowler of Stafford. He directs, that 64 grains of arſenic, reduced to a very fine powder, and mixed with as much fixed vegetable alkaline ſalt, ſhould be added to half a pound of diſtilled water in a florence flaſk; that it ſhould be then placed in a ſand-heat, and gently boiled till the arſenic be completely diſſolved; that after the ſolution is cold, half an ounce of compound ſpirit of lavender be added to it, and as much diſtilled water as to make the whole ſolution amount to a pound. This ſolution is taken in doſes, regulated according to the age, ſtrength, and other circumſtances of the patient, from two to twelve drops, once, twice, or oftener in the courſe of the day. And in the diſeaſes mentioned above, particularly in intermittents, it has been found to be a ſafe and very efficacious remedy, both by Dr Fowler and by other practitioners: but in ſome inſtances, even when given in very ſmall doſes, we have found it excite violent vomiting. But beſides this, it has alſo been alleged by ſome, that thoſe cured of intermittents by arſenic are very liable to become phthiſical. If arſenic ſhall ever be extenſively employed internally, it will probably be moſt certain and moſt ſafe in its operation when brought to the ſtate of a ſalt readily ſoluble in water."

15 Other uſes of arſenic. With regard to its other uſes he expreſſes himſelf thus: "Philoſophers are wont to evince the extraordinary poroſity of bodies, and the wonderful ſubtilty of vapours, by a ſympathetic ink made with orpiment and lime*; for writing made with vinegar of litharge, by itſelf inviſible, expoſed to the vapour of this liquor becomes in a few minutes brown, even though a great many folds of paper be interpoſed.

* See *Sympathetic* Ink.

16 Of the adulteration of wines. "Wines naturally acid, or grown ſo by age, ſtill continue to be edulcorated by lead, notwithſtanding the puniſhments attending the detection of this fraud: it is therefore of great conſequence to be in poſſeſſion of an eaſy method of diſcovering ſuch a ſophiſtication. For this purpoſe a probatory liquor has been recommended, compoſed of cauſtic fixed alkali and orpiment; which inſtantly throws down a black or dark brown precipitate in conſequence of the union of the ſulphur of the orpiment with the metal. The ſame effect will take place on the addition of common hepar ſulphuris: but methods have been contrived of eluding this proof. If a ſmall quantity of chalk be contained in the wine, the ſaline hepar does not produce the intended effect; for the falling of the white calcareous earth diminiſhes the blackneſs. The other probatory liquor is alſo rendered ineffectual by a large quantity of tartar; becauſe the tartareous acid, uniting with the lime, forms a kind of ſelenite, which in like manner diminiſhes the blackneſs.

17 Arſenic in compoſition with metals, &c. "Arſenic ſometimes enters metallic compoſitions, eſpecially copper and tin; but it were much to be wiſhed that ſuch compoſitions were baniſhed, at leaſt from the kitchen. Shot made of lead is ſometimes hardened by orpiment.

"Regulus of arſenic enters into the compoſition of Meuder's phoſphorus. The power of the calx in vitrification was long ago known to Geber; and it is frequently employed in glaſs-houſes, either for facilitating fuſion, for acquiring a certain degree of opacity, or finally for carrying off phlogiſton. The method in which mountain-cryſtals, placed over orpiment, white arſenic, crude antimony, and ſal ammoniac, mixed in a crucible, are tinged by means of heat, is deſcribed by Neri, and upon trial is found to be true. I have thus obtained theſe cryſtals beautifully marked with red, yellow, and opal ſpots; but at the ſame time cracked, which could ſcarcely be avoided.

18 In painting "In painting, too, the artiſts ſometimes employ arſenic. Painters in oil frequently uſe both orpiment and realgar; and it is probable that wood covered with a pigment mixed with white arſenic would not be ſpoiled by worms. A moſt beautiful green pigment may be precipitated from blue vitriol by means of white arſenic diſſolved in water, together with vegetable alkali. This prepared either with water or oil, affords a colour which ſuffers no change in many years. The playthings of children however, ſhould not be painted with this or any other preparation of arſenic, on account of their cuſtom of putting every thing into their mouths."

Arſenic is alſo uſed in dying, and the yellow combination of it with ſulphur has the property of readily diſſolving indigo; for which purpoſe it is uſed in cloth-printing. It lets it fall again, however, on expoſure to the air; and therefore can be employed only in pencil-colours, where a large quantity is laid on at once. The neutral arſenical ſalt is uſed in ſome manufactures in France; but for what purpoſes is not known.

ARSENIUS, a deacon of the Roman church, of great learning and piety. He was pitched upon by the pope to go to the emperor Theodoſius, as tutor to his ſon Arcadius. Arſenius arrived at Conſtantinople in the year 383. The emperor happening one day to go into the room where Arſenius was inſtructing Arcadius, his ſon was ſeated and the preceptor ſtanding; at this he was exceedingly diſpleaſed, took from his ſon the imperial ornaments, made Arſenius ſit in his place, and ordered Arcadius for the future to receive his leſſons ſtanding uncovered. Arcadius, however, profited but little by his tutor's inſtructions, for ſome time after he formed a deſign of diſpatching him. The officer to whom Arcadius had applied for this purpoſe, divulged the affair to Arſenius, who retired to the deſarts of Scete, where he paſſed many years in the exerciſes of the moſt ſtrict and fervent devotion. He died there, at 95 years of age.

ARSHOT, a town of the Auſtrian Netherlands, ſituated about 14 miles eaſt of the city of Mechlin, in E. Long. 4. 45. N. Lat. 51. 5.

ARSINOE (anc. geog.), a town of Egypt, on the weſt ſide of the Arabian gulf, near its extremity, to the ſouth of Heroopolis, (Strabo, Ptolemy); called *Cleopatris* by ſome. Another Arſinoe, a town of Cilicia, (Ptolemy); and the fifth of that name in Cilicia, (Stephanus); with a road or ſtation for ſhips, (Strabo). A third Arſinoe, in the ſouth of Cyprus, with a port between Citium and Salamis, (Strabo). A fourth, an inland town of Cyprus, called *Marium* formerly, (Stephanus). A fifth in the north of Cyprus, between Acamas and Soli, (Strabo); ſo called from Arſinoe, a queen of Egypt, Cyprus being in the hands of the Ptolemies. A ſixth Arſinoe, a maritime town of Cyrene, formerly called *Teuchira*. A ſeventh Arſinoe, in the Nomos Arſinoites, to the weſt of the Heracleotes, on the weſtern bank of the Nile, formerly called *Crocodilorum Urbs*, (Strabo); the name *Arſinoe* continued under Adrian, (Coin). Ptolemy calls this Arſinoe an inland metropolis, and therefore at ſome diſtance from the Nile, with a port called *Ptolemais*. An eighth Arſinoe, a maritime town of Lycia; ſo called by Ptolemy Philadelphus, after the name of his conſort, which did not hold long, it afterwards recovering its ancient name

Patara, (Strabo). A ninth, a town of the Troglodytæ, near the mouth of the Arabian Gulf, which towards Ethiopia is terminated by a promontory called *Dire*, (Ptolemy). This Arſinoe is called *Berenice*, and the third of that name in this quarter, with the diſtinction *Epidires*; becauſe ſituate on a neck of land running a great way out into the ſea.

ARSIS *and* THESIS, in muſic, is a term applied to compoſitions in which one part riſes and the other falls.

ARSMART, in botany. See PERSICARIA.

ARSON, in Engliſh law, is the malicious and wilful burning of the houſe or out-houſe of another man; which is felony at common law.

This is an offence of very great malignity, and much more pernicious to the public than ſimple theft: becauſe, firſt, it is an offence againſt that right of habitation, which is acquired by the law of nature as well as by the laws of ſociety; next, becauſe of the terror and confuſion that neceſſarily attend it; and, laſtly, becauſe in ſimple theft the thing ſtolen only changes its maſter, but ſtill remains *in eſſe* for the benefit of the public; whereas by burning the very ſubſtance is abſolutely deſtroyed. It is alſo frequently more deſtructive than murder itſelf, of which too it is often the cauſe: ſince murder, atrocious as it is, ſeldom extends beyond the felonious act deſigned; whereas fire too frequently involves in the common calamity perſons unknown to the incendiary, and not intended to be hurt by him, and friends as well as enemies.

ARSURA, in ancient cuſtoms, a term uſed for the melting of gold or ſilver, either to refine them, or to examine their value.—The method of doing this is explained at large in the Black Book of the Exchequer, aſcribed to Gervaiſe, in the chapter *De Officio Militis Argentarii*, being in thoſe days of great uſe, on account of the various places and different manners in which the king's money was paid.

ARSURA is alſo uſed for the loſs or diminution of the metal in the trial. In this ſenſe, a pound was ſaid *tot ardere denarios*, to loſe ſo many penny-weights.

ARSURA is alſo uſed for the duſt and ſweepings of ſilver-ſmiths, and others, who work in ſilver, melted down.

ART is defined by Lord Bacon, a proper diſpoſal of the things of nature by human thought and experience, ſo as to anſwer the ſeveral purpoſes of mankind; in which ſenſe *art* ſtands oppoſed to *nature*.

Art is principally uſed for a ſyſtem of rules ſerving to facilitate the performance of certain actions; in which ſenſe it ſtands oppoſed to *ſcience*, or a ſyſtem of ſpeculative principles.

Arts are commonly divided into *uſeful* or *mechanic*, *liberal* or *polite*. The former are thoſe wherein the *hand* and *body* are more concerned than the mind: of which kind are moſt of thoſe which furniſh us with the *neceſſaries* of life, and are popularly known by the name of *trades*; as baking, brewing, carpentry, ſmithery, weaving, &c.—The latter are ſuch as depend more on the labour of the mind than that of the hand; they are the produce of the *imagination*, their eſſence conſiſts in *expreſſion*, and their end is *pleaſure*. Of this kind are poetry, painting, muſic, &c.

1 Origin and progreſs of uſeful arts. [*Kames's Sketches*, Sk. V.]

Progreſs of the ARTS. Some uſeful arts muſt be nearly coeval with the human race; for food, cloathing, and habitation, even in their original ſimplicity, require ſome art. Many other arts are of ſuch antiquity as to place the inventors beyond the reach of tradition. Several have gradually crept into exiſtence without an inventor. The buſy mind, however, accuſtomed to a beginning in things, cannot reſt till it finds or imagines a beginning to every art. The moſt probable conjectures of this nature the reader may ſee in the hiſtorical introduction to the different articles.

In all countries where the people are barbarous and illiterate, the progreſs of arts is extremely ſlow. It is vouched by an old French poem, that the virtues of the loadſtone were known in France before anno 1180. The mariner's compaſs was exhibited at Venice anno 1260, by Paulus Venetus, as his own invention. John Goya of Amalphi was the firſt who, many years afterward, uſed it in navigation; and alſo paſſed for being the inventor. Though it was uſed in China for navigation long before it was known in Europe, yet to this day it is not ſo perfect as in Europe. Inſtead of ſuſpending it in order to make it act freely, it is placed upon a bed of ſand, by which every motion of the ſhip diſturbs its operation. Hand-mills, termed *querns*, were early uſed for grinding corn; and when corn came to be raiſed in greater quantity, horſe-mills ſucceeded. Water-mills for grinding corn are deſcribed by Vitruvius. Wind-mills were known in Greece and in Arabia as early as the ſeventh century; and yet no mention is made of them in Italy till the fourteenth. That they were not known in England in the reign of Henry VIII. appears from a houſhold book of an Earl of Northumberland, cotemporary with that king, ſtating an allowance for three mill-horſes, "two to draw in the mill, and one to carry ſtuff to the mill and fro." Water-mills for corn muſt in England have been of a later date. The ancients had mirror-glaſſes, and employed glaſs to imitate cryſtal vaſes and goblets; yet they never thought of uſing it in windows. In the 13th century, the Venetians were the only people who had the art of making cryſtal-glaſs for mirrors. A clock that ſtrikes the hours was unknown in Europe till the end of the 12th century. And hence the cuſtom of employing men to proclaim the hours during night; which to this day continues in Germany, Flanders and England. Galileo was the firſt who conceived an idea that a pendulum might be uſeful for meaſuring time; and Huygens was the firſt who put the idea in execution, by making a pendulum clock. Hook, in the year 1660, invented a ſpiral ſpring for a watch, though a watch was far from being a new invention. Paper was made no earlier than the 14th century; and the invention of printing was a century later. Silk manufactures were long eſtabliſhed in Greece before ſilk-worms were introduced there. The manufacturers were provided with raw ſilk from Perſia: but that commerce being frequently interrupted by war, two monks in the reign of Juſtinian, brought eggs of the ſilk-worm from Hindoſtan, and taught their countrymen the method of managing them.—The art of reading made a very ſlow progreſs. To encourage that art in England, the capital puniſhment for murder was remitted if the criminal could but read, which in law-language is termed *benefit of clergy*. One would imagine that the art muſt have made a very rapid progreſs when ſo greatly favoured: but there is a ſignal proof of the contrary; for ſo ſmall an edition of the Bible as 600 copies, tranſlated into Engliſh in the reign of Henry VIII. was not wholly ſold off in three years. The people of England muſt have been profoundly ignorant in Queen Elizabeth's time, when a forged clauſe added to the 20th article of the Engliſh creed paſſed unnoticed till about 50 years ago.

The diſcoveries of the Portugueſe in the weſt coaſt of Africa is a remarkable inſtance of the ſlow progreſs of arts. In the beginning of the 15th century, they were totally ignorant of that coaſt beyond Cape Non, 28 deg. north latitude. In 1410, the celebrated Prince Henry of Portugal fitted out a fleet for diſcoveries, which proceeded along the coaſt to Cape Bojadore in 26 deg. but had not courage to double it. In 1418, Triſtan Vaz diſcovered the iſland Porto Santo; and the year after, the iſland Maderia was diſcovered. In 1439, a Portugueſe captain doubled Cape Bojadore; and the next year the Portugueſe reached Cape Blanco, lat. 20 deg. In 1446, Nuna Triſtan doubled Cape Verd, lat. 14. 40. In 1448, Don Gonzallo Vallo took poſſeſſion of the Azores. In 1449, the iſlands of Cape Verd were diſcovered for Don Henry. In 1471, Pedro d'Eſcovar diſcovered the iſland St Thomas and Prince's Iſland. In 1484, Diego Cam diſcovered the kingdom of Congo. In 1486, Bartholomew Diaz, employed by John II. of Portugal, doubled the Cape of Good Hope, which he called *Cabo Tormentoſo*, from the tempeſtuous weather he found in the paſſage.

2 Cauſes which advance the progreſs of art.

The exertion of national ſpirit upon any particular art, promotes activity to proſecute other arts. The Romans, by conſtant ſtudy, came to excel in the art of war, which led them naturally to improve upon other arts. Having, in the progreſs of ſociety, acquired ſome degree of taſte and poliſh, a talent for writing broke forth. Nevius compoſed in verſe ſeven books of the Punic war; beſides comedies, replete with bitter raillery againſt the nobility. Ennius wrote annals, and an epic poem. Lucius Andronicus was the father of dramatic poetry in Rome. Pacuvius wrote tragedies. Plautus and Terence wrote comedies. Lucilius compoſed ſatires, which Cicero eſteems to be ſlight and void of erudition. Fabius Pictor, Cincius Alimentus, Piſo Frugi, Valerius Antias, and Cato, were rather annaliſts than hiſtorians, confining themſelves to naked facts, ranged in order of time. The genius of the Romans for the fine arts was much inflamed by Greek learning, when free intercourſe between the two nations was opened. Many of thoſe who made the greateſt figure in the Roman ſtate commenced authors; Cæſar, Cicero, &c. Sylla compoſed memoirs of his own tranſactions, a work much eſteemed even in the days of Plutarch.

The progreſs of art ſeldom fails to be rapid, when a people happen to be rouſed out of a torpid ſtate by ſome fortunate change of circumſtances. Proſperity, contraſted with former abaſement, gives to the mind a ſpring, which is vigorouſly exerted in every new purſuit. The Athenians made but a mean figure under the tyranny of Piſiſtratus; but upon regaining freedom and independence, they were converted into heroes. Miletus, a Greek city of Ionia, being deſtroyed by the king of Perſia, and the inhabitants made ſlaves, the Athenians, deeply affected with the miſery of their brethren, boldly attacked the king in his own dominions, and burnt the city of Sardis. In leſs than 10 years after, they gained a ſignal victory at Marathon; and, under Themiſtocles, made head againſt that prodigious army with which Xerxes threatened utter ruin to Greece. Such proſperity produced its uſual effect: arts flouriſhed with arms, and Athens became the chief theatre for ſciences as well as for fine arts. The reign of Auguſtus Cæſar, which put an end to the rancour of civil war, and reſtored peace to Rome with the comforts of ſociety, proved an auſpicious æra for literature; and produced a cloud of Latin hiſtorians, poets, and philoſophers, to whom the moderns are indebted for their taſte and talents. One who makes a figure rouſes emulation in all: one catches fire from another, and the national ſpirit is every where triumphant: claſſical works are compoſed, and uſeful diſcoveries made in every art and ſcience. With regard to Rome, it is true, that the Roman government under Auguſtus was in effect deſpotic: but deſpotiſm, in that ſingle inſtance, made no obſtruction to literature, it having been the politic of that reign to hide power as much as poſſible. A ſimilar revolution happened in Tuſcany about three centuries ago. That country having been divided into a number of ſmall republics, the people, excited by mutual hatred between ſmall nations in cloſe neighbourhood, became ferocious and bloody, flaming with revenge for the ſlighteſt offence. Theſe republics being united under the Great Duke of Tuſcany, enjoyed the ſweets of peace in a mild government. That comfortable revolution, which made the deeper impreſſion by a retroſpect to recent calamities, rouſed the national ſpirit, and produced ardent application to arts and literature. The reſtoration of the royal family in Englannd, which put an end to a cruel and envenomed civil war, promoted improvements of every kind: arts and induſtry made a rapid progreſs among the people, though left to themſelves by a weak and fluctuating adminiſtration. Had the nation, upon that favourable turn of fortune, been bleſſed with a ſucceſſion of able and virtuous princes, to what a height might not arts and ſciences have been carried! In Scotland, a favourable period for improvement was the reign of the firſt Robert, after ſhaking off the Engliſh yoke; but the domineering ſpirit of the feudal ſyſtem rendered abortive every attempt. The reſtoration of the royal family mentioned above, animated the legiſlature of Scotland to promote manufactures of various kinds: but in vain; for the union of the two crowns had introduced deſpotiſm into Scotland, which ſunk the genius of the people, and rendered them heartleſs and indolent. Liberty, indeed, and many other advantages, were procured to them by the union of the two kingdoms; but the ſalutary effects were long ſuſpended by mutual enmity, ſuch as commonly ſubſiſts between neighbouring nations. Enmity wore out gradually, and the eyes of the Scots were opened to the advantages of their preſent condition; the national ſpirit was rouſed to emulate and to excel; talents were exerted, hitherto latent; and Scotland at preſent makes a figure in arts and ſciences above what it ever made while an independent kingdom.

Another cauſe of activity and animation, is the being engaged in ſome important action of doubtful event; a ſtruggle for liberty, the reſiſting a potent invader, or the like. Greece, divided into ſmall ſtates frequently at war with each other, advanced literature and the fine arts to unrivalled perfection. The Corſicans, while engaged in a perilours war for defence of their liberties exerted a vigorous national ſpirit; they founded a univerſity for arts and ſciences, a public library and a public bank. After a long ſtupor during the dark ages of Chriſtianity, arts and literature revived among the turbulent ſtates of Italy. The royal ſociety in London, and the academy of ſciences in Paris, were both of them inſtituted after civil wars that had animated the people and rouſed their activity.

As the progreſs of arts and ſciences toward perfection is greatly promoted by emulation, nothing is more fatal to an art or ſcience than to remove that ſpur, as where ſome extraordinary genius appears who ſoars above rivalſhip. Mathematics ſeem to be declining in Britain: the great Newton having ſurpaſſed all the ancients, has not left to the moderns even the fainteſt hope of equalling him; and what man will enter the liſts who deſpairs of victory?

In a country thinly peopled, where even neceſſary arts want hands, it is common to ſee one perſon exerciſing more arts than one: in ſeveral parts of Scotland, one man ſerves as phyſician, ſurgeon, and apothecary. In every populous country, even ſimple arts are ſplit into parts, and each part has an artiſt appropropriated to it. In the large towns of ancient Egypt, a phyſician was confined to a ſingle diſeaſe. In mechanic arts that method is excellent. As a hand confined to a ſingle operation becomes both expert and expeditious, a mechanic art is perfected by having its different operations diſtributed among the greateſt number of hands; many hands are employed in making a watch, and a ſtill greater number in manufacturing a web of woollen cloth. Various arts or operations carried on by the ſame man, envigorate his mind, becauſe they exerciſe different faculties; and as he cannot be equally expert in every art or operation, he is frequently reduced to ſupply want of ſkill by thought and invention. Conſtant application, on the contrary, to a ſingle operation, confines the mind to a ſingle object, and excludes all thought and invention: in ſuch a train of life, the operator becomes dull and ſtupid, like a beaſt of burden. The difference is viſible in the manners of the people: in a country where, from want of hands, ſeveral occupations muſt be carried on by the ſame perſon, the people are knowing and converſable: in a populous country, were manufactures flouriſh, they are ignorant and unſociable. The ſame effect is equally viſible in countries where an art or manufacture is confined to a certain claſs of men. It is viſible in Indoſtan, where the people are divided into caſts, which never mix even by marriage, and where every man follows his father's trade. The Dutch lint-boors are a ſimilar inſtance; the ſame families carry on the trade from generation to generation; and are accordingly ignorant and brutiſh even beyond other Dutch peaſants. The inhabitants of Buckhaven, a ſea-port in the county of Fife, in Scotland, were originally a colony of foreigners, invited to teach the people the art of fiſhing. They continue fiſhers to this day, marry among themſelves, have little intercourſe with their neighbours, and are dull and ſtupid to a proverb.

3 Progreſs of the *fine arts.* Uſeful arts paved the way to fine arts. Men upon whom the former had beſtowed every convenience, turned their thoughts to the latter. Beauty was ſtudied in objects of ſight; and men of taſte attached themſelves to the fine arts, which multiplied their enjoyments and improved their benevolence. Sculpture and painting made an early figure in Greece; which afforded plenty of beautiful originals to be copied in theſe imitative arts. Statuary, a more ſimple imitation than painting, was ſooner brought to perfection: the ſtatue of Jupiter by Phidias, and of Juno by Polycletes, though the admiration of all the world, were executed long before the art of light and ſhade was known. Apollodorus, and Zeuxis his diſciple, who flouriſhed in the 15th Olympiad, were the firſt who figured in that art. Another cauſe concurred to advance ſtatuary before painting in Greece, viz. a great demand for ſtatues of the gods. Architecture, as a fine art, made a ſlower progreſs. Proportions, upon which its elegance chiefly depends, cannot be accurately aſcertained, but by an infinity of trials in great buildings: a model cannot be relied on; for a large and a ſmall building, even of the ſame form, require different proportions.

4 Literary compoſition. From the fine arts mentioned, we proceed to literature. It is agreed, among all antiquaries, that the firſt writings were in verſe, and that writing in proſe was of a much latter date. The firſt Greek who wrote in proſe was Pherecides Syrus: the firſt Roman was Appius Cæcus, who compoſed a declamation againſt Pyrrhus. The four books of the Chatah Bhade, which is the ſacred book of Hindoſtan, are compoſed in verſe ſtanzas; and the Arabian compoſitions in proſe followed long after thoſe in verſe. To account for that ſingular fact, many learned pens have been employed; but without ſucceſs. By ſome it has been urged, that as memory is the only record of events where writing is unknown, hiſtory originally was compoſed in verſe for the ſake of memory. This is not ſatisfactory. To undertake the painful taſk of compoſing in verſe, merely for the ſake of memory, would require more foreſight than ever was exerted by a barbarian: not to mention that other means were uſed for preſerving the memory of remarkable events; a heap of ſtones, a pillar, or other object that catches the eye. The account given by Longinus is more ingenious. In a fragment of his treatiſe on verſe, the only part that remains, he obſerves, "that meaſure or verſe belongs to poetry, becauſe poetry repreſents the various paſſions with their language; for which reaſon the ancients, in their ordinary diſcourſe, delivered their thoughts in verſe rather than in proſe." Longinus thought, that anciently men were more expoſed to accidents and dangers, than when they were protected by good government and by fortified cities. But he ſeems not to have adverted, that fear and grief, inſpired by dangers and misfortunes, are better ſuited to humble proſe than to elevated verſe. It may be added, that however natural poetical diction may be when one is animated with any vivid paſſion, it is not ſuppoſable that the ancients never wrote nor ſpoke but when excited by paſſion. Their hiſtory, their laws, their covenants, were certainly not compoſed in that tone of mind.

An important article in the progreſs of the fine arts, which writers have not ſufficiently attended to, will perhaps explain this myſtery. The article is the profeſſion of a bard, which ſprung up in early times, before writing was known †, and died away gradually as writing turned more and more common ‡.

The ſongs of the bards, being univerſal favourites, were certainly the firſt compoſitions that writing was employed upon: they would be carefully collected by the moſt ſkilful writers, in order to preſerve them in perpetual remembrance. The following part of the progreſs is obvious. People acquainted with no written compoſitions, but what were in verſe, compoſed in verſe their laws, their religious ceremonies, and every memorable tranſaction that was intended to be preſerved in memory by writing. But when ſubjects of writing multiplied, and became more and more involved; when people began to reaſon, to teach, and to harangue; they were obliged to deſcend to humble proſe: for to confine a writer or ſpeaker to verſe in handling ſubjects of that nature, would be a burden unſupportable.

5
Hiſtory.

The proſe compoſitions of early hiſtorians are all of them dramatic. A writer deſtitute of art is naturally prompted to relate facts as he ſaw them performed: he introduces his perſonages as ſpeaking and conferring; and he himſelf relates what was acted, and not ſpoke. The hiſtorical books of the Old Teſtament are compoſed in that mode; and ſo addicted to the dramatic are the authors of thoſe books, that they frequently introduce God himſelf into the dialogue. At the ſame time, the ſimplicity of that mode is happily ſuited to the poverty of every language in its early periods. The dramatic mode has a delicious effect in expreſſing ſentiment, and every thing that is ſimple and tender. Read, as an inſtance of a low incident becoming, by that means, not a little intereſting, Ruth i. 8. to iv. 16.

The dramatic mode is far from pleaſing ſo much in relating bare hiſtorical facts. Read, as an example, the ſtory of Adonijah in 1 Kings i. 11.—49.

In that paſſage there are frequent repetitions; not however by the ſame perſon, but by different perſons who have occaſion in the courſe of the ſtory to ſay the ſame things; which is natural in the dramatic mode, where things are repreſented preciſely as they were tranſacted. In that view, Homer's repetitions are a beauty, not a blemiſh; for they are confined to the dramatic part, and never occur in the narrative.

But the dramatic mode of compoſition, however pleaſing, is tedious and intolerable in a long hiſtory. In the progreſs of ſociety new appetites and new paſſions ariſe; men come to be involved with each other in various connections; incidents and events multiply, and hiſtory becomes intricate by an endleſs variety of circumſtances. Dialogue accordingly is more ſparingly uſed, and in hiſtory plain narration is mixed with it. Narration is as it were the ground-work; and dialogue is raiſed upon it, like flowers in embroidery. Homer is admitted by all to be the great maſter in that mode of compoſition.

The narrative mode came in time ſo to prevail, that in a long chain of hiſtory, the writer commonly leaves off dialogue altogether. Early writers of that kind appear to have very little judgment in diſtinguiſhing capital facts from minute circumſtances, ſuch as can be ſupplied by the reader without being mentioned. The hiſtory of the Trojan war by Dares Phrygius is a curious inſtance of that cold and creeping manner of compoſition. The Roman hiſtories before the time of Cicero are chronicles merely. Cato, Fabius Pictor, and Piſo, confined themſelves to naked facts. In the Auguſtæ Hiſtoriæ Scriptores we find nothing but a jejune narrative of facts, commonly of very little moment, concerning a degenerate people, without a ſingle incident that can rouſe the imagination or exerciſe the judgment. The monkiſh hiſtories are all of them compoſed in the ſame manner.

The dry narrative manner being very little intereſting or agreeable, a taſte for embelliſhment prompted ſome writers to be copious and verboſe. Saxo-Grammaticus, who in the 12th century compoſed in Latin a hiſtory of Denmark, ſurpriſingly pure at that early period, is extremely verboſe and full of tautologies. Such a ſtyle, at any rate unpleaſant, is intolerable in a modern tongue, before it is enriched with a ſtock of phraſes for expreſſing aptly the great variety of incidents that enter into hiſtory.

The perfection of hiſtorical compoſition, which writers at laſt attain to after wandering through various imperfect modes, is a relation of intereſting facts, connected with their motives and conſequences. An hiſtory of that kind is truly a chain of cauſes and effects.

The hiſtory of Thucydides, and ſtill more that of Tacitus, are ſhining inſtances of that mode.

6
Eloquence.

Eloquence was of a later date than the art of literary compoſition: for till the latter was improved, there were no models for ſtudying the former. Cicero's oration for Roſcius is compoſed in a ſtyle diffuſe and highly ornamented; which, ſays Plutarch, was univerſally approved, becauſe at that time the ſtyle in Aſia, introduced into Rome with its luxury, was in high vogue. But Cicero, in a journey to Greece, where he leiſurely ſtudied Greek authors, was taught to prune off ſuperfluities, and to purify his ſtyle, which he did to a high degree of refinement. He introduced into his native tongue a ſweetneſs, a grace, a majeſty, that ſurpriſed the world, and even the Romans themſelves. Cicero obſerves with great regret, that if ambition for power had not drawn Julius Cæſar from the bar to command legions, he would have become the moſt complete orator in the world. So partial are men to the profeſſion in which they excel. Eloquence triumphs in a popular aſſembly, makes ſome figure in a court of law compoſed of many judges, very little where there is but a ſingle judge, and none at all in a deſpotic government. Eloquence flouriſhed in the republics of Athens and of Rome; and makes ſome figure at preſent in a Britiſh houſe of Commons.

7
Tragedy.

The Greek ſtage has been juſtly admired among all polite nations. The tragedies of Sophocles and Euripides in particular are by all critics held to be perfect in their kind, excellent models for imitation, but far above rivalſhip. If the Greek ſtage was ſo early brought to maturity, it is a phenomenon not a little ſingular in the progreſs of arts. The Greek tragedy made a rapid progreſs from Theſpis to Sophocles and Euripides, whoſe compoſitions are wonderful productions of genius, conſidering that the Greeks at that period were but beginning to emerge from roughneſs and barbarity into a taſte for literature. The compoſitions of Eſchylus, Sophocles, and Euripides, muſt

† See the article *Writing*.

‡ See *Bard*.

have been highly reliſhed among people who had no idea of any thing more perfect. We judge by compariſon, and every work is held to be perfect that has no rival. It ought at the ſame time to be kept in view, that it was not the dialogue which chiefly enchanted the Athenians, nor variety in the paſſions repreſented, nor perfection in the actors; but machinery and pompous decoration, joined with exquiſite muſic. That theſe particulars were carried to the greateſt height, we may with certainty conclude from the extravagant ſums beſtowed on them: the exhibiting a ſingle tragedy was more expenſive to the Athenians than their fleet or their army in any ſingle campaign.

One would imagine, however, that theſe compoſitions were too ſimple to enchant for ever; as variety in action, ſentiment, and paſſion is requiſite, without which the ſtage will not continue long a favourite entertainment: and yet we find not a ſingle improvement attempted after the days of Sophocles and Euripides. The manner of performance, indeed, prevented abſolutely any improvement. A fluctuation of paſſion and refined ſentiments would have made no figure on the Grecian ſtage. Imagine the diſcording ſcene between Brutus and Caſſius in Julius Cæſar to be there exhibited, or the handkerchief in the Moor of Venice: how ſlight would be their effect, when pronounced in a maſk, and through a pipe? The workings of nature upon the countenance, and the flections of voice expreſſive of various feelings, ſo deeply affecting in modern repreſentation, would have been entirely loſt. If a great genius had ariſen with talents for compoſing a pathetic tragedy in perfection, he would have made no figure in Greece. An edifice muſt have been erected of a moderate ſize: new actors muſt have been trained to act with a bare face, and to pronounce in their own voice. And after all, their remained a greater miracle ſtill to be performed, viz. a total reformation of taſte in the people of Athens. In one word, the ſimplicity of the Greek tragedy was ſuited to the manner of acting; and that manner excluded all improvements.

8
Comedy.

With reſpect to comedy, it does not appear that the Greek comedy ſurpaſſed the tragedy in its progreſs toward perfection. Horace mentions three ſtages of Greek comedy. The firſt well ſuited to the rough and courſe manners of the Greeks, when Eupolis, Cratinus, and Ariſtophanes, wrote. Theſe authors were not aſhamed to repreſent on the ſtage real perſons, not even diſguiſing their names: of which we have a ſtriking inſtance in a comedy of Ariſtophanes, called *the Clouds*, where Socrates is introduced, and moſt contemptuouſly treated. This ſort of comedy, ſparing neither gods nor men, was reſtrained by the magiſtrates of Athens, ſo far as to prohibit perſons to be named on the ſtage. This led writers to do what is done at preſent: the characters and manners of known perſons were painted ſo much to the life, that there could be no miſtake: and the ſatire was indeed heightened by this regulation, as it was an additional pleaſure to find out the names that were meant in the repreſentation. This was termed the *middle comedy*. But as there ſtill remained too great ſcope for obloquy and licentiouſneſs, a law was made prohibiting real events or incidents to be introduced upon the ſtage. This law happily baniſhed ſatire againſt individuals, and confined it to manners and cuſtoms in general. Obedient to this law are the comedies of Menander, Philemon, and Diphilus, who flouriſhed about 300 years before the Chriſtian æra. And this is termed the *third ſtage* of Greek comedy. The comedies of Ariſtophanes which ſtill remain, err not leſs againſt taſte than againſt decency. But the Greek comedy is ſuppoſed to have been conſiderably refined by Menander and his cotemporaries. Their works, however, were far from perfection, if we can draw any conjecture from their imitator Plautus, who wrote about a century later. Plautus was a writer of genius; and it may be reaſonably ſuppoſed that his copies did not fall much ſhort of the originals, at leaſt in matters that can be faithfully copied: and he ſhows very little art, either in his compoſitions or in the conduct of his pieces. With reſpect to the former, his plots are wondrous ſimple, very little varied, and very little intereſting. The ſubject of almoſt every piece is a young man in love with a muſic-girl, deſiring to purchaſe her from the procurer, and employing a favourite ſlave to cheat his father out of the price; and the different ways of accompliſhing the cheat is all the variety we find. In ſome few of his comedies the ſtory riſes to a higher tone, the muſic-girl being diſcovered to be the daughter of a freeman, which removes every obſtruction to a marriage between her and her lover. In the conduct of his pieces there is a miſerable defect of art. Inſtead of unfolding the ſubject in the progreſs of the action, as is done by Terence, and by every modern writer, Plautus introduces a perſon for no other end but to explain the ſtory to the audience. In one of his comedies, a houſehold-god is ſo obliging as not only to unfold the ſubject, but to relate before-hand every particular that is to be repreſented, not excepting the cataſtrophe.

The Roman theatre, from the time of Plautus to that of Terence, made a rapid progreſs. Ariſtotle defines comedy to be "an imitation of light and trivial ſubjects, provoking laughter." The comedies of Plautus correſpond accurately to that definition: thoſe of Terence riſe to a higher tone.

Nothing is more evident than the ſuperiority of Terence above Plautus in the art of writing; and, conſidering that Terence is a later writer, nothing would appear more natural, if they did not copy the ſame originals. It may be owing to genius that Terence excelled in purity of language and propriety of dialogue; but how account for his ſuperiority over Plautus in the conſtruction and conduct of a play? It will not certainly be thought, that Plautus would imitate the worſt conſtructed plays, leaving the beſt to thoſe who ſhould come after him. This difficulty does not ſeem to have occurred to any of the commentators. Had the works of Menander and of his cotemporaries been preſerved, they probably would have explained the myſtery; which for want of that light will probably remain a myſtery for ever.

9
Epopee.

Homer has for more than 2000 years been held the prince of poets. Such perfection in an author who flouriſhed when arts were far ſhort of maturity, is truly wonderful. The nations engaged in the Trojan war are deſcribed by him as in a progreſs from the ſhepherd-ſtate to that of agriculture. Frequent mention is made in the Iliad of the moſt eminent men being ſhepherds. Andromache, in particular, mentions ſeven of her brethren who were ſlain by Achilles as they tended their father's flocks and herds. In that ſtate, garments of woollen-cloth were uſed; but the ſkins of beaſts, the original clothing, were ſtill worn as an upper garment: every chief in the Iliad appears in that dreſs. Such indeed was the ſimplicity of this early period, that a black ewe was promiſed by each chief to the man who would undertake to be a ſpy. In times of ſuch ſimplicity, literature could not be far advanced; and it is a great doubt, whether there was at that time a ſingle poem of the epic kind for Homer to imitate or improve upon. Homer is undoubtedly a wonderful genius, perhaps the greateſt that ever exiſted; his fire, and the boldneſs of his conceptions, are inimitable. But in that early age, it would fall little ſhort of a real miracle, to find ſuch ripeneſs of judgment, and correctneſs of execution, as in modern writers are the fruits of long experience and progreſſive improvements during the courſe of many centuries. Accordingly, that Homer is far from being ſo ripe, or ſo correct, cannot eſcape the obſervation of any reader of taſte and diſcernment. One ſtriking particular is, his digreſſions without end, which draw our attention from the principal ſubject. Diomedes, for inſtance, meeting with Glaucus in the field of battle, and doubting, from his majeſtic air, whether he might not be an immortal, inquires who he was, declaring that he would not fight with a god. Glaucus lays hold of this very ſlight opportunity, in the very heat of action, to give a long hiſtory of his family. In the mean time, the reader's patience is put to a trial, and his ardour cools. Again, Agamemnon deſiring advice how to reſiſt the Trojans, Diomedes ſprings forward; but, before he offers advice, gives the hiſtory of all his progenitors, and of their characters, in a long train. And, after all, what was the ſage advice that required ſuch a preface? It was, that Agamemnon ſhould exhort the Greeks to fight bravely. At any rate, was Diomedes ſo little known, as to make it proper to ſuſpend the action at ſo critical a juncture, for a genealogical hiſtory? There is a third particular which juſtly merits cenſure; and that is, an endleſs number of minute circumſtances, eſpecially in the deſcription of battles, where they are moſt improper. The capital beauty of an epic poem is, the ſelection of ſuch incidents and circumſtances as make a deep impreſſion, keeping out of view every thing low or familiar. An account of a ſingle battle employs the whole fifth book of the Iliad and a great part of the ſixth: yet in the whole there is no general action; but unknown warriors whom we never heard of before, killed at a diſtance with an arrow or a javelin; and every wound deſcribed with anatomical accuracy. The whole ſeventeenth book is employed in the conteſt about the dead body of Patroclus, ſtuffed with minute circumſtances, below the dignity of an epic poem. In ſuch ſcenes the reader is fatigued with endleſs particulars; and has nothing to ſupport him but the melody of Homer's verſification.

10
Cauſes of the decline of the fine arts.

Having traced the progreſs of the fine arts toward maturity, in a ſummary way, the decline of theſe arts comes next in order. An art, in its progreſs toward maturity, is greatly promoted by emulation; and, after arriving at maturity, its downfal is not leſs promoted by it. It is difficult to judge of perfection but by compariſon; and an artiſt, ambitious to outſtrip his predeceſſors, cannot ſubmit to be an imitator, but muſt ſtrike out ſomething new, which, in an art advanced to ripeneſs, ſeldom fails to be a degeneracy. This cauſe of the decline of the fine arts may be illuſtrated by various inſtances. The perfection of vocal muſic is to accompany paſſion, and to enforce ſentiment. In ancient Greece, the province of muſic was well underſtood; which, being confined within its proper ſphere, had an enchanting influence. Harmony at that time was very little cultivated, becauſe it was of very little uſe; melody reaches the heart, and it is by it chiefly that a ſentiment is enforced, or a paſſion ſoothed: harmony, on the contrary, reaches the ear only; and it is a matter of undoubted experience, that the moſt melodious airs admit but of very ſimple harmony. Artiſts, in later times, ignorant why harmony was ſo little regarded by the ancients, applied themſelves ſeriouſly to its cultivation; and they have been wonderfully ſucceſsful. But they have been ſucceſsful at the expence of melody; which, in modern compoſitions, generally ſpeaking, is loſt amid the blaze of harmony. Theſe compoſitions tickle the ear by the luxury of complicated ſounds, but ſeldom make any impreſſion on the heart. The Italian opera, in its form, reſembles the Greek tragedy, from which it is evidently copied; but very little in ſubſtance. In the latter, muſic being made ſubſervient to ſentiment, the dialogue is nervous and ſublime: in the former, the whole weight is laid on muſic; and the dialogue, devoid of ſentiment, is weak and ſpiritleſs. Reſtleſs man knows no golden mean, but will be attempting innovations without end.—By the ſame ambition, architecture has viſibly declined from its perfection. The Ionic was the favourite order when architecture was in its height of glory. The Corinthian order came next; which, in attempting greater perfection, has deviated from the true ſimplicity of nature: and the deviation is ſtill greater in the Compoſite order. With reſpect to literary productions, the firſt eſſays of the Romans were very imperfect. We may judge of this from Plautus, whoſe compoſitions are abundantly rude, though much admired by his cotemporaries, being the beſt that exiſted at that time. The exalted ſpirit of the Romans hurried them on to the grand and beautiful; and literary productions of all kinds were in perfection when Auguſtus reigned. In attempting ſtill greater perfection, the Roman compoſitions became a ſtrange jumble of inconſiſtent parts: they were tumid and pompous; and, at the ſame time, full of antitheſes, conceit, and tinſel wit. Every thing new in the fine arts pleaſes, though leſs perfect than what we are accuſtomed to; and, for that reaſon, ſuch compoſitions were generally reliſhed. We ſee not by what gradual ſteps writers, after the time of Auguſtus, deviated from the patterns that were before them; for no book of any moment after that time is preſerved till we come down to Seneca, in whoſe works nature and ſimplicity give place to artificial thought and baſtard wit. He was a great corrupter of the Roman taſte; and after him nothing was reliſhed but brilliant ſtrokes of fancy, with very little regard to ſentiment: even Virgil and Cicero made no figure in compariſon. Lucan has a forced elevation of thought and ſtyle very difficult to be ſupported; and, accordingly, he ſinks ofen into puerile reflections; witneſs his encomium on the river Po; which, ſays he, would equal the Danube, had it the ſame number of tributary ſtreams. Quintilian, a writer of true and claſſical taſte, who was protected and encouraged by Veſpaſian, attempted to ſtem the tide of falſe writing. His rhetoric is compoſed in an elegant ſtyle; and his obſervations contain every delicacy of the critical art. At the ſame time flouriſhed Tacitus, poſſeſſing a more extenſive knowledge of the nature of man than any other author, ancient or modern, if Shakeſpeare be not excepted. His ſtyle is original, conciſe, compact, and comprehenſive; and, in what is properly called his *hiſtory*, perfectly correct and beautiful. He has been imitated by ſeveral, but never equalled by any. Brutus is ſaid to be the laſt of the Romans for love of liberty: Quintilian and Tacitus may be ſaid to be the laſt of the Romans for literary genius. Pliny the Younger is no exception: his ſtyle is affected, turgid, and full of childiſh brilliancy. Seneca and Pliny are proper examples of writers who ſtudy ſhow more than ſubſtance, and who make ſenſe yield to ſound. The difference between theſe authors and thoſe of the Auguſtan age, reſembles the difference between Greek and Italian muſic. Muſic, among the Greeks, limited itſelf to the employment to which it is deſtined by nature, viz. to be the handmaid of ſenſe, to enforce, enliven, or ſweeten a ſentiment. In the Italian opera, the miſtreſs is degraded to be handmaid; and harmony triumphs, with very little regard to ſentiment.

Another great cauſe that precipitates the downfal of every fine art is deſpotiſm. The reaſon is obvious; and there is a diſmal example of it in Rome, particularly with regard to eloquence. We learn from a dialogue accounting for the corruption of the Roman eloquence, that in the decline of the art it became faſhionable to ſtuff harangues with impertinent poetical quotations, without any view but ornament merely; and this alſo was long faſhionable in France. It happened unluckily for the Romans, and for the world, that the fine arts were at their height in Rome, and not much upon the decline in Greece, when deſpotiſm put an end to the republic. Auguſtus, it is true, retarded their fall, particularly that of literature; it being the politic of his reign to hide deſpotiſm, and to give his government an air of freedom. His court was a ſchool of urbanity, where people of genius acquired that delicacy of taſte, that elevation of ſentiment, and that purity of expreſſion, which characteriſe the writers of his time. He honoured men of learning, admitted them to his table, and was bountiful to them. It would be painful to follow the decline of the fine arts in Rome to their total extirpation. The tyranny of Tiberius, and of ſubſequent emperors, broke at laſt the elevated and independent ſpirit of the brave Romans, reduced them to abject ſlavery, and left not a ſpark of genius. The ſcience of law is the only exception, as it flouriſhed even in the worſt of times: the Roman lawyers were a reſpectable body, and leſs the object of jealouſy than men of power and extenſive landed property. Among the Greeks alſo, a conquered people, the fine arts decayed; but not ſo rapidly as at Rome; the Greeks, farther removed from the ſeat of government, being leſs within the reach of a Roman tyrant. During their depreſſion, they were guilty of the moſt puerile conceits: witneſs verſes compoſed in the form of an ax, an egg, wings, and ſuch like. The ſtyle of Greek authors, in the reign of the emperor Adrian, is unequal, obſcure, ſtiff, and affected. Lucian is the only exception that may be made.

We need ſcarce any other cauſe but deſpotiſm, to account for the decline of ſtatuary and painting in Greece. Theſe arts had arrived at their utmoſt perfection about the time of Alexander the Great; and from that time they declined gradually with the vigour of a free people; for Greece was now enſlaved by the Macedonian power. It may in general be obſerved, that when a nation becomes ſtationary in that degree of power which it acquires from its conſtitution and ſituation, the national ſpirit ſubſides, and men of talents become rare. It is ſtill worſe with a nation that is ſunk below its former power and pre-eminence; and worſt of all when it is reduced to ſlavery. Other cauſes concurred to accelerate the downfal of the arts mentioned. Greece, in the days of Alexander, was filled with ſtatues of excellent workmanſhip, and there being little demand for more, the later ſtatuaries were reduced to heads and buſts. At laſt the Romans put a total end both to ſtatuary and painting in Greece, by plundering it of its fineſt pieces; and the Greeks, expoſed to the avarice of the conquerors, beſtowed no longer any money on the fine arts.

The decline of the fine arts in Rome is by a *writer of taſte and elegance aſcribed to a cauſe different from any above-mentioned, a cauſe that overwhelms manhood as well as the fine arts wherever it prevails; and that is opulence, joined with its faithful attendants avarice and luxury. "In ancient times, (ſays he), when naked virtue had her admirers, the liberal arts were in their higheſt vigour; and there was a generous conteſt among men, that nothing of real and permanent advantage ſhould long remain undiſcovered. Democritus extracted the juice of every herb and plant; and, leſt the virtue of a ſingle ſtone or twig ſhould eſcape him, he conſumed a lifetime in experiments. Eudoxus, immerſed in the ſtudy of aſtronomy, ſpent his age upon the top of a mountain. Chryſippus, to ſtimulate his inventive faculty, thrice purified his genius with hellebore. To turn to the imitative arts: Lyſippus, while labouring on the forms of a ſingle ſtatue, periſhed from want. Myron, whoſe powerful hand gave to the braſs almoſt the ſoul of man and animals,—at his death found not an heir! Of us of modern times what ſhall we ſay? Immerſed in drunkenneſs and debauchery, we want the ſpirit to cultivate thoſe arts which we poſſeſs. We inveigh againſt the manners of antiquity; we ſtudy vice alone; and vice is all we teach. Where now is the art of reaſoning? Where aſtronomy? Where is the right path of wiſdom? What man now a-days is heard in our temples to make a vow for the attainment of eloquence, or for the diſcovery of the fountain of true philoſophy? Nor do we even pray for health of body, or a ſound underſtanding. One, while he has ſcarce entered the porch of the temple, devotes a gift in the event of the death of a rich relation; another prays for the diſcovery of a treaſure; a third for a miniſteral fortune. The ſenate itſelf, the exemplary preceptor of what is good and laudable, has promiſed a thouſand pounds of gold to the capitol; and, to remove all reproach from the crime of avarice, has offered a bribe to Jupiter himſelf. How ſhould we wonder that the art of painting has declined, when,

* Petronius Arbiter.

when, in the eyes both of the gods and men, there is more beauty in a maſs of gold than in all the works of Phidias and Apelles."—In England, the fine arts are far from ſuch perfection as to ſuffer by opulence. They are in a progreſs, it is true, toward maturity; but they proceed in a very ſlow pace.

There is ſtill another cauſe that never fails to undermine a fine art in a country where it is brought to perfection, abſtracting from every one of the cauſes above-mentioned. It is remarked a little above, that nothing is more fatal to an art or to a ſcience than a performance ſo much ſuperior to all of the kind as to extinguiſh emulation. This remark is exemplified in the great Newton, who, having ſurpaſſed all the ancients, has not left to his countrymen even the fainteſt hope of rivalling him; and to that cauſe is attributed the viſible decline of mathematics in Great-Britain. The ſame cauſe would have been fatal to the arts of ſtatuary and painting among the Greeks, even though they had continued a free people. The decay of painting in modern Italy is, probably, owing to the ſame cauſe: Michael Angelo, Raphael, Titian, &c. are lofty oaks that bear down young plants in their neighbourhood, and intercept from them the ſunſhine of emulation. Had the art of painting made a ſlower progreſs in Italy, it might have there continued in vigour to this day. Velleius Paterculus ſays judiciouſly, "Ut primo ad conſequendos quos priores ducimus accendimur; ita, ubi aut præteriri aut æquari eos poſſe deſperavimus, ſtudium cum ſpe ſeneſcit; et quod adſequi non poteſt, ſequi deſinit: præteritoque eo in quo eminere non poſſimus, aliquid in quo nitamur conquirimus."

The decline of an art or ſcience proceeding from the foregoing cauſe, is the moſt rapid where a ſtrict compariſon can be inſtituted between the works of different maſters. The ſuperiority of Newton above every other mathematician can be aſcertained with preciſion: and hence the ſudden decline of that ſcience in Great Britain. In Italy a talent for painting continued many years in vigour, becauſe no painter appeared with ſuch ſuperiority of genius as to carry perfection in every branch of the art. As one ſurpaſſed in deſigning, one in colouring, one in graceful attitudes, there was ſtill ſcope for emulation. But when at laſt there was not a ſingle perfection but what one or other maſter had excelled in, from that period the art began to languiſh. Architecture continued longer in vigour than painting, becauſe the principles of compariſon in the former are leſs preciſe than in the latter. The artiſt who could not rival his predeceſſors in an eſtabliſhed mode, ſought out a new mode for himſelf, which, though perhaps leſs elegant or perfect, was for a time ſupported by novelty.

11
Uſeful arts leſs ſubject to decline.

Uſeful arts will never be neglected in a country where there is any police; for every man finds his account in them. Fine arts are more precarious. They are not reliſhed but by perſons of taſte, who are rare; and ſuch as can ſpare great ſums for ſupporting them are ſtill more rare. For that reaſon, they will never flouriſh in any country, unleſs patronized by the ſovereign, or by men of power and opulence. They merit ſuch patronage, as one of the ſprings of government: and a capital ſpring they make, by multiplying amuſements, and humanizing manners; upon which account they have always been encouraged by good princes.

12
Theory of the polite arts.

General Theory of the Polite Arts. The eſſence of the polite arts, as before obſerved, conſiſts in *expreſſion*. The end of all theſe arts is *pleaſure*; whereas the end of the ſciences is *inſtruction* and *utility*. Some of the polite arts indeed, as eloquence, poetry, and architecture, are frequently applied to objects that are uſeful, or exerciſed in matters that are inſtructive, as we ſhall ſhow more particularly in their proper place; but in theſe caſes, though the ground-work belongs to thoſe ſciences which employ the underſtanding, yet the expreſſion ariſes from the inventive faculty. It is a picture that is deſigned by Minerva, to which the muſes add the colouring, and the graces the frame. This union forms therefore the perfection of the art, according to that ſententious and well known precept of Horace: *Omne tulit punctum, qui miſcuit utile dulci.*

13
What arts ſo denominated.

Under the denomination, therefore, of Polite Arts, we comprehend, 1. Eloquence; 2. Poetry; 3. Muſic; 4. Painting; 5. Sculpture; 6. Graving; 7. Architecture; 8. Declamation; 9. Dancing. Particular deſcriptions of theſe arts are given under their reſpective names. This branch of the preſent article is intended as a general introduction to them; and, as ſuch, will be occaſionally referred to.

14
Uſe of precepts.

There is one very eſſential reflection, which it appears to us proper to make in the firſt place, on the polite arts in general. All the rules of the world are not ſufficient to make a great poet, an able orator, or an excellent artiſt; becauſe, the quality, neceſſary to form theſe, depends on the natural diſpoſition, the fire of genius, which no human art can confer, but which is the pure gift of heaven. The rules, however, will prevent a man from being a bad artiſt, a dull orator, or a wretched poet; ſeeing they are the reflections of the greateſt maſters in thoſe arts, and they point out the rocks which the artiſt ſhould ſhun in the exerciſe of his talents. They are of uſe moreover, in facilitating his labours, and in directing him to arrive by the ſhorteſt and ſureſt road to perfection. They refine, ſtrengthen, and confirm, his taſte. Nature abandoned to herſelf, has conſtantly ſomething wild and ſavage. Art, founded on juſt and ſagacious rules, gives her elegance, dignity, and politeneſs; and it is impoſſible to ſacrifice properly to the graces, without knowing the incenſe that is pleaſing to them.

15
Beauty, genius, taſte, what.

Beauty is the object of all the polite arts. It is not, however, ſo eaſy, as it may ſeem, to give a clear and determinate idea of what we preciſely mean by that term*. Many able writers, who have treated expreſsly on the ſubject, have ſhown that they were totally ignorant of what it was. It is one of thoſe expreſſions that we comprehend immediately, that preſent us with a clear and preciſe idea, that leave a diſtinct impreſſion on our minds, when it is ſimply written or pronounced; but which philoſophers envelope in darkneſs, when they attempt to elucidate it by definitions and deſcriptions, and the more, as mankind have different ideas of beauty, their opinions and taſtes being as various as their underſtandings and phyſiognomies. We may ſay, however, in general, that beauty reſults from the various perfections of which any object is ſuſceptible, and which it actually poſſeſſes; and that the perfections which produce beauty conſiſt principally in the agreeable and delightful proportions which are found, 1. Between the ſeveral parts of the ſame object; 2. Between each part and the whole together; 3. Between the parts and the end or deſign of the object to which they belong. *Genius*, or invention, is that faculty of the mind by which *beauty* is produced. *Taſte* †, diſpoſition, or rather the natural ſenſation of the mind refined by art, ſerves to guide the genius in diſcerning, embracing, and producing, that which is beautiful of every kind. From whence it follows, that the general theory of the polite arts is nothing more than the knowledge of what they contain that is truly beautiful and agreeable; and it is this knowledge, this theory, which modern philoſophers call by the Latin name of *æſthetica*.

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* See the article *Beauty*.

It ſhould be conſtantly remembered, that the eſſence of the polite arts conſiſts in expreſſion. This expreſſion lies ſometimes in the words, and ſometimes in the pen; ſometimes in ſounds and their harmony, and at others in corporeal attitudes; ſometimes in the pencil, or in the chiſel, and at others in the graver; ſometimes in a proper diſpoſition or judicious employment of the mechanic arts, and at others merely in their manner of acting. From whence ariſe thoſe arts that we have mentioned, and which are deſcribed in their order.

16 First general rule.

The general theory of the polite arts, or *eſthetics*, neceſſarily ſuppoſes, therefore, certain rules; but theſe general rules are of no great number. The firſt is, That whoever would devote himſelf the polite arts, ſhould above all things *conſult his genius*; diveſt himſelf of all ſelf-love; and examine if he be a true ſon of Apollo, and cheriſhed by the muſes: for

> In vain, raſh author, doſt thou ſtrive to climb,
> By lofty verſe, Parnaſſus' height ſublime,
> If heaven does not by ſecret powers inſpire,
> Or if thy natal ſtar darts not poetic fire.

17 *Imagination*, what.

18 *Novelty* and *Invention*.

This precept with regard to poetry in particular, is applicable to all the polite arts in general; for their moſt happy ſucceſs is founded on *imagination*. By this term we underſtand, in general, a faculty of the mind, a particular genius, a lively invention, a certain ſubtile ſpirit, which gives a facility in diſcovering ſomething new. But it is neceſſary alſo to preſcribe juſt bounds to this term *new*, which muſt not be here taken in an abſolute ſenſe. Solomon wiſely remarks, that, even in his time, *there was nothing new under the ſun*. In fact, all that exiſts, and all that is capable of being diſcovered in the known world, has already been diſcovered. The fine arts in their imitations of nature, in their expreſſions, can borrow images, figures, compariſons, from thoſe things only that exiſt and are known. As there have been from the beginning of the world to our days, millions of authors in each of the polite arts, almoſt all the poſſible combinations of the various ſubjects have been produced by their lively imaginations; and when we hear the ignorant part of mankind talk of a work of wit or of art *that is entirely new*, that offers ideas which were before utterly unknown, that had never entered into the brain of any other man, we ſhould refer ſuch aſſertions to the claſs of popular errors; and reflect on thoſe ſtories we every day hear of certain empirics, who pretend to be alone poſſeſſed of marvellous methods of cure by means of ſimples; as if there were any plant, any ſtalk of graſs that grows in our world, that can have eſcaped the reſearches of botaniſts. But the novelty, of which we here ſpeak, conſiſts in the ingenious uſe of combinations of all the various objects of nature, that are new, happy, and agreeable, that have not yet been exhauſted, and which appear even to be inexhauſtible, and of the uſe which the artiſt makes of all new diſcoveries, which he turns to his advantage, by a judicious application. Invention therefore ſuppoſes a conſiderable fund of preliminary knowledge, ſuch as is capable of furniſhing ideas and images, to form new combinations. But there is no art by which invention itſelf can be produced; for that, as we have already ſaid, is the gift of heaven; and it is an endowment which we cannot even make uſe of whenever we pleaſe. We would rather ſay, therefore, that invention conſiſts in producing, in works of genius, *that which is unexpected*; an object, a harmony, a perfection, a thought, an expreſſion, of which we had no idea, that we could not foreſee, nor hope to find, where the artiſt has ſo happily placed it, and where we perceive it with delight. This idea appears applicable to ſuch of the polite arts as affect the mind by the hearing as well as by the ſight; and it is a matter that is highly eſſential.

19 2d Rule, Improvement of taſte.

The ſecond rule is, That every artiſt ought inceſſantly to labour in the improvement of his *taſte*; in acquiring that ſenſible, refined, and clear diſcernment, by which he will be enabled to diſtinguiſh the real beauties in each object, the ornaments that are agreeable to it, and the proportions and relations that ſubſiſt among the ſeveral parts: and by this faculty, he will be regulated in the employment of his natural talents. This labour conſiſts not only in the profound reflections he will make on the properties of objects as they relate to the fine arts, but alſo in a conſtant, aſſiduous ſtudy of the grand models of beauty.

20 3d, Imitation of nature.

The third rule to be obſerved in the practice of the polite arts, is *the imitation of nature*. Every object in the univerſe has its peculiar nature, of which the artiſt ſhould never loſe ſight in his manner of treating it. In vain will he otherwiſe ornament his work with the moſt refined and moſt brilliant ſtrokes; for, if nature be not juſtly imitated, it will for ever remain imperfect. The ſublime Homer has ſometimes ſinned againſt this rule: for, as the gods have a nature peculiar to themſelves, it cannot be a juſt imitation when we attribute to them paſſions that are ſcarce pardonable in mortals, and make them frequently converſe in a language that is at once vulgar and ridiculous. It was not to imitate nature, to put into the mouth of a hero, at the moment of a deciſive battle, an harangue that muſt become tedious by its exceſſive length, and which certainly could not have been heard by the thouſandth-part of a numerous army: but we have already touched upon ſome of the faults that are ſtrewed over the poems of that great man; to multiply or dwell upon them would be ungrateful. We muſt, however, obſerve that this imitation of nature, which appears at firſt view ſo ſimple and ſo eaſy, is of all things the moſt difficult in practice; and that it requires a diſcernment ſo ſagacious, and an expreſſion ſo happy, as is rarely beſtowed by heaven on mortal man.

21 4th, Perſpicuity.

Perſpicuity forms the fourth rule of expreſſion. In all the fine arts, in general, an obſcure, perplexed, ambiguous, and elaborate expreſſion, is always bad. The true ſtriking beauty muſt be manifeſt and perceptible to the moſt ignorant of mankind as well as the moſt learned. Thoſe are ever falſe or inferior beauties that have occaſion for a covering, a kind of veil that may make them appear greater than they really are: true beauty wants no veil, but ſhines by its native luſtre. From the union of the true imitation of nature with perſpicuity of expreſſion, ariſes that *truth* which is ſo eſſential in the productions of the fine arts.

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† See *Taſte*.

22
5th, Elevation of ſentiment.

In all the polite arts, and in all the ſubjects they embrace, there muſt neceſſarily reign an elevation of ſentiment, that expreſſes each object in the greateſt perfection of which it is ſuſceptible; that imitates nature in her moſt exalted beauty. This makes the fifth general rule. The deſign of the fine arts being to excite pleaſure by the expreſſion of that which is beautiful, every artiſt ſhould raiſe himſelf above the ſubject; and, chooſing the moſt favourable light wherein to place it, ſhould there embelliſh it with the greateſt, moſt noble, and beautiful ornaments, that his own genius can ſuggeſt; ſtill, however, obſerving a ſtrict imitation of nature.

23
6th, The ſublime to be endeavoured after.

From the obſervation of theſe two laſt rules reſults the *ſublime*, which is the union of the greateſt perſpicuity with the ſtricteſt truth and moſt exalted elevation poſſible. It is neceſſary to remark here, that the moſt ſimple and common ſubjects are ſuſceptible of a ſublime that is agreeable to their nature. An idyl or landſcape may be as ſublime in their kinds as an epic poem or a hiſtory-piece. When Moſes begins the book of Geneſis with theſe words, *In the beginning God created the heaven and the earth*; or when he tells us, that God ſaid, *Let there be light, and there was light*; theſe expreſſions are ſublime in the higheſt degree, becauſe they are perfectly clear, true, and elevated. Every author ſhould therefore endeavour after the ſublime* in every ſubject that he undertakes; and this makes the ſixth and laſt general rule in the practice of the polite arts. But if he cannot attain to this, it is, however, indiſpenſably neceſſary that he conſtantly make uſe of expreſſions that are *noble and refined*. Every thing that is *low*, *indecent*, or *diſagreeable*, is naturally repugnant to the ſublime, and ought to be for ever baniſhed from all works that proceed from the noble and liberal arts.

* See the article GRANDEUR *and Sublimity*.

ART is alſo an appellation given to ſeveral ſuperſtitious practices, as, *St Anſelhm's art*, *St Paul's art*, &c.

Art and Part, in Scots law. See ACCESSORY.

ARTA, by ſome called *Larta*, a town of Lower Albania, in Turkey in Europe, with a Greek archbiſhop's ſee. It is a pretty large town, and contains about 7 or 8000 inhabitants, Greeks and Turks, but the former are the moſt numerous. The cathedral has as many windows and doors as there are days in the year. It is ſupported by above 2000 marble pillars; and was built by Michael Ducas Commeno emperor of Conſtantinople, as appears by an inſcription over the great door. It carries on a conſiderable trade, particularly in tobacco and furs. E Long. 31. 30. N. Lat. 39. 28.

ARTABA, an ancient meaſure of capacity uſed by the Perſians, Medes, and Egyptians.

The Perſian artaba is repreſented by Herodotus as bigger than the Attic medimnus by three Attic chœnixes: from which it appears that it was equal to $6\frac{3}{4}$ Roman modii, conſequently that it contained $166\frac{2}{3}$ pounds of wine or water, or $126\frac{2}{3}$ pounds of wheat. The Egyptian artaba contained five Roman modii, and fell ſhort of the Attic medimnus by one modius; conſequently held $133\frac{1}{3}$ pounds of water or wine, 100 pounds of wheat, or 60 of flour.

ARTABANUS, the name of ſeveral kings of Parthia. See PARTHIA.

ARTABAZUS, the ſon of Pharnaces, commanded the Parthians and Choraſmians in the famous expedition of Xerxes. After the battle of Salamis, he eſcorted the king his maſter to the Helleſpont with 60,000 choſen men; and after the battle of Platæa, in which Mardonius engaged contrary to his advice, he made a noble retreat, and returned to Aſia with 40,000 men under his command.

ARTAXATA, *orum*, the royal reſidence and metropolis of Armenia Major (Strabo, Pliny, Juvenal); and built according to a plan of Hannibal, for king Artaxias, after whom it was called. It was ſituated on an elbow of the river Araxes, which formed a kind of peninſula, and ſurrounded the town like a wall, except on the ſide of the Iſthmus, but this ſide was ſecured by a rampart and ditch. This town was deemed ſo ſtrong, that Lucullus, after having defeated Tigranes, durſt not lay ſiege to it; but Pompey compelled him to deliver it up without ſtriking a blow. It was then levelled with the ground; but the Armenians have a tradition, that the ruins of it are ſtill to be ſeen at a place called *Ardachat*. Sir John Chardin ſays, that it has the name of *Ardachat* from Artaxias, whom in the Eaſt they call *Ardechier*. Here are the remains of a ſtately palace which the Armenians take to be that of Tiridates who reigned in the time of Conſtantine the Great. One front of this building is but half ruined, and there are many other fine antiquities which the inhabitants call *Tact. Tradat*, that is, the throne of Tiridates. Tavernier alſo mentions the ruins of Artaxata between Erivan and mount Ararat, but does not ſpecify them. The ancient geographers mention another city of the ſame name, likewiſe ſituated on the Araxes, but in the northern part of Media, known among the ancients by the name of *Atropatia*.

ARTAXERXES, the name of ſeveral kings of Perſia. See PERSIA.

ARTEDIA: A genus of the digynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 45th order, *Umbellatæ*. The involucra are pinnatifid; the floſcules of the diſc are maſculine; and the fruit is hiſpid with ſcales.—There is but one ſpecies, the ſquamata with ſquamoſe ſeeds, a native of the Eaſt: Rewvolf found it growing on mount Libanus. It is an annual plant, whoſe ſtalks riſe about two feet high, ſending out a few ſide branches, which are garniſhed with narrow compound leaves reſembling thoſe of dill; the extremity of the ſtalk is terminated by a large umbel of white flowers, compoſed of five unequal petals. Theſe are ſucceeded by roundiſh compreſſed fruit, each having two ſeeds, whoſe borders are ſcaly.

ARTEMIDORUS, famous for his Treatiſe on Dreams. He was born at Epheſus, but took upon him the ſurname of *Daldianus* in this book, by way of reſpect to his mother's country, Daltis. He ſtyled himſelf

ſelf *the Epheſian* in his own performances. He not only bought up all that had been written concerning the explication of dreams which amounted to many volumes: but he likewiſe ſpent many years in travelling, in order to contract an acquaintance with fortune-tellers: he alſo carried on an extenſive correſpondence with all the people of this ſort in the cities and aſſemblies of Greece, Italy, and the moſt populous iſlands; collecting at the ſame time all the old dreams, and the events which are ſaid to have followed them. The work which he wrote on dreams conſiſted of five books: the firſt three were dedicated to one Caſſius Maximus; and the laſt two to his ſon, whom he took a good deal of pains to inſtruct in the nature and interpretation of dreams. This work, though filled with frivolous obſervations, contains ſome things that are intereſting. It was firſt printed in Greek at Venice in 1518; and Rigaltius publiſhed an edition at Paris, in Greek and Latin, in 1603, and added ſome notes. Artemidorus wrote alſo a treatiſe upon Auguries, and another upon Chiromancy; but they are not exſtant. He lived under the emperor Antoninus Pius.

ARTEMISIA, wife of Mauſolus king of Caria, has immortalized herſelf by the honours which ſhe paid to the memory of her huſband. She built for him in Halicarnaſſus a very magnificent tomb, called the *Mauſoleum*, which was one of the ſeven wonders of the world, and from which the title of *Mauſoleum* was afterwards given to all tombs remarkable for their grandeur; but ſhe died of regret and ſorrow before the Mauſoleum was finiſhed. She appointed panegyrics to be made in honour of him, and propoſed a prize of great value for the perſon who ſhould compoſe the beſt. He died about the end of the 106th Olympiad, 351 years before the Chriſtian æra.

ARTEMISIA, queen of Caria, and the daughter of Ligdamis, marched in perſon in the expedition of Xerxes againſt the Greeks, and performed wonders in the ſea-fight near Salamis, 480 years before the Chriſtian æra. Being purſued by an Athenian veſſel, ſhe attacked one of the Perſian ſhips, commanded by Demaſithymus, king of Calyndus, her enemy, and ſunk it; on which the Athenians, thinking that her ſhip was on the ſide of the Greeks, ceaſed their purſuit: but Xerxes was the principal perſon impoſed upon in this affair; for believing ſhe had ſunk an Athenian veſſel, he declared, that "the men had behaved like women, and the women like men." Xerxes intruſted her with the care of the young princes of Perſia, his ſons, when, agreeably to her advice, he abandoned Greece, in order to return to Aſia. Theſe great qualities did not ſecure her from the weakneſs of love: ſhe was paſſionately fond of a man of Abydos, whoſe name was Dardanus, and was ſo enraged at his neglect of her, that ſhe put out his eyes while he was aſleep. The gods, in order to puniſh her for this, inſpired her with a ſtill ſtronger paſſion for him; ſo that the oracle having adviſed her to go to Leucas, which was the uſage of deſperate lovers, ſhe took the leap from thence, and was interred in that place.—Many writers confound this Artemiſia with the former, the wife of Mauſolus.

ARTEMISIA, *Mugwort, Southernwood,* and *Wormwood:* A genus of the polygamia ſuperflua order, belonging to the ſyngeneſia claſs of plants; and in the natural method rank under the 49th order, *Compoſitæ-nucamentaceæ.* The receptacle is either naked, or a little downy; it has no pappus; the calyx is imbricated with roundiſh ſcales; and the corolla has no radii.—The

Species are 23; of which the moſt noted are the following. 1. The vulgaris, or common mugwort, grows naturally on banks and by the ſides of foot-paths in many parts of Britain; ſo is ſeldom admitted into gardens, where it would prove a troubleſome weed, as it ſpreads very faſt by its creeping roots. It flowers in June, at which time the plant is ready for uſe. 2. The dracunculus, or tarragon, which is frequently uſed in ſallads, eſpecially by the French, is a very hardy plant, and ſpreads greatly by its creeping roots. 3. The abrotanum, or ſouthernwood, which is kept in gardens for the ſake of its agreeable ſcent, is a low ſhrub, ſeldom riſing more than three or four feet high, ſending out lateral ſhruby branches, growing erect, garniſhed with five briſtly leaves, having an agreeable ſcent when bruiſed: the flowers are produced in ſpikes from the extremity of the branches; but unleſs the autumn proves warm, they ſeldom open in England. 4. The ſantonicum produces the ſemen ſantonicum, which is much uſed for worms in children. It grows naturally in Perſia, from whence the ſeeds are brought to Europe. It hath the appearance of wild mugwort; the branches are ſlender, erect, and garniſhed with linear winged leaves, and terminate by recurved ſlender ſpikes of flowers which have naked receptacles. 5. The artemiſia maritima, or ſea-wormwood, grows naturally on the ſea-coaſts in moſt parts of Britain, where there are ſeveral varieties, if not diſtinct ſpecies, to be found. Theſe are low under ſhrubs, moſt of which creep at the root, by which they multiply greatly in their natural ſituation, but when tranſplanted into gardens ſeldom thrive ſo well. 6. The pontica, or pontic wormwood, commonly called *Roman wormwood,* is a low herbaceous plant, whoſe ſtalks die in autumn, and new ones appear in the ſpring. Theſe are garniſhed with finely-divided leaves, whoſe under-ſides are woolly: and the upper part of the ſtalks are furniſhed with globular flowers which nod on one ſide, having naked receptacles. Theſe appear in Auguſt, but are rarely ſucceeded by ſeeds in Britain. 7. The abſinthium, or common worm-wood, grows naturally in lanes and uncultivated places, and is too well known to require any particular deſcription. 8. The arboreſcens, or tree-wormwood, grows naturally in Italy and the Levant near the ſea. It riſes, with a woody ſtalk, ſix or ſeven feet high, ſending out many ligneous branches, garniſhed with leaves ſomewhat like thoſe of the common wormwood, but more finely divided, and much whiter. The branches are terminated by ſpikes of globular flowers in the autumn, which are ſeldom ſucceeded by ſeeds in Britain.

Culture. The ſouthernwood is propagated by ſlips or cuttings planted in a ſhady border about the beginning of April, obſerving to water them duly in dry weather. In this border they may remain till the following autumn, when they ſhould be tranſplanted, either into pots or thoſe parts of the garden where they are to remain. The ſantonicum is likewiſe propagated by ſlips: but the plants ſhould be placed in a dry ſoil and ſheltered ſituation, where they will endure the cold

Artemiſia.

of our ordinary winters pretty well; though it will be proper to have a plant or two in pots, which may be ſheltered under a common hot-bed frame in winter, to preſerve the ſpecies. The true wormwood is eaſily propagated in the ſame manner. The cuttings muſt be planted in a ſhady border, and duly watered during the ſummer ſeaſon, in which caſe they will take root freely. In autumn, ſome of the young plants ſhould be potted, that they may be ſheltered in winter; the others may be planted in a warm border, where they will live, provided the winter proves favourable. The other ſorts ſpread by their creeping roots; and require no culture, as they are very hardy, and will thrive any where.

Medicinal Uſes. The ſeeds of the ſantonicum are ſmall, light, chaffy, compoſed as it were of a number of thin membranous coats, of a yellowiſh colour, an unpleaſant ſmell, and a very bitter taſte. They are celebrated for anthelmintic virtues (which they have in common with other bitters), and are ſometimes taken in this intention, either along with molaſſes or candied with ſugar. They are not very often met with genuine in the ſhops. The leaves of the ſea, common, and Roman wormwoods, are uſed as ſtomachics, but are all very diſagreeable: the Roman is the leaſt ſo, and therefore is to be preferred; but the other two kinds are generally ſubſtituted in its place. The diſtilled oil of wormwood is ſometimes made uſe of to rub on the belly as a cure for worms.

The leaves of the vulgaris, or common mugwort, have a light aromatic ſmell, and an herbaceous bitteriſh taſte. They were formerly celebrated as uterine and antihyſteric: an infuſion of them is ſometimes drank, either alone or in conjunction with other ſubſtances, in ſuppreſſion of the menſtrual evacuations. This medicine is certainly a very mild one, and conſiderably leſs hot than moſt others to which theſe virtues are attributed. In ſome parts of Britain, mugwort is of common uſe as a pot-herb. It is now, however, very little employed in medicine; and it is probably with propriety that the London College have rejected it from their pharmacopœia.

The moxa, ſo famous in the eaſtern countries for curing the gout by burning it on the part affected, is the lanugo or down growing on the under ſide of the leaves of a ſpecies of mugwort, ſuppoſed to be the ſame with the common ſort. From ſome dried ſamples of this plant which were brought into England Mr Miller reckons them to be the ſame, differing only in ſize; in which the Eaſt Indian kind is inferior to it. He ſuppoſes that the lanugo of our mugwort would be equally efficacious. But according to Abbé Groſier, “the leaves are more deeply indented than thoſe of the common kind; it is alſo ſofter, and of a more ſilky texture. The ancient Chineſe made great uſe of it in medicine. In all the northern provinces, the principal remedy for moſt diſeaſes conſiſted in making deep punctures in the body, upon which ſmall balls of the down of this plant were burnt. Theſe punctures were made with needles of gold or ſteel, without drawing blood; and all the ſkill required in the phyſician, was to determine their number and depth, and where it was neceſſary to make them. It was neceſſary that the down of the mugwort ſhould be very old; and, as every kind of fire was not proper for lighting theſe ſalutary balls, they employed mirrors made of ice or metal. “They cauſed the water to freeze (ſays the ancient text) in a round convex veſſel; and the ice being preſented to the ſun, collected its rays, and ſet fire to the down of the plant.” The literati are not at preſent agreed whether the ſecret of curing diſeaſes by punctures be preſerved; but theſe downy balls are ſtill uſed inſtead of cupping-glaſſes in apoplectic and lethargic caſes. Girdles made of this down are alſo recommended for the ſciatica, and thoſe afflicted with the rheumatiſm in their legs are adviſed to quilt their ſtockings with it. The mugwort deſtined for this purpoſe is gathered only in autumn; and care muſt be taken to pick that which has the ſhorteſt and ſofteſt down.

Hiſt. of China.

Artemiſia,
Artemiſium.

“In China, the juice of the common mugwort, when green, is uſed to ſtop ſpitting of blood: and the ſeeds are employed for the ſame purpoſe. The doſe of the latter is divided into two parts; one of which is reduced to aſhes, and put into water in which the other has been boiled. Theſe aſhes, it is ſaid, when taken as ſnuff, immediately ſtop bleedings of the noſe. The Chineſe preſcribe this plant alſo with ſucceſs for dyſenteries which proceed from weakneſs, and for pleuriſies, and diſorders of the ſtomach. An infuſion of the ſtalks and buttons of mugwort is recommended to old people inſtead of tea.—Mugwort was formerly conſidered there as a powerful preſervative againſt witchcraft. The ancient books relate, that, in the third century of the Chriſtian æra, it was cuſtomary for people to gather this plant before ſun-riſe, and to ſuſpend it afterwards over their doors. The poets of the ſeventh century mention this cuſtom, and deſcribe the manner in which the ſtreets of the capital were ornamented with it on the fifth day of the fifth moon; that is to ſay, about midſummer.

“Of a ſpecies which bears prickles on the edges of its leaves, the leaves, when dried, are beaten with a wooden bat until the ſoft part is entirely ſeparated from the fibres; and, after they have been dipped in water mixed with ſaltpetre, they are uſed for tinder; no other kind is known at Pe-king; and it is equal to that of Europe. It appears that the ancient Chineſe made uſe of the ſoft part of this plant for quilting, for making mattreſſes, and even for cloth. They alſo employed it for manufacturing a kind of paper.”

ARTEMISIUM (anc. geog.), a promontory on the north-eaſt of Eubœa (called *Leon* and *Cale Acte* by Ptolemy), memorable for the firſt ſea-engagements between the Greeks and Xerxes.

The Grecian fleet was ſtationed in the harbour; while that of the Perſians, too numerous for any harbour to contain, had anchored in the road that extends between the city of Caſtanæa and the promontory of Sepias, on the coaſt of Theſſaly.

The firſt line of their fleet was ſheltered by the coaſt of Theſſaly; but the other lines, to the number of ſeven, rode at anchor, at ſmall intervals, with the prows of the veſſels turned to the ſea. When they adopted this arrangement, the waters were ſmooth, the ſky clear, the weather calm and ſerene: but on the morning of the ſecond day after their arrival on the coaſt, the ſky began to lour; the appearance of the heavens grew threatening and terrible; a dreadful ſtorm ſucceeded; and for three days raged with unabating fury. Four hundred galleys were deſtroyed by its violence, beſides a vaſt number of ſtoreſhips and tranſports. Eight hundred ſhips of war, however, beſides innumerable veſſels of burthen, ſailed into the Pegaſean bay, and anchored in the road of Aphetè, which, at the diſtance of a few miles, lies directly oppoſite to the harbour of Artemiſium.

From *Gillies's Hiſtory of Greece.*

The Grecians had poſted centinels on the heights of Eubœa to obſerve the conſequences of the ſtorm, and to watch the motion of the enemy. When informed of the diſaſter which had befallen them, they poured out a joyous libation, and ſacrificed, with pious gratitude, to "Neptune the Deliverer."

The Perſians, however, having recovered from the terrors of the ſtorm, prepared for battle; and as they entertained not the ſmalleſt doubt of conquering, they detached 200 of their beſt ſailing veſſels round the iſle of Eubœa, to intercept the expected flight of the enemy through the narrow Euripus.

About ſun-ſet the Grecian fleet approached in a line; and the Perſians met them with the confidence of victory, as their ſhips were ſtill ſufficiently numerous to ſurround thoſe of their opponents. At the firſt ſignal the Greeks formed into a circle, at the ſecond they began the fight. Though crowded into a narrow compaſs, and having the enemy on every ſide, they ſoon took 30 of their ſhips, and ſunk many more. Night came on, accompanied with an impetuous ſtorm of rain and thunder; the Greeks retired into the harbour of Artemiſium; the enemy were driven to the coaſt of Theſſaly.

By good fortune, however, rather than by deſign, the greateſt part of the Perſian fleet eſcaped immediate deſtruction, and gained the Pegaſean bay; but the ſhips ordered to ſail round Eubœa met with a more dreadful diſaſter. They were overtaken by the ſtorm, after they had adventured further from the ſhore than was uſual with the wary mariners of antiquity. Clouds ſoon intercepted the ſtars, by which alone they directed their courſe; and after continuing during the greateſt part of the night the ſport of the elements, they all periſhed miſerably amidſt the ſhoals and rocks of an unknown coaſt.

The morning aroſe with different proſpects and hopes to the Perſians and the Greeks. To the former it diſcovered the extent of their misfortunes; to the latter it brought a reinforcement of 53 Athenian ſhips. Encouraged by this favourable circumſtance, they determined again to attack the enemy, at the ſame hour as on the preceding day, becauſe their knowledge of the coaſt and their ſkill in fighting their ſhips rendered the duſk peculiarly propitious to their deſigns. At the appointed time, they ſailed towards the road of Aphetè; and having cut off the Cilician ſquadron from the reſt, totally deſtroyed it, and returned at night to Artemiſium.—The Perſian commanders being deeply affected with their repeated diſaſters, but ſtill more alarmed at the much dreaded reſentment of their king, they determined to make one vigorous effort for reſtoring the glory of their arms. By art and ſtratagem, and under favour of the night, the Greeks had hitherto gained many important advantages. It now belonged to the Perſians to chooſe the time for action. On the third day at noon, they ſailed forth in the form of a creſcent, which was ſtill ſufficiently extenſive to infold the Grecian line. The Greeks, animated by former ſucceſs, were averſe to decline any offer of battle; yet it is probable that their admirals, and particularly Themiſtocles, would much rather have delayed it to a more favourable opportunity. Rage, reſentment, and indignation, ſupplied the defect of the Barbarians in ſkill and courage. The battle was longer, and more doubtful, than on any former occaſion; many Grecian veſſels were deſtroyed, five were taken by the Egyptians, who particularly ſignalized themſelves on the ſide of the Barbarians, as the Athenians did on that of the Greeks. The perſevering valour of the latter at length prevailed, the enemy retiring, and acknowledging their ſuperiority, by leaving them in poſſeſſion of the dead and the wreck. But the victory coſt them dear; ſince their veſſels, particularly thoſe of the Athenians, were reduced to a very ſhattered condition; and their great inferiority in the number and ſize of their ſhips, made them feel more ſenſibly every diminution of ſtrength.

ARTEMISIUM, a town of Oenotria, (Stephanus): now *S. Agatha*, in the Hither Calabria, on the river Piſaurus, or la Foglia, diſtant eight miles from the Tuſcan ſea.—Another of the Conteſtani, in Spain, (Strabo); otherwiſe called *Dianium:* now *Denia*, on the ſea-coaſt of Valencia.

ARTERIOTOMY, the opening an artery, with deſign to procure an evacuation of blood. See SURGERY.

ARTERY, in anatomy, a conical tube or canal which conveys the blood from the heart to all parts of the body. See ANATOMY, n° 117,—125.

ARTHRITIS, in medicine, the GOUT. See the *Index* ſubjoined to MEDICINE.

ARTHRODIA, in natural hiſtory, a genus of imperfect cryſtals, found always in complex maſſes, and forming long ſingle pyramids, with very ſhort and ſlender columns.

ARTHRODIA, in anatomy, a ſpecies of articulation, wherein the flat head of one bone is received into a ſhallow ſocket in the other. The humerus and ſcapula are joined by this ſpecies of articulation.

ARTHUR, the celebrated hero of the Britons, is ſaid to have been the ſon of Uther Pendragon king of Britain, and to have been born in 501. His life is a continued ſcene of wonders. It is ſaid that he killed four hundred and ſeventy Saxons with his own hand in one day; and after having ſubdued many mighty nations, and inſtituted the order of the Knights of the Round Table, died A. D. 542, of wounds which he received in battle. The moſt particular detail of his ſtory and his exploits is that given by Geffroy of Monmouth: but the probable is there ſo blended with the mavellous and the extravagant, that not only the truth of the whole, but even the reality of Arthur's exiſtence has been called in queſtion.

In this controverſy, Mr Whittaker has taken much pains to vindicate the exiſtence, and diſcriminate between the real and the fabulous tranſactions, of the Britiſh worthy. "Many of the actions (he obſerves) attributed to Arthur by the Welch chronicles of Britain, are as abſurd in themſelves as they are ſpurious in their authority. Written, as thoſe narratives were many centuries after the facts, and being merely the authentic accounts of Arthur, embelliſhed with the fictions and diſtorted by the perverſions of folly; they are inconſiſtent equally with the ſtate of the times, and the

Hiſtory of Mancheſter, vol. ii. 4to. edit. p. 31. *et ſeq.*

the hiſtory of the continent and the iſland. And the ignorance of the forgers, and the credulity of their abettors, can be equalled only by the injudiciouſneſs and incredulity of the opponents to both. If ſome accounts of Arthur and Cunobeline in theſe hiſtories be certainly ſpurious, others are as certainly genuine. And the relations of Suetonius, Dio, and Nennius, are not to be rejected, becauſe of the falſehoods which impoſture has engrafted upon them, and abſurdity admitted with them.

"The exiſtence of Arthur is evinced by that of the fables, which have at once annihilated his actions and his name with the miſjudging critic. And the reaſoners own arguments really turn againſt himſelf, and demonſtrate the point which they were intended to diſprove. The annals of Wales have long laboured in Arthur's commendation. The highlanders have long had a poetical hiſtory of his exploits in their own language. The whole iſland is in traditionary poſſeſſion of his character, and 600 or 700 places within it are ſtill diſtinguiſhed by his name.

"The genuine actions of the chief are mentioned by his own hiſtorians, with a modeſty and conciſeneſs that is no bad argument of the truth, and with a particularity of time and place that is a good evidence of the facts. They are noticed by men whom the death of the hero had exempted from all temptation to flattery: they are recited by perſons, whom a proximity to the times had precluded from all poſſibility of miſtake: and they are atteſted by the beſt hiſtorical authority, writers who lived cotemporary with him, authors who converſed with his warriors, and hiſtorians that wrote within a few years after him. He is ſpoken of as the honourable father of the Britiſh heroes by the aged Llomarch, a writer actually cotemporary with him, and ſome time reſident at his court. One of his greater actions is incidentally recorded by Talieſin, an hiſtorical bard living under Maelgwn Gwined, who was a ſovereign among the Britons in the days of Arthur, Gildas, and Llomarch. Another of his conſiderable exploits is caſually intimated by Myrdhin Wyhlt or Merlinus Caledonius, who complains of the ſevere treatment which he himſelf received from Rydderch Hael, a king cotemporary with Urien Reged, and engaged with him in a war againſt the Saxons on the death of Ida in 560. And all his actions are particularly recited by Nennius.

"In the *Hiſtoria Britonum* of this laſt author, Arthur's victories over the Saxons are thus recorded. The firſt battle was fought at the mouth of the river, which is denominated *Glem*. The ſecond, third, fourth, and fifth, were upon another river, that is called *Duglas*, and lies in the region Linuis. The ſixth was on a ſtream, which bears the appellation of *Baſſas*. The ſeventh was in the wood of Celidon, that is, in Cat Coit Celidon. The eighth was at Caſtle Gunnion. And the ninth was at the city of the Legion. The tenth was on the bank of the river Ribroit; the eleventh at the hill AgnedCathregonion; and the twelfth at Mount Badon. Theſe twelve battles of Arthur are deſcribed to us in the ſame manner as Vortimer's three. Only the general facts are mentioned, and only the common names of places are recited, in both. And from the whole air and aſpect of the hiſtory, the remarkable conciſeneſs with which the notices are given, and the great eaſe with which the places are pointed out, the detail appears to have been drawn up at the diſtance only of a few years from the tranſactions, and when theſe little references were ſufficiently underſtood."

Mr. Whittaker proceeds to aſcertain the ſcenes of Arthur's battles; after which he gives a relation of them with a ſurpriſing particularity. A ſevere critic might be apt to ſay, as Dr. Kippis obſerves, that it requires all our faith in the author's judgment, as well as in his ingenuity and learning, not to ſuſpect that he ſometimes allows too much ſcope to fancy and conjecture. However, the whole of what he hath advanced is ſingularly curious, and deſerves peculiar attention and conſideration. And no one can help admiring the penetration with which he hath formed ſuch a regular detail of facts, from the combined aid of hiſtory, romance, and tradition. According to Mr Whittaker, Arthur's principal exploits were againſt the northern Saxons, whilſt he was only prince of the Silures, and Ambroſius was the dictator or pendragon of the Britons. "In a ſeries probably of five campaigns, and in a ſucceſſion certainly of eleven victories, this great commander had repelled the Saxons from the north of Flavia, diſlodged them from all Maxima, and diſpoſſeſſed them of all Valentia. And theſe were ſucceſſes ſo unchequered with misfortunes, ſo great in themſelves, and ſo beneficial to the public, that the name of Arthur claims the firſt rank in the liſt of military, and the better one of patriot, heroes." The twelfth battle of Arthur was fought in the ſouth of England, after he was elected to the pendragonſhip, againſt Cerdic the Saxon. "This (ſays Mr Whittaker) was a moſt extraordinary victory, and completes the circle of Arthur's military glories." In the author's account of this prince's conduct in peace, he aſſerts, that "Arthur ſaw that an appointment was wanted, which ſhould at once be a more regular and more honourable ſignature of merit; by the certainty of the honour and the greatneſs of the dignity, call out all the worth of all the worthy in the nation; and collect it round the throne of the pendragon. Accordingly he eſtabliſhed a military order. It was the firſt that had ever been inſtituted in the iſland; and it has ſince been imitated by all the nations on the continent. By means of this aſſociation, Arthur raiſed among the provincials a general glow of ingenuous heroiſm, the firſt ſpirit of chivalry that ever appeared in Europe; that manly and honourable gallantry of ſoul, which has made him and his worthies the ſubject of romantic hiſtories over all the weſt of it. By this, and this alone, could he have been what hiſtory repreſents him, the Reverend Father of the Britiſh Heroes in general, even to the concluſion of the ſixth century, and nearly the middle of the ſeventh. The order naturally ſurvived its founder. And the members of it were denominated the Warriors of Arthur, though the perſons were born half a century after his death." Mr Whittaker goes on to inform us, that, under the prudent management of Arthur for 20 years together, a fair proſpect dawned upon the Britons, and long ſcenes of future glories opened to their imaginations. "But the gay viſion was deſtroyed at once by the commencement of a civil war. Many towns ſtill remained in ruins, the memorial of the former wars, and the diſgrace of the preſent. The diffuſed ſpirit of chivalry was turned up-

Ibid. p. 45—64.

on the nation, and heroiſm became the tool of diſſenſion. And the dreadful combination of civil evils was begun and conſummated, at once, by the death of the renowned Arthur in battle. Thus died the incomparable hero in 542."

To theſe obſervations it may not be improper to add the following account of the diſcovery of Arthur's tomb, which appears to be tolerably well authenticated. Henry II. who was the firſt of the Plantagenet line, being, in the laſt year of his reign, at Pembroke, and hearing there a Welſh bard ſinging to his harp the ſtory of Arthur, concluding with an account of his death and burial in the church-yard of Glaſtenbury between two pyramids; the king inſtantly gave orders that the matter ſhould be enquired into, and the body dug up. This was done as the king directed; and at the depth of ſeven feet was found a vaſt ſtone, whereon was faſtened a leaden croſs, with this inſcription on the inſide: *Hic Jacet Sepultus Inclytus Rex Arturius in Inſula Avalonia*; i. e. "Here lies the famous King Arthur, buried in the iſle of Avalon." Digging ſtill lower, they found the king's body in the trunk of a tree, his beautiful queen lying by him, with long flowing hair, in colour bright as gold, which however ſunk into duſt when touched. The king's bones were very large ſized; and in his ſkull there were ten wounds or more, all cicatrized, except that of which he died. This diſcovery was made in the year 1189, as Giraldus Cambrenſis tells us, who ſaw theſe bones, and examined the whole matter carefully. There was alſo a table containing this ſtory, ſet up in the monaſtery of Glaſtenbury, and the leaden croſs with the inſcription remained there till the diſſolution of the monaſtery, where it was ſeen by the great antiquary Leland, but what is become of it ſince does not appear.

On the different places above alluded to as being diſtinguiſhed by our hero's name, and ſerving to evince his exiſtence, the following may be mentioned as one of the principal.

Arthur's Seat, a high hill in the neighbourhood of Edinburgh, ſaid to have been ſo denominated from a tradition that king Arthur ſurveyed the country from its ſummit, and had alſo defeated the Saxons in its neighbourhood. This hill riſes by a ſteep and rugged aſcent, till it terminates in a rocky point near 700 feet high from the baſe, being more than double the height of the croſs on the top of St. Paul's, London, which is 340 feet. On the ſouth it is in many parts a perpendicular rock, compoſed of baſaltic pillars, regularly pentagonal or hexagonal, about three feet in diameter, and from 40 to 50 feet in height. Contiguous, upon the weſt, and partly connected with it at the baſe, are Saliſbury craggs, of inferior height, but exhibiting an appearance equally ſingular and grand. They preſent to the city an awful front of broken rocks and precipices, forming a ſort of natural amphitheatre of ſolid rock; and backward from the craggy verge above, the hill forms an extenſive irregular ſlope, the ſurface affording paſture to numerous flocks of ſheep. The craggs, beſides ores, ſpars, rock-plants, and here and there it is ſaid ſome precious ſtones, afford an inexhauſtible ſupply of granite for paving the ſtreets and other purpoſes. In quarrying, a part of the craggs has been worn down into a ſpacious ſhelf, having the appearance of a lofty terrace, and ſtretching a conſiderable length. From hence is a near and diſtinct proſpect of the city with its environs and the adjacent country. But from the pinnacle called Arthur's Seat the view is more noble and extenſive. The traveller may here ſit and ſurvey at his eaſe the centre of the kingdom, beſides having a complete view of Edinburgh and its caſtle, on which he looks down as if ſeated among the clouds. In a word, the German ocean, the whole courſe of the Forth, the diſtant Grampians, and a large portion of the moſt populous and beſt cultivated part of Scotland, form a landſcape ſublime, various, and beautiful.

The denomination of this hill, derived as above, has been adduced as an argument againſt thoſe who diſpute the exiſtence of the Britiſh Arthur. That derivation, however, though probable, is not without uncertainty. For *Arthur's Seat* is ſaid to be derived, or rather corrupted, from *Ard Seir*, a "place or field of arrows," where people ſhoot at a mark: And this not improperly; for among theſe cliffs is a dell or recluſe valley, where the wind can ſcarcely reach, now called the *Hunter's bog*, the bottom of it being a moraſs. The adjacent craggs are ſuppoſed to have taken their name from the Earl of *Saliſbury*, who in the reign of Edward III. accompanied that prince in an expedition againſt the Scots.

ARTICHOAK, in botany. See CINARA.

ARTICLE, a clauſe or condition of a contract, treaty, &c. It is alſo a ſmall part or diviſion of a diſcourſe, book, or writing, &c.

ARTICLE of Death, the laſt pangs or agony of one juſt expiring.

ARTICLE of Faith, is by ſome defined a point of Chriſtian doctrine, which we are obliged to believe, as having been revealed by God himſelf, and allowed and eſtabliſhed as ſuch by the church.

The thirty-nine articles were founded, for the moſt part, upon a body of articles compiled and publiſhed in the reign of Edward VI. They were firſt paſſed in the convocation, and confirmed by royal authority in the year 1562. They were afterwards ratified anew in the year 1571, and again by Charles I. The law requires a ſubſcription to theſe articles of all perſons ordained to be deacons or prieſts, 13 El. cap. 12. of all clergymen inducted to any eccleſiaſtical living, by the ſame ſtatute, and of licenſed lecturers and curates, 13 El. cap. 12. and 13. and 14. Ch. 2. cap. 4. of the heads of colleges, of chancellors, officials and commiſſaries, and of ſchool-maſters. By 1 Will. 3. cap. 18. diſſenting teachers are to ſubſcribe all, except the 34th, 35th, and 36th, and part of the 20th (and in the caſe of Anabaptiſts, except alſo part of the 27th); otherwiſe they are exempted from the benefits of the act of toleration.

ARTICLE, in grammar, denotes a particle uſed in moſt languages for the declining of nouns, and denoting the ſeveral caſes and genders thereof.

The uſe of articles ariſes chiefly hence, that in languages which have no different terminations, to expreſs the different ſtates and circumſtances of nouns, there is ſomething required to ſupply that office.

The Latins have no articles; but the Greeks, and moſt of the modern languages, have had recourſe to them for fixing and aſcertaining the vague ſignification of common and appellative names.

The Greeks have their ο, the eaſtern tongues their *he emphaticum;* the Italians their *il, lo,* and *la.* The French their *le, la,* and *les.* The Germans their *der, das, dat.*

The Engliſh alſo have two articles *a* and *the*; which being prefixed to ſubſtantives, apply their general ſignification to ſome particular things.

Some grammarians make the article a diſtinct part of ſpeech; others will have it a pronoun, and others a noun adjective. See GRAMMAR.

Articles are of great ſervice in a language, as they contribute to the more neat and preciſe expreſſing of ſeveral properties and relations, which muſt otherwiſe be loſt. And hence one great advantage of ſuch languages over the Latin, in that the article being either expreſſed or left out, makes an alteration in the ſenſe, which the Latins cannot diſtinguiſh. Thus when the devil ſaid to our Saviour, *Se tu es Filius Dei,* it may be either underſtood, "if thou art *a* ſon of God," or, "if thou art *the* ſon of God." The Italians even prefix articles to proper names, which do not naturally need any, becauſe they themſelves ſignify things individually. Thus they ſay, *il Arioſto, il Taſſo, il Petrarcha.* Even the French join the article to the proper names of kingdoms, provinces, &c. as *la Suede, la Normandie.* And we likewiſe annex it to the names of certain mountains and rivers; as The *Rhine,* The *Danube,* The *Alps,* &c.

ARTICULATE SOUNDS are ſuch ſounds as expreſs the letters, ſyllables, or words, of any alphabet or language; ſuch are formed by the human voice, and by ſome few birds, as parrots, &c.

ARTICULATION, or JOINTING, is the joining of bones together. See ANATOMY, n° 46.

ARTICULATION, in botany, is the connection of parts that conſiſt of joints or knees, ſuch as the pods of French honey-ſuckles, which when ripe divide into ſo many parts as there are knees or joints; alſo thoſe parts of plants which ſwell into nodes or joints; and which uſually ſend forth branches.

ARTIFICER, a perſon whoſe employment it is to manufacture any kind of commodity, as in iron, braſs, wool, &c. ſuch are ſmiths, braziers, carpenters, &c. The Roman artificers had their peculiar temples, where they aſſembled and choſe their own patron, to defend their cauſes: they were exempted from all perſonal ſervices. Taruntenus Paternus reckons 32 ſpecies of artificers, and Conſtantine 35, who enjoyed this privilege. The artificers were incorporated into divers colleges or companies, each of which had their tutelar gods, to whom they offered their worſhip. Several of theſe, when they quitted their profeſſion, hung up their tools, a votive offering to their gods. Artificers were held a degree below merchants, and *argentarii* or money-changers, and their employment more ſordid. Some deny, that in the earlieſt ages of the Roman ſtate artificers were ranked in the number of citizens: others, who aſſert their citizenſhip, allow that they were held in contempt, as being unfit for war, and ſo poor that they could ſcarce pay any taxes. For which reaſon they were not entered among the citizens in the cenſor's books; the deſign of the cenſus being only to ſee what number of perſons were yearly fit to bear arms, and to pay taxes towards the ſupport of the ſtate. It may be added, that much of the artificers buſineſs was done by ſlaves and foreigners, who left little for the Romans to mind but their huſbandry and war. By means of the arts, the minds of men are engaged in inventions beneficial to the whole community; and thus prove the grand preſervative againſt the barbariſm and brutality, which ever attend on an indolent and inactive ſtupidity.

By the Engliſh laws, artificers in wool, iron, ſteel, braſs, or other metal, going out of the kingdom into any foreign country without licence, are to be impriſoned three months, and fined in a ſum not exceeding one hundred pounds. And ſuch as going abroad, and not returning on warning given by ambaſſadors, &c. ſhall be diſabled from holding lands by deſcent or deviſe, from receiving any legacy, &c. and be deemed aliens. Stat. 5. Geo. I. cap. 27. By 23 Geo. II. cap. 13. § 1. penalty is alſo inflicted on ſeducing artificers to go abroad. Ramazini has a treatiſe on the diſeaſes of artificers.

ARTIFICIAL, in a general ſenſe, denotes ſomething made, faſhioned, or produced by art, in contradiſtinction from the productions of nature.

ARTIFICIAL is alſo frequently uſed for factitious. Thus we have artificial ſal ammoniac, artificial borax, &c.

ARTIFICIAL Fire-works are compoſitions of inflammable materials, chiefly uſed on ſolemn occaſions, by way of rejoicing. See PYROTECHNY.

ARTIFICIAL Lightening. See ELECTRICITY and LIGHTNING.

ARTIFICIAL Lines, on a ſector or ſcale are certain lines ſo contrived, as to repreſent the logarithmic ſines and tangents; which, by the help of the line of numbers, will ſolve all queſtions in trigonometry, navigation, &c. pretty exactly.

ARTIFICIAL Magnets. See MAGNETS.

ARTIGI, indeclinable, (Pliny); *Artigis,* (Ptolemy); a town of the Turduli, in Bætica. Now *Alhama.*

ARTILLERY, in its general ſenſe, denotes the offenſive apparatus of war, particularly of the miſſile kind. Among the French the term was anciently appropriated to ARCHERY. In its modern acceptation it ſignifies fire-arms, mounted on their carriages and ready for action, with their balls, their bombs, their grenades, &c.

If we take the term in a more extenſive meaning, it includes the powder, the matches, inſtruments for fireworks, the utenſils of ordnance, the machines which facilitate their motion and tranſport them, the vehicles over which they traverſe rivers, every thing neceſſary to them, and all that enters into the form of a train of artillery.

The ſame word, ſtill farther extended in its meaning, likewiſe comprehends the men deſtined for the ſervice of the *artillery*; the people who provide the artillery with materials and implements when engaged, the cannoniers, the bombardiers, the officers of every rank, and engineers of every kind.

By *artillery* is likewiſe underſtood the ſcience which the officers of artillery ought to poſſeſs. This ſcience teaches to know the nature of all the materials and ingredients which enter into the compoſition and the ſtructure of every thing relative to the artillery, ſuch as nitre, ſulphur, charcoal: the properties of air and fire; the compoſition and preparation of gun-powder; the materials for fire-works; the conſtruction, proportions, &c. of the different warlike machines; the arrangement, movement, and whole management, of cannon, &c. in the field or in ſieges, in ſuch a manner, that each of them, according to the length of its tube, and the diameter of its bore, may be ſituated in the beſt place and at the propereſt diſtance for execution, and that the whole train taken together may reciprocally aſſiſt and ſupport each other with the greateſt advantage.

Artillery has undergone many changes from its origin to the preſent time. The artillery of the ancients were the catapulta, the baliſtæ, the different kinds of ſlings, &c. In latter ages, the Franks uſed the hatchet as a miſſile weapon, throwing it in the ſame manner as the Americans do theirs, called the *tomahawk*. The Gaſcons and Genoeſe were excellent croſs-bow-men. The Swiſs owed their victories to their ſtrength and ſkill in the uſe of the pike, halberd, and eſpadon or two-handed ſword; and the victories of Creſſy, Poictiers, and Agincourt, will occaſion the valour and ſkill of the Engliſh archers to be tranſmitted down to lateſt poſterity. See ARCHERY.

The chevalier Folard was extremely attached to the ancient machines firſt mentioned, and ſeemed even to prefer them to our fire-arms: an opinion which muſt appear not a little extraordinary from ſuch a perſon. Father Daniel might well be miſtaken in the compariſon which he made between the effects of ancient and modern artillery, and in his concluſion that the latter was of little uſe: the ſituation of this good father removed him from the ſcenes of war and the opportunities of military experience. But it is aſtoniſhing, that one ſo learned in the military art as the commentator of Polybius, who had ocular demonſtration of the ſucceſs of modern artillery, ſhould have declared ſo violently againſt it. Whatever be the caſe with theſe authors and their maxims, it may be aſſerted, that cannon is one of the moſt ſingular diſcoveries which have been made amongſt men; and by little and little it has changed the whole art of war, and of conſequence influenced the whole ſyſtem of policy, in Europe. The æra of artillery is dated from the battle of Creſſy in 1346, becauſe it is only from that day that cannons were mentioned in battle. Edward III. of England ſucceſsfully employed ſome pieces of artillery placed in the front of his army. The invention of artillery was then known in France as well as in England; but probably Philip VI. marched with ſo much hurry and precipitation to attack his enemy, that he left his cannon as uſeleſs incumbrances behind him. The ignorance of that age in mechanical arts conſiderably retarded the progreſs of artillery; and that of which they were then poſſeſſed was ſo unwieldy and imperfect, that they could not poſſibly diſcern its importance and efficacy in practice.

After the invention of gun-powder, the Spaniards were the firſt who armed part of their foot with muſkets and harquebuſſes, and mixed them with the pikes. In this they were ſoon imitated by moſt other nations; though the Engliſh had not entirely laid aſide their favourite weapon the long-bow, and generally taken to the uſe of fire arms, during the reign of queen Elizabeth.

The firſt muſkets were very heavy, and could not be fired without a reſt: they had matchlocks, and barrels of a wide bore, that carried a large ball and charge of powder, and did execution at a great diſtance. The muſketeers on a march carried only their reſts and ammunition, and had boys to bear their muſkets after them, for which they were allowed great additional pay. They were very ſlow in loading, not only by reaſon of the unwieldineſs of the pieces, and becauſe they carried the powder and balls ſeparate, but from the time it took to prepare and adjuſt the match; ſo that their fire was not near ſo briſk as ours is now. Afterwards a lighter kind of matchlock-muſket came into uſe; and they carried their ammunition in bandeliers, which were broad belts that came over the ſhoulder, to which were hung ſeveral little caſes of wood covered with leather, each containing a charge of powder; the balls they carried looſe in a pouch, and they had alſo a priming-horn hanging by their ſide. Matchlocks were, about the beginning of this century, univerſally diſuſed in Europe, and the troops were armed with firelocks; to which, much about the ſame time, the bayonet being added, pikes alſo were laid aſide; which latter change, whether it was for the better or not, is a point that ſtill admits of diſpute among the beſt military writers, who are divided in their opinions about it, though moſt of them diſapprove of it.

The old Engliſh writers call thoſe large muſkets *calivers;* the harquebuſs was a lighter piece, that could be fired without a reſt. The matchlock was fired by a match, fixed by a kind of tongs in the ſerpentine or cock, which by pulling the trigger was brought down with great quickneſs upon the priming in the pan, over which there was a ſliding cover, which was drawn back by hand, juſt at the time of firing. There was a great deal of nicety and care required to fit the match properly to the cock, ſo as to come down exactly true on the priming, to blow the aſhes from the coal, and to guard the pan from the ſparks that fell from it: a great deal of time was alſo loſt in taking it out of the cock, and returning it between the fingers of the left-hand, every time that the piece was fired; and wet weather often rendered the matches uſeleſs. However, moſt writers allow that they were very ſure, and leſs apt to miſs fire than the firelock.

The firelock is ſo called, from producing fire of itſelf, by the action of the flint and ſteel. The moſt ancient invention of this ſort is the wheel-lock, which we find mentioned in Luigi Collado's Treatiſe of Artillery, printed at Venice, 1586, as then lately invented in Germany. This ſort of lock was uſed till within theſe hundred years, eſpecially for piſtols and carbines. It was compoſed of a ſolid ſteel wheel, with an axis, to which was faſtened a chain, which, by being round it, drew up a very ſtrong ſpring; on pulling the trigger, the ſpring acting, whirled about the wheel with great velocity, and the friction of the edge of it (which was a little notched) againſt the ſtone produced the fire: the cock was made ſo as to bring the ſtone upon the edge of the wheel, part of which was in the pan, and touched the priming; they uſed any common hard pebble for that purpoſe, which ſerved as well as flint.

Theſe locks were inconvenient, took time to wind up (or ſpan, as they termed it), and ſometimes would not go off; an inſtance of which may be ſeen in Ludlow's Memoirs.

When the firelock, ſuch as we now uſe, was invented, we cannot aſcertain: it is called, by writers of about the middle of the laſt century, a *ſnaphane* or *ſnaphance;* which being the Dutch word for a *firelock,* ſeems to indicate that it is a Dutch invention, and that we took it from them. But Ward, in his Animadverſions of War, printed in 1639, p. 502, after deſcribing the exerciſe of the firelock, piſtol, and carbine (by which he means the wheel-lock), ſays, that as moſt of our pieces go with Engliſh locks, which differ from firelocks, he ſhall add the method of handling them; and then gives the exerciſe of the ſnaphine carbine; by which it appears, that there was little or no difference between that and the pieces now in uſe. The more modern writers call it a *fuſee,* from the French word *fuſil;* whence the name of fuſileers is ſtill continued to ſeveral regiments, which were the firſt that were armed with them on the diſuſe of matchlocks.

They uſed the muſket and reſt in England ſo late as the beginning of the civil wars, as may be ſeen in Col. Bariffe's Young Artillery Man, printed at London, 1643.

Figuerra, in his embaſſy in 1518, relates, that the Perſians would neither make uſe of infantry nor of artillery, becauſe by them the impetuoſity of attack, and the facility of retreat were equally incumbered and retarded: in theſe expedients alone their addreſs and their glory conſiſted. This method of advancing and recalling is widely different from the preſent conduct of war, as the artillery in armies is now prodigiouſly multiplied, and muſt be tranſported to every place where any body of troops whatever is deſtined to operate.

The length and diameter of cannon has been much diminiſhed, which muſt likewiſe proportionably diminiſh their weight. It is by long practice and experience that they have diſcovered how much might be deduced from their magnitude in both theſe reſpects with propriety, without hurting the grand effects which, on ſome occaſions, it is neceſſary they ſhould produce, by rendering them more eaſy to be wielded, which was the advantage purſued by leſſening their ſize. See further the articles CANNON, GUNNERY, and PROJECTILES.

Improvements, however, are ſtill making, and will probably long continue to be made, in theſe ignivomous machines that mock the thunder, which, though they ſeem to be invented for the deſtruction of the human race, and the ſubverſion of empires, have yet by their effects rendered war leſs ſavage and leſs ſanguine; political alliances have been more ſucceſsfully conciliated among all nations, conqueſts are become leſs frequent and leſs rapid, and ſucceſſes in war have been more eaſily reduced to calculation.

Wealth of Nations, Philad. edit vol. iii. 65.

The change introduced into the military art by the modern artillery, Dr Smith obſerves, has enhanced greatly both the expence of exerciſing and diſciplining any particular number of ſoldiers in time of peace, and that of employing them in time of war. Both their arms and their ammunition are become more expenſive. A muſket is a more expenſive machine than a javelin or a bow and arrows; a cannon or a mortar, than a baliſta or a catapulta. The powder which is ſpent in a modern review is loſt irrecoverably and occaſions a very conſiderable expence. The javelins and arrows which were thrown or ſhot in an ancient one, could eaſily be picked up again, and were beſides of very little value. The cannon and the mortar are not only much dearer, but much heavier machines than the baliſta or catapulta, and require a greater expence, not only to prepare them for the field, but to carry them to it. As the ſuperiority of the modern artillery too over that of the ancients is very great, it has become much more difficult, and conſequently much more expenſive, to fortify a town ſo as to reſiſt even for a few weeks the attack of that ſuperior artillery.

In modern war the great expence of fire-arms gives an evident advantage to the nation which can beſt afford that expence; and conſequently, to an opulent and civilized, over a poor and barbarous nation. In ancient times, the opulent and civilized found it difficult to defend themſelves againſt the poor and barbarous nations. In modern times the poor and barbarous find it difficult to defend themſelves againſt the opulent and civilized. The invention of fire-arms, an invention which at firſt ſight appears to be ſo pernicious, is certainly favourable both to the permanency and to the extenſion of civilization.

It has to many appeared matter of ſurpriſe, that the battles of the ancients ſhould be deſcribed with an order, perſpicuity, and circumſtantial minuteneſs; which are not to be found in the military writers of modern times. Scholars have endeavoured to explain this difference, by obſerving the immenſe diſproportion, in point of dignity and abilities, between the military hiſtorians of modern Europe and thoſe of Greece and Rome. But the difficulty will be better ſolved, Dr Gillies thinks, by reflecting on the changes introduced into the art of war by the change of artillery; which, in military operations, form the pivot on which the whole turns. 1. From the nature of fire-arms, modern battles are involved in ſmoke and confuſion. 2. From the ſame cauſe, modern armies occupy a much greater extent of ground, and begin to act at much greater diſtances; which renders it more difficult to obſerve and aſcertain their manœuvres. 3. The immenſe train of artillery, ammunition, &c. required in the practice of modern war, gives a certain immobility to our armies which renders it impoſſible to perform, without great danger, thoſe rapid evolutions in ſight of an enemy, which ſo often decided the battles of the ancients. With us almoſt every thing depends on the judicious choice of ground, a matter requiring greater military genius, but not admitting the embelliſhments of hiſtorical deſcription.

In the battles of the Greeks and Romans, the extraordinary diſproportion between the numbers ſlain on the ſide of the victors and the vanquiſhed, has been obſerved as another remarkable circumſtance. But this neceſſarily reſulted from the nature of their arms. Their principal weapons being not miſſile, but manual, armies could not begin to act till they had approached ſo nearly to each other, that the conquered found themſelves cut off from all poſſibility of retreat. In modern times, ſuch conſequences ſeldom take place. The uſe of fire-arms (which often renders the action itſelf more bloody) furniſhes the defeated party with various means of retreating with conſiderable ſafety. The ſphere of military action is ſo widely extended in modern times, that before the victors can run over the ſpace which ſeparates them from the vanquiſhed, the latter may fall back, and proceed with little loſs beyond their reach; and ſhould any village, hedge, ravine, &c. be found in their way may often check the ardour of the purſuers. Upon theſe conſiderations, the invention of gun-powder and modern artillery may be ſaid to have ſaved the effuſion of human blood. Equeſtrian engagements (ſince the principles on which cavalry act remain nearly the ſame in every age) are ſtill diſtinguiſhed by ſimilar circumſtances to thoſe which appear ſo extraordinary in the battles of antiquity.

ARTILLERY-Park, the place in the rear of both lines in the army; for encamping the artillery, which is drawn up in lines, of which one is formed by the guns; the ammunition waggons make two or three lines, 60 paces behind the guns, and 30 diſtant from one another; the pontoons and tumbrils make the laſt line. The whole is ſurrounded with a rope which forms the park: the gunners and matroſſes encamp on the flanks; and the bombardiers, pontoonmen, and artificers, in the rear.

ARTILLERY-Train, a certain number of pieces of ordnance, mounted on carriages, with all their furniture fit for marching.

ARTIST, in a general ſenſe, a perſon ſkilled in ſome art. Mr Harris defines an artiſt to be, "A perſon poſſeſſing an habitual power of becoming the cauſe of ſome effect, according to a ſyſtem of various and well-approved precepts." See ART.

We are told* of a privilege granted at Vicenza to artiſts, like that of *clergy* in England: in virtue thereof, criminals adjudged to death ſave their lives if they can prove themſelves the moſt excellent and conſummate workmen in any uſeful art. This benefit is allowed them *in favorem artis*, for the firſt offence, except in ſome particular crimes, of which coining is one; for here the greater the artiſt, the more dangerous the perſon.

ARTIST *(Artiſta)*, in an academical ſenſe, denotes a philoſopher or proficient in the faculty of arts.

In the early ages of univerſities, the ſeven liberal arts completed the whole courſe of ſtudy, or philoſophy, as it was called; whence the maſters of this faculty were denominated *Artiſts*. What they underſtood by the liberal arts uſed to be ſummed up in the following Latin verſe:

Lingua, Tropus, Ratio, Numerus, Tonus, Angulus
Aſtra.

ARTIST is more peculiarly uſed by Paracelſus and other adepts, for a chemiſt or alchemiſt. We find frequent mention, in authors of this claſs, of Elias Artiſta, or Elias the artiſt, who is to come ſome time before the diſſolution of the world, and reſtore and make perfect all arts and ſciences, but eſpecially the gold-making art; and uſher in a truly golden age, or millennium. The lower and meaner things in this ſublime art, Paracelſus obſerves, God has permitted to be already diſcovered; but for the greater and more important matters, as the tranſmutation of other metals into gold, they are reſerved to the coming of Elias the artiſt.

ARTOBRIGA, a town of Vindelicia (Ptolemy): Now *Altzburg*, in Bavaria, on the Danube, below Ingolſtadt (Aventinus); but Cluverius ſuppoſes it to be *Lebenau*, on the Saltzbach, below Lauffen, in the archbiſhopric of Saltzburg.

ARTOCARPUS (from αρτος, *bread*, and καρπος, *fruit*), the BREAD-FRUIT TREE: A genus of the monandria order, belonging to the monœcia claſs of plants. It has a cylindric amentum or catkin, which thickens gradually, and is covered with flowers; the male and female in different amentum. In the *male*, the calyx is two-valved, and the corolla is wanting. In the *female*, there is no calyx or corolla; the ſtylus is one, and the drupa is many-celled.

Though this tree has been mentioned by many voyagers, particularly Dampier, by Rumphius, and by Lord Anſon, yet very little notice ſeems to have been taken of it till the return of Captain Wallace from the South Seas, and ſince that time by others who have touched at Otaheite and ſome countries in the Eaſt Indies. Captain Dampier relates, that in Guam, one of the Ladrone iſlands, "there is a certain fruit called the *bread-fruit*, growing on a tree as big as our large apple-trees, with dark leaves. The fruit is round, and grows on the boughs like apples, of the bigneſs of a good penny loaf: when ripe, it turns yellow, ſoft, and ſweet; but the natives take it green, and bake it in an oven till the rind is black: this they ſcrape off, and eat the inſide, which is ſoft and white, like the inſide of new-baked bread, having neither ſeed nor ſtone; but if it is kept above 24 hours it is harſh. As this fruit is in ſeaſon eight months in the year, the natives feed upon no other ſort of bread during that time. They told us that all the Ladrone iſlands had plenty of it. I never heard of it in any other place."

Rumphius, after deſcribing the tree, obſerves, that "the fruit is ſhaped like a heart, and increaſes to the ſize of a child's head. Its ſurface or rind is thick, green, and covered every where with warts of a quadragonal or hexagonal figure, like cut diamonds, but without points. The more flat and ſmooth theſe warts are, the fewer ſeeds are contained in the fruit, and the greater is the quantity of pith, and that of a more glutinous nature. The internal part of the rind, or peel conſiſts of a fleſhy ſubſtance, full of twiſted fibres, which have the appearance of fine wool; theſe adhere to, and in ſome meaſure form it. The fleſhy part of this fruit becomes ſofter towards the middle, where there is a ſmall cavity formed without any nuts or ſeeds, except in one ſpecies, which has but a ſmall number, and this ſort is not good unleſs it is baked, or prepared ſome other way: but if the outward rind be taken off, and the fibrous fleſh dried and afterwards boiled with meat as we do cabbage, it has then the taſte of artichoke bottoms. The inhabitants of Amboyna dreſs it in the liquor of cocoa-nuts: but they prefer it roaſted on coals till the outward part or peel is burnt. They afterwards cut it into pieces, and eat it with the milk of the cocoa-nut. Some people make fritters of it, or fry it in oil; and others, as the Sumatrians, dry the internal ſoft part, and keep it to uſe inſtead of bread with other food. It affords a great deal of nouriſhment, and is very ſatisfying, therefore proper for hard-working people; and being of a gentle aſtringent quality, is good for perſons of a laxative habit of body.

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* *Evel*, Diſcourſe of Medals, p. 237, &c.

It is more nouriſhing boiled in our manner with fat meat than roaſted on coals. The milky juice which diſtils from the trunk, boiled with the cocoa-nut oil, makes a very ſtrong bird-lime. This tree is to be found on the eaſtern parts of Sumatra, and in the Malay language is called *ſoccus* and *ſoccum capas*. It grows likewiſe about the town of Bantam in Java, and in Balega and Madura, and is known there by the name of *ſoccum*."

In Anſon's voyage we are informed, "that the rima, or bread-fruit tree, is common in all the Ladrone iſlands and ſome of the Philipines. It is ſomewhat larger than our apple-tree, and bears a broad dark-coloured leaf with five indentures on each ſide. The fruit hangs on boughs like apples; and is of the ſize of a penny loaf, with a thick tough rind, which when full ripe turns yellow. The natives gather it before it is quite ripe, and bake it till the cruſt is pretty black; then they raſp it, and there remains a pretty loaf, with a tender yellow cruſt, and the crumb of it is ſoft and ſweet as a new-baked roll: it is without any ſeeds or ſtones. This fruit the inhabitants enjoy for about ſeven months; during which they never eat any other kind of bread: but they are obliged to bake it every day; for when it grows a little ſtale, it becomes harſh and huſky, ſomewhat like the potatoe-bread made in the weſt of England. There is, however, a remedy for this; which is cutting the loaf into ſlices when it is new, and drying it in the ſun, by which it is changed into the pleaſanteſt ruſk that can be eaten."

Captain Cook, in his voyage, obſerves, that this fruit not only ſerves as a ſubſtitute for bread among the inhabitants of Otaheite * and the neighbouring iſlands, but alſo, variouſly dreſſed, compoſes the principal part of their food. It grows on a tree that is about the ſize of a middling oak; its leaves are frequently a foot and an half long, of an oblong ſhape, deeply ſinuated like thoſe of the fig-tree, which they reſemble in colour and conſiſtence, and in the exſuding of a milky juice upon being broken. The fruit is about the ſize and ſhape of a new-born child's head; and the ſurface is reticulated †, not much unlike a truffle; it is covered with a thin ſkin, and has a core about as big as the handle of a ſmall knife. The eatable part lies between the ſkin and the core; it is as white as ſnow, and ſomewhat of the conſiſtence of new bread; it muſt be roaſted before it is eaten, being firſt divided into three or four parts; its taſte is inſipid, with a ſlight ſweetneſs ſomewhat reſembling that of the crumb of wheaten bread mixed with a Jeruſalem artichoke. This fruit is alſo cooked in a kind of oven, which renders it ſoft, and ſomething like a boiled potatoe; not quite ſo farinaceous as a good one, but more ſo than thoſe of the middling ſort. Of the bread-fruit they alſo make three diſhes, by putting either water or the milk of the cocoa-nut to it, then beating it to a paſte with a ſtone peſtle, and afterwards mixing it with ripe plantains, bananas, or the ſour paſte which they call *mahie*.

The mahie, which is likewiſe made to ſerve as a ſuccedaneum for ripe bread-fruit before the ſeaſon comes on, is thus made: The fruit of the bread-tree is gathered juſt before it is perfectly ripe; and being laid in heaps, is cloſely covered with leaves: in this ſtate it undergoes a fermentation, and becomes diſagreeably ſweet; the core is then taken out entire, which is done by gently pulling out the ſtalk, and the reſt of the fruit is thrown into a hole which is dug for that purpoſe generally in the houſes, and neatly lined in the bottom and ſides with graſs: the whole is then covered with leaves and heavy ſtones laid upon them; in this ſtate it undergoes a ſecond fermentation, and becomes ſour, after which it will ſuffer no change for many months. It is taken out of the hole as it is wanted for uſe; and being made into balls, it is wrapped up in leaves and baked: after it is dreſſed, it will keep five or ſix weeks. It is eaten both cold and hot; and the natives ſeldom make a meal without it, though to Europeans the taſte is as diſagreeable as that of a pickled olive generally is the firſt time it is eaten. The fruit itſelf is in ſeaſon eight months in the year, and the mahie ſupplies the inhabitants during the other four.

To procure this principal article of their food (the bread-fruit), coſts theſe happy people no trouble or labour except climbing up a tree: the tree which produces it does not indeed grow ſpontaneouſly; but if a man plants ten of them in his life-time, which he may do in about an hour, he will as completely fulfil his duty to his own and future generations, as the native of our leſs temperate climate can do by ploughing in the cold of winter, and reaping in the ſummer's heat, as often as theſe ſeaſons return; even if, after he has procured bread for his preſent houſehold, he ſhould convert a ſurplus into money, and lay it up for his children.

There are two ſpecies of artocarpus, viz. the inciſus, with gaſhed leaves; and the integrifolia, with entire leaves. There is alſo ſaid to be another diſtinction, into that which bears fruit with ſtones or ſeeds, and that in which the fruit has none. The parts of fructification of that tree which bears the fruit without ſtones are defective. The amentum, or catkin, which contains the male parts, never expands. The ſtyli, or female part of the fruit, are likewiſe deficient. From which it follows, that there can be no ſtones or ſeeds, and therefore that this tree can be propagated only by ſuckers or layers; although it is abundantly evident, that it muſt originally have proceeded from the ſeed-bearing bread-fruit tree. Inſtances of this kind we ſometimes find in European fruits; ſuch as the barberry, and the Corinthian grape from Zant commonly called currants, which can therefore be increaſed only by layers and cuttings. Dr Solander was aſſured by the oldeſt inhabitants of Otaheite and the adjoining iſlands, that they well remember there was formerly plenty of the ſeed-bearing bread-fruit; but they had been neglected upon account of the preference given to the bread-fruit without ſeeds, which they propagate by ſuckers.

ARTOIS, a province of France, and one of the fineſt and moſt fertile in the whole kingdom; formerly it was one of the 17 provinces of the Netherlands, but now belongs entirely to France. The names of *Artois*, and *Arras* its capital, are derived from the Atrebates, a people of Gallia Belgica, mentioned by Julius Cæſar. Its greateſt length from north to ſouth is about 24 leagues, and its breadth about 12, being bounded to the ſouth and weſt by Picardy, to the eaſt by Hainault, and to the north by Flanders. A con-

* *Hawkeſworth's account of Captain Cooke's voyage.*

† Plate LVIII.

ſiderable trade is carried on in the province in grain, flax, hops, wool, and linen cloth. The ſtates, who meet regularly once a-year, conſiſt of the clergy, nobility, and commoners; and ſit generally a fortnight at Arras: their chief buſineſs is to deliberate on the ways and means to raiſe the money which the king demands of them, and which uſually amounts to about 400,000 livres, excluſive of forage-money. The moſt conſiderable places in Artois are, Arras the capital, Bapaume, Bethune, St Venant, and St Omer.

ARTOLICA (anc. geog.), a town of the Salaſſii, in Gallia Ciſpadana, (Antonine); at the foot of the Alps: now called *la Tuile* by the inhabitants, a hamlet of Savoy, in the duchy of Aouſt, at the foot of mount St Bernard the Leſs.

ARTOTYRITES, a Chriſtian ſect, in the primitive church, who celebrated the euchariſt with bread and cheeſe, ſaying, that the firſt oblations of men were not only of the fruit of the earth, but of their flocks. The word is derived from αρτος, *bread*, and τυροο, *cheeſe*.

The Artotyrites admitted women to the prieſthood and epiſcopacy; and Epiphanius tells us, it was a common thing to ſee ſeven girls at once enter into their church, robed in white, and holding a torch in their hand; where they wept, and bewailed the wretchedneſs of human nature, and the miſeries of this life.

ARUA (anc. geog.), a town of Bætica, of the reſort of the Conventus Hiſpalenſis, (Pliny): now *Alcclea*, a citadel of Andaluſia, on the Bætis, or Guadalquiver, ſeven leagues above Seville.

ARVALES FRATRES, in Roman antiquity, a college of 12 prieſts, inſtituted by Romulus, and choſen out of the moſt noble families, himſelf being one of that body: they aſſiſted in the ſacrifices of the ambervalia annually offered to Ceres and Bacchus, for the proſperity of the fruits of the earth; when they wore on their heads crowns made of ears of corn.—The original of this inſtitution was as follows: Acca Laurentia, Romulus's nurſe, was accuſtomed once a-year to make a ſolemn ſacrifice for a bleſſing on the fields, her 12 ſons always aſſiſting her in the ſolemnity; but at laſt loſing one of her ſons, Romulus offered himſelf to ſupply his place, and gave this ſmall ſociety the name of *Arvales fratres*. This order was in great repute at Rome: they held the dignity for life, and never loſt it upon account of impriſonment, baniſhment, or any other accident.

ARUBA, a ſmall iſland on the coaſt of Terra Firma, ſubject to the Dutch, and ſituated in W. Long. 69. 30. N. Lat. 12. 30.

ARUCI (anc. geog.), a town of the Celtici, in the north of Luſitania, (Antonine, inſcription); called alſo *Aruci Novem*, to diſtinguiſh it from the following: Now ſuppoſed to be *Moura*, a ſmall city of Portugal, near the confluence of the Ardila and Guadalquiver.

ARUCI VETUS (anc. geog.), a ſmall city of the Turdetani, in Bætica, (Ptolemy); now *Aroche*, a hamlet of Andaluſia, on the confines of Portugal and Eſtramadura, on the river Gama, ſeven leagues to the eaſt of Aruci Novum or Moura. From it a mountain, in its neighbourhood, takes the name *Arucitanus*. Now *la Sierra de Aroche*.

ARUCIA (anc. geog.), a town of Illyria, in the inland part of Liburnia, (Ptolemy): Now *Bregna*; according to ſome; but *Ottoſchatz*, according to others; a citadel of Morlachia.

ARVERNI, an appellation early uſed for the capital of the Arverni, according to the cuſtom of the latter ages of naming towns from the people; it was formerly called *Nemoſſus*, (Strabo). The *Arverni*, a brave and ancient people, and one of the moſt powerful nations of Gaul, claimed affinity with the Romans, as deſcendants from Antenor, (Lucan): and after their conqueſt by the Romans, their ancient liberty was preſerved to them on account of their bravery, (Pliny). Above 1000 years ago the town was called *Clarus Mons*, from its ſituation, (Valeſius.) Now *Clermont*, in Auvergne, E. Long. 3. 20. N. Lat. 45. 42.

ARVIL-SUPPER, a feaſt or entertainment made at funerals, in the north part of England. Arvil-bread is the bread delivered to the poor at funeral ſolemnities: and *arvil*, *arval*, *arfal*, are uſed for the burial or funeral rites; as,

> Come, bring my jerkin, Tibb, I'll to the *arvil*;
> Yon man's dea ſcuy ſeoun, it makes me marvil.
> *Yorkſh. Dial.* p. 58.

ARVIRAGUS, an ancient Britiſh king who flouriſhed in the time of the emperor Domitian. He gained a complete victory over Claudius: but being ſoon after beſieged in the city of Wincheſter, he made a treaty with the Romans, and married the emperor's daughter Genuiſſa. This monarch lived to a good old age: he confirmed the ancient laws, enacted new ones, and liberally rewarded perſons of merit.

ARUM, WAKEROBIN, or CUCKOW-PINT: A genus of the polyandria order, belonging to the gynandria claſs of plants; and in the natural method ranking under the 2d order, *Piperitæ*. The ſpatha is monophyllous, and cowl-ſhaped; the ſpadix is naked above, female below, and ſtamen'd in the middle.—The

Species are 22; of which the moſt remarkable are the following. 1. The maculatum, or common wakerobin, grows naturally in woods and on ſhady banks in moſt parts of Britain. The leaves are halberd-ſhaped, very entire, and ſpotted; the berries numerous, growing in a naked cluſter. The flowers appear in April; and their wonderful ſtructure hath given riſe to many diſputes among the botaniſts. The receptacle is long, in the ſhape of a club, with the ſeed-buds ſurrounding its baſe. The chives are fixed to the receptacle amongſt the ſeed-buds, ſo that there is no occaſion for the tips to be ſupported upon threads, and therefore they have none; but they are fixed to the fruit-ſtalk, and placed between two rows of tendrils: the point in diſpute is what is the uſe of thoſe tendrils? 2. The proboſcidium. 3. The ariſarium. 4. The tenuifolium. Theſe three ſpecies have uſually been ſeparated from this genus, and diſtinguiſhed by the general name of *ariſarum*, or *friar's cowl*, on account of the reſemblance of their flowers to the ſhape of the cowls worn by friars. The flowers appear in April. 5. The italicum, is a native of Italy, Spain, and Portugal. The leaves riſe a foot and an half high, terminating in a point; they are very large, and finely veined with white, interſperſed with black ſpots, which, together with the fine ſhining green, make a pretty variety. The flowers grow near a foot high;

and have very long upright ſpathas, which are of a pale green. They appear in the end of April, or beginning of May. 6. The dracunculus, or common dragons, grows naturally in moſt of the ſouthern parts of Europe. It hath a ſtraight ſtalk three or four feet high, which is ſpotted like the belly of a ſnake : at the top it is ſpread out into leaves, which are cut into ſeveral narrow ſegments almoſt to the bottom, and are ſpread open like a hand ; at the top of the ſtalk the flower is produced, which is in ſhape like the common arum, having a long ſpatha of a dark purple colour, ſtanding erect, with a large piſtil of the ſame colour, ſo that when it is in flower it makes no unpleaſing appearance; but the flower hath ſo ſtrong a ſcent of carrion, that few people can endure it, for which reaſon it hath been baniſhed moſt gardens. 7. The trilobatum, or arum of Ceylon, is a native of that iſland and ſome other parts of India; ſo is very impatient of cold. It is a low plant ; the flower riſes immediately from the root, ſtanding on a very ſhort footſtalk : the ſpatha is long, erect, and of a fine ſcarlet colour, as is alſo the piſtil. 8. The colocaſia. 9. The divaricatum, with ſpear-ſhaped leaves. 10. The peregrinum, or elder. 11. The eſculentum, or eatable arum. 12. The ſagittifolium, or greateſt Egyptian arum. All theſe ſpecies have mild roots, which are eaten by the inhabitants of the hot countries, where they grow naturally ; and ſome of them are cultivated by the inhabitants of the ſugar colonies, where their roots are conſtantly eaten, as alſo the leaves of ſome of them, particularly thoſe of the eſculentum, which they call *Indian kale ;* and which, in thoſe countries where many of the eſculent vegetables of England are with difficulty produced, proves a good ſuccedaneum. 13. The arboreſcens, or dumb cane, is a native of the ſugar iſlands and warm parts of America, where it grows chiefly on low grounds. All the parts of it abound with an acrid juice ; ſo that if a leaf or part of the ſtalk is broken and applied to the tip of the tongue, it occaſions a very painful ſenſation and a great defluxion of ſaliva. The ſtalks of this plant are ſometimes applid to the mouths of the negroes by way of puniſhment.

Culture. All the ſpecies of this plant are hardy, except the trilobatum and the arboreſcens. The former muſt be kept conſtantly in a ſtove, and the laſt in a moderate hot-bed. The arboreſcens is propagated by cutting off the ſtalks into lengths of three or four joints, which muſt be left to dry ſix weeks or two months ; for if the wounded part is not perfectly healed over before the cuttings are planted, they will rot and decay. They are then to be planted in ſmall pots filled with light ſandy earth, and plunged in a moderate hot-bed of tan, obſerving to let them have little water till they have taken good root.

Medicinal Uſes. The roots of the maculatum and dracunculus are uſed in medicine, and differ in nothing but that the latter is ſomewhat ſtronger than the former. All the parts of the arum, particularly the root, have an extremely pungent, acrimonious taſte ; if the root be but lightly chewed, it continues to burn and vellicate the tongue for ſome hours, occaſioning at the ſame time a conſiderable thirſt : theſe ſymptoms are alleviated by butter, milk, or oily liquors. Dried and kept for ſome time, it loſes much of its acrimony, and becomes at length an almoſt inſipid farinaceous ſubſtance.

This root is a powerful ſtimulant and attenuant. It is reckoned a medicine of great efficacy in ſome cachectic and chlorotic caſes, in weakneſs of the ſtomach occaſioned by a load of viſcid phlegm. Great benefit has been obtained from it in rheumatic pains, particularly thoſe of the fixed kind, and which were ſeated deep. In theſe caſes it may given from ten grains to a ſcruple of the freſh root twice or thrice a-day, made into a bolus or emulſion with unctuous and mucilaginous ſubſtances, which cover its pungency, and prevent its making any painful impreſſion on the tongue. It generally excites a ſlight tingling ſenſation through the whole habit, and, when the patient is kept warm in bed, produces a copious ſweat.

The arum was formerly an ingredient in an officinal preparation, the compound powder ; but in that form its virtues are very precarious. Some recommended a tincture of it drawn with wine ; but neither wine, water, nor ſpirits, extract its virtues.

ARUNDA, a town of Hiſpania Bætica, on the Annas, or Guadiana, (Ptolemy, Pliny) : Now ſaid to be *Ronda*, in the province of Granada, on the confines of Andaluſia. W. Long. 5. 40. Lat. 36. 26.

ARUNDEL (Thomas), archbiſhop of Canterbury in the reign of Richard II. Henry IV. and Henry V. He was the ſecond ſon of Robert Earl of Arundel and Warren, and brother of Richard Earl of Arundel who was beheaded. At 22 years of age, from being archdeacon of Taunton he was raiſed to the biſhopric of Ely, the 6th of April 1375, in the reign of Edward III. He was a great benefactor to the church and palace of this ſee ; among other donations he gave a curious table of maſſy gold, adorned with precious ſtones, which had been given to prince Edward by the king of Spain, and ſold by the latter to Biſhop Arundel. In 1386, he was appointed lord chancellor of England ; two years after, he was tranſlated to the ſee of York ; and, in 1316, was advanced to the archipiſcopal ſee of Canterbury, when he reſigned the chancellorſhip. This was the firſt inſtance of the tranſlation of an archbiſhop of York to the ſee of Canterbury. Scarcely was he fixed in this ſee, when he had a conteſt with the univerſity of Oxford about the right of viſitation. The affair was referred to king Richard, who determined it in favour of the archbiſhop. At his viſitation in London, he revived an old conſtitution, by which the inhabitants of the reſpective pariſhes were obliged to pay to their rector one-half-penny in the pound out of the rent of their houſes. In the ſecond year of his tranſlation, a parliament being held at London, the commons with the king's leave impeached the archbiſhop, together with his brother the earl of Arundel, and the Duke of Gloceſter, of high treaſon. The archbiſhop was ſentenced to be baniſhed, and within forty days to depart the kingdom on pain of death. He retired firſt to France ; and then to the court of Rome, where Pope Boniface IX. gave him a kind reception. About this time the Duke of Lancaſter (afterwards Henry IV.) was in France, having been baniſhed by king Richard. The nobility and others, tired with the oppreſſions of Richard, ſolicited the Duke to take the crown. This their requeſt they drew up in a letter, and ſent it over by faithful meſſengers to archbiſhop Arundel, deſiring him to be their advocate on this occaſion with the Duke. The archbiſhop, being a fellow-ſufferer, gladly accepted the office; and went with the meſſengers to the Duke at Paris, where they delivered the letters from the nobles and commons of England, and the archbiſhop ſeconded them with the beſt arguments he could invent. The inviting offer, after ſome objections which were eaſily obviated, the Duke accepted; and upon his acceſſion to the throne, Arundel, who had returned with him to England, was reſtored to his ſee. In the firſt year of this prince's reign, Arundel ſummoned a ſynod which ſat at St Paul's. The next year the commons moved that the revenues of the church might be applied to the ſervice of the public; but Arundel oppoſed the motion with ſuch vigour, that it was thrown aſide. In the year 1408, Arundel began to exert himſelf againſt the Lollards, or Wickliffites; and his zeal for ſuppreſſing that ſect carried him to ſeveral unjuſtifiable ſeverities againſt the heads of it, particularly againſt Sir John Oldcaſtle and Lord Cobham. He alſo procured a ſynodical conſtitution, which forbad the tranſlation of the Scriptures into the vulgar tongue. This prelate died at Canterbury, Feb. 20th, 1413, of an inflammation in his throat, with which he was ſeized (as it is pretended) whilſt he was pronouncing ſentence upon Lord Cobham. The Lollards aſſerted this to be a judgment from God; and indeed Biſhop Goodwin ſpeaks in the ſame manner, ſaying "He who had with-held from the people the word of God, the food of the ſoul, by the juſt judgement of God had his throat ſo cloſed, that he could not ſpeak a ſingle word, nor ſwallow meat or drink, and was ſo ſtarved to death." He was buried in the cathedral church of Canterbury, near the weſt end, under a monument erected by himſelf in his lifetime. To this church he was a conſiderable benefactor: for he built the lantern-tower and great part of the nave; gave a ring of five bells, called from him *Arundel's ring*; ſeveral rich veſtments, a mitre enchaſed with jewels, a ſilver gilt croſier, and two golden chalices.

Arundel, a borough and market town in Suſſex, ſeated on the north-weſt ſide of the river Arun, over which there is a bridge. It had a harbour, wherein a ſhip of 100 ton burthen might ride; but the ſea had ruined it ſo far, that, in 1733, an act paſſed for repairing it, and for erecting new piers, locks, &c. The caſtle, which gives the title of *earl* to its poſſeſſors, is ſeated on the eaſt of the Tame, and is reputed to be a mile in compaſs. It ſends two members to parliament; and is 55 miles ſouth-weſt-by-ſouth of London, and 10 miles eaſt of Chicheſter. Arundel is the premier earldom in England, belonging to the illuſtrious family of Norfolk; and is the only title in England that goes along with the lands. W. Long. 0. 25. N. Lat. 50. 45.

Arundel Oil, in the materia medica. At Bombay, Gambroon, and Surat, in the Eaſt Indies, there grows a tree which bears a nut incloſed in a rough huſk, which reſembles much the horſe-cheſnut; and the kernel of the nut yields an oil by expreſſion, which is of a purgative nature. A tea-ſpoonful of it is reckoned a doſe. The tree goes by the name of the *Arundel tree* at Bombay, and its oil by that of the *Arundel oil*. Mr. Sinclair, one of the ſurgeons belonging to the royal regiment of artillery, who was formerly ſurgeon to an Eaſt India ſhip, gave Dr Monro of London a ſmall bottle full of this oil, which he ſaid was much uſed for the cure of the dyſentery in India, and that he had given it in four recent caſes of dyſentery with ſucceſs.—Dr Monro thinks it probable that this is the oil of the purging nuts mentioned in Dale's Pharmacologia, which are got from the tree called *Lignum Moluccenſe, Pavana dictum, fructu avellanæ*, J. B. I. 342; and *pinus Indica, nucleo purgante*, C. B. 492; and the *palma Chriſti Indica*, Turnefort, Mat. Med.

ARUNDELIAN Marbles, Oxford Marbles, or Parian Chronicle, are ancient ſtones (as has been ſuppoſed), whereon is inſcribed a chronicle of the city of Athens, engraven in capital letters in the iſland of Paros, one of the Cyclades, 264 years before Jeſus Chriſt. They take their firſt name from Thomas Earl of Arundel, who procured them out of the Eaſt, or from Henry his grandſon, who preſented them to the Univerſity of Oxford.

The Arundelian Marbles, in their perfect ſtate, contained a chronological detail of the principal events of Greece during a period of 1318 years, beginning with Cecrops, before Chriſt 1582 years, and ending with the archonſhip of Diognetus, before Chriſt 264. But the chronicle of the laſt 90 years is loſt; ſo that the part now remaining ends at the archonſhip of Diotimus, 354 years before the birth of Chriſt: and in this fragment the inſcription is at preſent ſo much corroded and effaced, that the ſenſe can only be diſcovered by very learned and induſtrious antiquaries; or, more properly ſpeaking, ſupplied by their conjectures.

This chronicle, and many other relics of antiquity, real or pretended, were purchaſed in Aſia Minor, in Greece, or in the iſlands of the Archipelago, by Mr William Petty, who in the year 1624 was ſent by Thomas Earl of Arundel for the purpoſe of making ſuch collections for him in the Eaſt. They were brought into England about the beginning of the year 1627, and placed in the gardens belonging to Arundel-houſe in London.

Soon after their arrival they excited a general curioſity, and were viewed by many inquiſitive and learned men; among others by Sir Robert Cotton, who prevailed upon Selden to employ his abilities in explaining the Greek inſcriptions. Selden and two of his friends, Patrick Young, or, as he ſtyled himſelf in Latin, *Patricus Junius*, and Richard James, immediately commenced their operations, by cleaning and examining the marble containing the Smyrnean and Magneſian league, and afterwards proceeded to the Parian Chronicle. The following year Selden publiſhed a ſmall volume in quarto, including about 39 inſcriptions copied from the marbles.

In the turbulent reign of Charles I. and the ſubſequent uſurpation, Arundel-houſe was often deſerted by the illuſtrious owners; and, in their abſence, ſome of the marbles were defaced and broken, and others either ſtolen or uſed for the ordinary purpoſes of architecture. The chronological marble, in particular, was unfortunately broken and defaced. The upper part, containing 31 epochas, is ſaid to have been worked up in repairing a chimney in Arundel-houſe.

In the year 1667, the Hon. Henry Howard, afterwards

wards Duke of Norfolk, the grandſon of the firſt collector, preſented theſe ſuppoſed remains of antiquity to the univerſity of Oxford.

Selden's work becoming very ſcarce, Biſhop Fell engaged Mr. Prideaux to publiſh a new edition of the inſcriptions, which was printed at Oxford in 1676. In 1732 Mr Maittaire obliged the public with a more comprehenſive view of the marbles than either of his predeceſſors. Laſtly, Dr Chandler publiſhed a new and improved copy of the marbles in 1763, in which he corrected the miſtakes of the former editors; and in ſome of the inſcriptions, particularly that of the Parian chronicle, ſupplied the *lacunæ* by many ingenious conjectures.

The Arundelian marbles have generally been regarded as a curious monument of antiquity. They were, however, diſcovered in ſome inſtances to be inconſiſtent with the moſt authentic hiſtorical accounts; Sir Iſaac Newton and ſeveral other modern philoſophers paid little or no regard to them; and of late their abſolute authenticity has been ſeverely queſtioned in an expreſs diſſertation upon the ſubject, entitled, *The Parian Chronicle.* In this diſſertation much ingenuity as well as judgment and a great extent of ancient learning are diſplayed. His doubts, the author obſerves, ariſe from the following conſiderations.

I. "The characters have no certain or unequivocal marks of antiquity." The Π and Z, which frequently occur in the form ſuppoſed to be the moſt ancient (viz. the perpendicular line of the Π on the right hand only half as long as that on the left, and the Z in the form of a proſtrate ⌶), are ſo well known, that any modern fabricator of a Greek inſcription, which he intends to impoſe upon the world as a relic of antiquity, would moſt probably uſe them in preference to the more common and ordinary forms. But the letters in the Parian Chronicle have no appearance of antiquity except this very equivocal one. They do not in the leaſt reſemble the Sigean, the Nemean, or the Delian inſcriptions, which are ſuppoſed to be of a more ancient date. They differ in many reſpects from the letters on the Marmor Sandvicenſe, which, according to the learned editor of that inſcription, was engraved in the year before Chriſt 374. They bear no ſort of reſemblance to the characters on the Farneſian pillars, to thoſe of the Alexandrian manuſcript, or others of a later date. They ſeem, continues our author, to reſemble perhaps more than any other the letters of the alphabet taken by Montfaucon from the Marmor Cyzicenum at Venice. They are plain and ſimple in their form, and ſuch as an ordinary ſtone-cutter of the preſent age would probably make, if he were employed to engrave a Greek inſcription according to the alphabet now in uſe. The ſmall letters intermixed among the larger have, in the opinion of our author, an air of affectation and artifice, rather than genuine antiquity; and he is perſuaded, that the antiquity of an inſcription can never be proved by the mere form of the letters, becauſe the moſt ancient characters may be as eaſily counterfeited as thoſe which compoſe our preſent alphabets.

That the learned reader may form a competent idea of the characters in the Parian Chronicle, the author has compared them with thoſe of other inſcriptions, and given what is uſually termed a *fac ſimile.*

In regard to ſeveral *archaiſms*, as they are called, in this chronicle, and which our author ſpecifies, he contends, that no concluſion can be drawn from them in favour of its antiquity. What reaſon could there be, he aſks, for introducing theſe into the Parian chronicle? We do not uſually find them in Greek writers of the ſame age, or even in thoſe of the moſt early date. The reign of Ptolemy Philadelphus, with the 21ſt year of which the date of the chronicle coincides, was not an age of rude antiquity with reſpect to the Greek language; being only 130 years after the time of Xenophon and Plato, when the Greek was ſpoken and written in its utmoſt purity and elegance: and we can ſcarcely ſuppoſe, that even a ſtone-cutter, in that refined age, would have been permitted to diſgrace a ſuperb and learned monument with ſuch barbariſms as occur in the chronicle. The archaiſms, however, he remarks are not uniformly obſerved in this inſcription. He adduces ſix inſtances of deviation; and adds, he is almoſt tempted to ſuſpect that εμ Παρω εμ Μαραθωνι, and other pretended archaiſms, are owing to a mere affectation of antiquity, or to a corrupted dialect and pronunciation in later ages. Theſe archaiſms, our author acknowledges, appear on other marbles; but he thinks, that, for that very reaſon, they would naturally be adopted by the fabricator of a ſuppoſititious inſcription; and the authenticity of thoſe inſcriptions in which they appear muſt be eſtabliſhed before they can be urged in oppoſition to the preſent argument.

II. "It is not probable that the chronicle was engraved for *private uſe.*"—Our author thinks it an impoſſible ſuppoſition that ſuch an expenſive and cumberſome work could have been executed by a private citizen, either for his own amuſement, or for the benefit of his fellow-citizens. In the firſt place, a long inſcription could not be engraved in marble without ſuch an expence as few learned Greeks were able to afford. Or, if its author, by an uncommon felicity, was able to erect ſuch a literary monument, the ſcheme would have been uſeleſs and imprudent; as all the contents of the inſcription might have been publiſhed more commodiouſly and effectually by the common mode of writing in uſe at that time.

A variety of arguments is adduced, illuſtrating the ſuperiority of a manuſcript to ſuch an inſcription as the chronicle, in a number of reſpects; and enforcing the improbability of its having ever been executed, either for public or private uſe. Much evidence from ancient hiſtory is likewiſe produced in ſupport of the aſſertion, that the common mode of writing, in the reign of Ptolemy Philadelphus, was not on ſtones. It is not, however, neceſſary to prove, by the teſtimony of ancient authors, that books were written on parchment, or paper made of the Egyptian papyrus, or any ſuch materials, before the date of the Parian chronicle. This is ſufficiently evinced by the very exiſtence of the writings of Moſes, David, Solomon, and the Jewiſh prophets; the works of Homer, Heſiod, Anacreon, Pindar, Eſchylus, Sophocles, Euripides, Herodotus, Hippocrates, Ariſtophanes, Thucydides, Xenophon, Plato, Demoſthenes, Ariſtotle, &c. And it is ſtill more inconteſtibly proved by the libraries which were collected in preceding ages, or about that time, ſuch as thoſe of Polycrates in Samos, Piſiſtratus and Euclides at Athens, Nicocrates in Cyprus, Euripides the poet, Ariſtotle the philoſopher, Clearchus at Heraclea Pontica, and the moſt extenſive and magnificent library of Ptolemy Philadelphus in Egypt, founded in or before the year 284, which in his time is ſaid to have contained 100,000 volumes, and to have been enlarged by his ſucceſſors to the amount of almoſt 700,000. Not long afterwards a library was founded at Pergamus by Attalus and Eumenes, which, according to Plutarch, contained 200,000. Theſe are clear and deciſive proofs, that the common mode of writing in the time of Ptolemy Philadelphus was not on ſtones.

III. "The chronicle does not appear to have been engraved by *public authority*."

1: The firſt argument in ſupport of this opinion is, that inſcriptions of that kind uſually begin with a particular form; as, Η ΒΟΥΛΗ ΚΑΙ Ο ΔΗΜΟΣ, 'The ſenate and the people;' or thus, ΕΔΟΞΕΝ ΤΗΙ ΒΟΥΛΗΙ ΚΑΙ ΤΟΙ ΔΗΜΩΙ, 'It pleaſed the ſenate and the people, &c.' But the Parian chronicle begins in the manner of a private man, ſpeaking of his own performance in the firſt perſon ſingular. This argument, our author remarks, cannot be much affected by obſerving, that the beginning of the inſcription is obliterated; for it is neceſſarily implied by the words now remaining.

2. The facts, and dates, which are mentioned in this chronicle, do not appear to have been extracted from any public records, or calculated to anſwer the purpoſe of authentic documents; as many eminent princes and magiſtrates are paſſed over without notice; in ſeveral inſtances, the tranſactions of whole centuries are omitted: and the facts, chiefly ſpecified are not matters of general or national importance.

3. The Parian inſcription is ſuch a one as we can hardly ſuppoſe the magiſtrates of the people of Paros would have ordered to be engraved. Stately ſepulchres, pillars, triumphal arches, and the like, were erected to perpetuate the glory of eminent men. The remembrance of events in which nations were intereſted, the ſucceſſion of princes, &c. were preſerved in the ſame manner. Leagues, decrees, and laws, were likewiſe engraved on marble or braſs, and fixed to a pillar, the walls of a temple, or other public buildings; becauſe ſuch inſcriptions were deſigned for the inſpection of the people, as they eſſentially concerned their conduct, their property, their liberty, or their lives. But, our author aſks, for whom could the chronicle of Paros be intended? It contains no encomiums on any of the patriots, the heroes, or the demigods of the country, no decrees of the magiſtrates, no public records, no laws of ſtate. On the contrary, it is a work of mere ſpeculation and learning, in which the inhabitants of that iſland, eſpecially the common people, had not the leaſt intereſt or concern.

Theſe words at the beginning, αρχοντος εμ Παρω, would naturally lead us to ſuppoſe, that the inſcription related to Paros. And, if ſo, it would have been natural for the author to have mentioned ſome of the moſt important occurrences in the hiſtory of that iſland. But, ſays this acute and learned critic, what ſcheme does our chronologer purſue on this occaſion? Does he record the events and revolutions of his own country? Does he mention any of the battles, ſieges, and treaties of the Parians? any of their public inſtitutions? any of their poets, patriots, or warriors? Does he mention Archilochus, who was honoured by his countrymen, and diſtinguiſhed as a poet in a general aſſembly of the Greeks?—Not a ſyllable on any of theſe ſubjects! On the contrary, he rambles from place to place, and records the tranſactions of Athens, Corinth, Macedon, Lydia, Crete, Cyprus, Sicily, Perſia, and other foreign countries with which Paros had no connection.

In this view the inſcription ſeems to have been as impertinent in the iſland of Paros, as a marble monument would be in this country, recording the antiquities of France or Spain, or one in Jamaica recording the revolutions of England. But upon ſuppoſition that the inſcription is a forgery, it is eaſy to account for this extraordinary circumſtance. A few chronological occurrences in the ancient hiſtory or Paros, would not have been ſo intereſting to the generality of readers, or ſo valuable in the eſtimation of every lover of antiquities, or, in ſhort, ſo profitable to the compiler, as a general ſyſtem of Grecian chronology.

IV. "The Greek and Roman writers, for a long time after the date of this work, complain that they had no chronological account of the affairs of ancient Greece." This poſition is confirmed by the teſtimony of Julius Africanus, Juſtin Martyr, Plutarch, Joſephus, Varro, Diodorus Siculus, and others; and the following ſeries of interrogatories is ſubjoined: 'Thucydides, I know, lived 140 years before the chronicle is ſaid to have been written; but if Thucydides, as well as other writers, complained that there was nothing but uncertainty in the earlier period of Grecian hiſtory, from whence can we ſuppoſe the author of this inſcription collected ſuch a clear, determinate, and comprehenſive ſyſtem of chronology? If we had any ſources of information, which were unknown to ſucceeding writers, how happens it, that they ſhould all of them overlook this moſt conſiderable, moſt exact, moſt creditable author? Why did they omit this ancient account of their early ages? Why did they not copy his moſt memorable epochas? Why did they not produce his authority? or, at leaſt, why did they not mention his opinion? Surely nothing, to all appearance, could be more elaborate, more important, or of higher authority, than a chronological table, which was thought worthy of being engraved on marble.

V. "The chronicle is not once mentioned by any writer of antiquity." This indeed appears a ſtrong argument againſt its authenticity. Apollodorus, an Athenian, the diſciple of Ariſtarchus the grammarian, and Panætius the philoſopher, wrote a genealogical and hiſtorical work on the early ages of Greece; but, though compoſed 120 years after the date of the Parian chronicle, it does not contain the ſmalleſt traces of a ſyſtematical chronology. It is remarkable too that the chronicle of Apollodorus is quoted by Diodorus Siculus, Strabo, Plutarch, A. Gellius, Lucian, and many other writers of antiquity; while the Parian chronicle, which comprehends a more extenſive period, is entirely unnoticed. It contains, however, ſuch wonderful diſcoveries in ancient hiſtory, that if it had exiſted 264 years before the Chriſtian æra, it muſt have excited a general attention, and been referred to as an authority by writers of ſucceeding times. But we do not find, in any author of antiquity, either poet or hiſtorian, geographer or chronologer, mythologiſt or ſcholiaſt, the moſt diſtant alluſion to the Parian chronicle; though it was ſuch a common practice among the ancients to mention the works of their predeceſſors, that in many books we find references and alluſions to three, four, five, ſix, or ſevent hundred different authors of every denomination.

VI. "Some of the facts mentioned in the chronicle ſeem to have been taken from writers of a later date." Our inquirer collates ſeveral paſſages in the Parian chronicle with parallel paſſages in Greek authors, to evince that there is, in the former, an appearance of imitation, or a ſtronger reſemblance than ſuch as may be ſuppoſed to ariſe from accident; that there are likewiſe ſome improbabilities attending the account of Deucalion, as related in the Parian chronicle; and that the names of ſix, and, if the lacunæ are properly ſupplied, the names of 12 cities appear to have been engraved on the marble, exactly as we find them in Ælian's Various Hiſtory. But there is not, our author obſerves, any imaginable reaſon for this particular arrangement. It does not correſpond with the time of their foundation, with their ſituation in Ionia, with their relative importance, or with the order in which they are placed by other eminent hiſtorians. The argument by which our author endeavours to prove that the Parian chronicle has, in this inſtance, copied Ælian's Various Hiſtory, ſeems deciſive of the fact. He obſerves, that ſix names may be tranſpoſed 720 different ways; and that 12 names admit of 479,001,600 different tranſpoſitions. Suppoſing then, there is no particular reaſon for one arrangement rather than another, it will follow, that the chance of two authors, placing them in the ſame order, is, in the former caſe, as 1 to 720; and in the latter, as 1 to 479,001,600. It is therefore, ſays he, utterly improbable, that theſe names would have been placed in this order on the marble, if the author of the inſcription had not tranſcribed them from the hiſtorian.

It may indeed be urged, with regard to this ſimilarity of arrangement in the Parian chronicle and Ælian's Various Hiſtory, that the inference might be the very inverſe of that which is ſpecified by our author. But that Ælian ſhould have ſeen the Parian chronicle, without once mentioning it; or that he ſhould have exactly copied a liſt of towns, arranged neither according to chronological nor topographical order; is indeed a ſuppoſition equally improbable with the other.

VII. "Parachroniſms appear in ſome of the epochas, which we can ſcarcely ſuppoſe a Greek chronologer in the 129th Olympiad would be liable to commit." After ſpecifying theſe, our inquirer aſks, Would a writer of reputation and learning, in one of the moſt poliſhed and enlightened æras of ancient Greece, commit ſuch miſtakes, in oppoſition to the poſitive atteſtations of the moſt accurate hiſtorians, in events of public notoriety? Would a private citizen, or a magiſtrate of Paros, order a crude and inaccurate ſeries of epochas to be engraved, at a great expence, and tranſmitted to poſterity on a marble moument? It is hardly probable.

VIII. "The hiſtory of the diſcovery of the Parian chronicle is obſcure and unſatisfactory. Our author obſerves, that it is attended with ſome ſuſpicious circumſtances, and without any of thoſe clear and unequivocal evidences which always diſcriminate truth from falſehood. There are no data in the inſcription by which to diſcover the place where the marble was erected. The place likewiſe where it was found is not aſcertained; though the generality of writers who have had occaſion to mention it have ſuppoſed that it was found in the iſland of Paros. If it was erected at Smyrna, as ſome imagine, our author aſks, for what purpoſe does the writer mention Aſtyanax the archon of Paros, and not one circumſtance relative to Smyrna? If, adds he, it was erected at Paros, why does he not mention more archons of that city than one? Or how ſhall we account for his profound ſilence with reſpect to all the events and revolutions which muſt have happened in that iſland, and have been infinitely more intereſting to the natives than the tranſactions of any foreign country?

The train of circumſtances by which the Parian chronicle came into the poſſeſſion of Mr Petty, whom Lord Arundel had ſent into the eaſt for the purpoſe of collecting antiquities, as well as the ſubſequent conduct of Peireſc, its former owner, affords our author a ſtrong preſumption, that, "the inſcription was actually fabricated, with the view of obtaining for it a high price, upon the pretence that it was a relic of great antiquity. It is certain, that there is ſomething myſterious in the conduct of the firſt oſtenſible proprietors. Theſe marbles had been totally unknown, or unnoticed, for almoſt 1900 years, and at laſt they are dug out of the ground—no body can tell us when or where!"

IX. "The literary world has been frequently impoſed upon by ſpurious books and inſcriptions; and therefore we ſhould be extremely cautious with regard to what we receive under the venerable name of antiquity." This propoſition is illuſtrated by a great variety of examples, and very properly expoſes the forgeries which have diſgraced the republic of letters in different ages; and although one of the more recent ones cited, namely, Oſſian's poems, be a point very far indeed from being eſtabliſhed, yet that deceptions of this kind have been practiſed is an unqueſtionable fact.

In endeavouring, towards the end of his diſſertation to inveſtigate the time of the ſuppoſed forgery, he obſerves, That the 16th century, and the prior part of the 17th, produced a multitude of grammarians, critics, and commentators, deeply verſed in Grecian literature, and amply qualified for the compilation of ſuch a chronological ſyſtem as that of the Arundelian marbles. Above all, the ſcience of chronology was particularly ſtudied and inveſtigated about that time: "Nunc fervet chronologia," ſays Scaliger in the year 1605, "omnes hoc ferrum excalfaciunt." Cauſabon treats thoſe perſons with contempt who were unacquainted with the improvements which had been made in that department of learning after the revival of letters. Innumerable ſyſtems of chronology had been publiſhed before the year 1625; from which it was eaſy to extract a ſeries of memorable events, and give the compilation a Grecian dreſs. "The avidity," ſays our author, "with which all relics of antiquity were then collected, and the high price at which they were purchaſed, were ſufficient inducements to any one, whoſe avarice or whoſe neceſſity was ſtronger than his integrity, to engrave his labours on marble, and tranſmit them to Smyrna, as a commodious emporium for ſuch rarities."

The preciſe period of the fabrication, however, muſt ſtill be reckoned apocryphal and uncertain. The ſum of fifty guineas, which Peireſc gave to the ſuppoſed fabricator, was inadequate to ſuch a laborious and expenſive work. Upon the whole, perhaps, it would be too haſty to pronounce deciſively that this famous Chronicle ſo long reſpected, is an impoſition upon the public. It may, however, be ſafely affirmed, that the ſuſpicions againſt it are extremely ſtrong, and the objections already cited of a nature very difficult to be removed. No attempts have yet been made with this view: But under ſome future article, as CHRONOLOGY, MARBLES, or PARIAN *Chronicle*, we may poſſibly have an opportunity of reſuming the ſubject with additional information.

ARUNDO, the REED: A genus of the digynia order, belonging to the triandria claſs of plants; and in the natural method ranking under the 4th order, *Gramina*. The calyx conſiſts of two valves, and the floſcules are thick and downy.

Species and properties. 1. The phragmitis, or common marſh-reed, grows by the ſides of rivers and in ſtanding waters. 2. The debax, or manured reed, is a native of warm countries, but will bear the cold of moderate winters in the open air. It dies to the ſurface in autumn, but appears again in the ſpring, and if kept ſupplied with water, will grow 10 or 12 feet high in one ſummer. The ſtalks of this are brought from Spain and Portugal; and are uſed by the weavers, as alſo for making fiſhing-rods. 3. The verſicolor, or Indian variegated reed, is ſuppoſed to be a variety of the ſecond, differing from it only in having variegated leaves. 4. The bambos, or bamboo*, is a native of the Eaſt Indies and ſome parts of America; where it frequently attains the height of 60 feet. The main root is long, thick, jointed, ſpreads horizontally, and ſends out many cylindrical woody fibres, of a whitiſh colour, and many feet long. From the joints of the main root ſpring ſeveral round jointed ſtalks to a prodigious height, and at about 10 or 12 feet from the ground ſend out at their joints ſeveral ſtalks joined together at their baſe: theſe run up in the ſame manner as thoſe they ſhoot out from. If any of theſe be planted with a piece of the firſt ſtalk adhering to them, they will perpetuate their ſpecies. They are armed at their joints with one or two ſharp rigid ſpines, and furniſhed with oblong oval leaves, eight or nine inches long, ſeated on ſhort footſtalks. The flowers are produced in large panicles from the joints of the ſtalk, placed three in a parcel cloſe to their receptacles: they reſemble thoſe of the common reed, and are ſucceeded by ſeeds of the ſame form ſurrounded with down.

The young ſhoots are covered with a dark-green bark; theſe when very tender are put up in vinegar, ſalt, garlic, and the pods of capſicum, and thus afford a pickle, which is eſteemed a valuable condiment in the Indies, and is ſaid greatly to promote the appetite and aſſiſt digeſtion (ſee ACHIAR). The ſtalks in their young ſtate are almoſt ſolid, and contain a milky juice: this is of a ſweet nature; and as the ſtalks advance in age, they become hollow, except at the joints, where they are ſtopped by a woody membrane, upon which this liquor lodges, and concretes into a ſubſtance called *Tabaxir*, or ſugar of *Mambu*, which was held in ſuch eſteem by the ancients, in ſome particular diſorders, that it was equal in value to its weight in ſilver. The old ſtalks grow to five or ſix inches diameter, are then of a ſhining yellow colour, and ſo hard and durable that they are uſed in buildings, and for making all ſorts of houſhold furniture. Theſe, when bored through the membranes at their joints, are converted into water-pipes. They ſerve alſo to make the ſticks and poles with which the ſlaves or other perſons carry thoſe ſorts of litters which are called *palanquins*, and are ſo common and convenient in all the Eaſt. The ſmaller ſtalks are uſed for walking-ſticks. The inhabitants of Otaheite make flutes of them, about a foot long, with two holes only, which they ſtop with the firſt finger of the left hand and the middle one of the right, and they blow through their noſtrils. 5. The arborea, with a tree-like ſtalk, differs from the former only in having narrower leaves. 6. The orientalis is what the Turks uſe as writing-pens; it grows in a valley near mount Athos, as alſo on the banks of the river Jordan. None of theſe plants are at preſent to be found in Britain.

Culture. As all theſe plants grow naturally in low marſhy lands, they muſt be ſupplied with plenty of water. The ſecond kind requires little care; the third is more delicate, and requires to be kept in pots. The fourth, fifth, and ſixth ſorts muſt be preſerved in ſtoves. They are to be planted in tubs filled with rich earth, and plentifully ſupplied with water. When the tubs decay, they may be ſuffered to grow into the tan, which will encourage them to grow to a larger ſize: but care muſt be taken, when the bed is refreſhed with new tan, to leave a ſufficient quantity of old tan about the roots of the plants; for if they are too much bared and the new tan laid near them, when that heats, it will ſcorch their roots, ſo that the plants are ſometimes deſtroyed by it.

ARUNDO Saccharifera, or *Sugar-cane*. See SACCHARUM.

ARUSINI CAMPI (erroneouſly written *Tauraſini* by Cluverius), plains in Lucania famous for the laſt battle fought between the Romans and Pyrrhus. That prince being at Tarentum, and hearing that the two new conſuls Curius Dentatus and Cornelius Lentulus had divided their forces, the one including Lucania and the other Samnium; he likewiſe divided a choſen detachment of his army into two bodies, marching with his Epirots againſt Dentatus, in hopes of ſurpriſing him in his camp near Beneventum. But the conſul, having notice of his approach, marched out of his entrenchments with a ſtrong detachment of legionaries to meet him, repulſed his van-guard, put many of the Epirots to the ſword, and took ſome of their elephants. Curius, encouraged by this ſucceſs, marched into the Aruſian fields, and drew up his army in a plain, which was wide enough for his troops, but too narrow for the Epirot phalanx to act with its full effect. But the king's eagearneſs to try his ſtrength and ſkill with ſo renowned a commander, ſtimulated him to engage at that great diſadvantage. Upon the firſt ſignal the action began; and one of the kings wings giving way, victory ſeemed to incline to the Romans. But that wing where the king fought in perſon repulſed the enemy, and drove them to their intrenchments. This advantage was in great part owing to the elephants; a circumſtance which Curius perceiving, commanded a body of reſerve, which he had poſted near the

* See Bamboo.

the camp, to advance and attack thoſe animals with burning torches; which frightened and annoyed them to ſuch a degree, that they wheeled about, broke into the phalanx, and put that body into the utmoſt diſorder. The Romans taking advantage of this confuſion, charged with ſuch fury that the enemy were entirely broken and defeated. Pyrrhus retired to Tarentum, attended only by a ſmall body of horſe, leaving the Romans in full poſſeſſion of his camp; which they ſo much admired, that they made it a model which they followed ever after.

ARUSPICES, or HARUSPICES, in Roman antiquity, an order of prieſts who pretended to fortel future events by inſpecting the intrails of victims killed in ſacrifice; they were alſo conſulted on occaſion of portents and prodigies. The haruſpices were always choſen from the beſt families; and as their employment was of the ſame nature as that of the augurs, they were as much honoured. Their college, as well as thoſe of the other religious orders, had its particular regiſters and records.

ARX, in the ancient military art, a town, fort, or caſtle, for defence of a place.

The arx in ancient Rome was a diſtinct edifice from the capitol, though ſome have confounded the two. According to Ryckius, the arx, properly ſpeaking, was a place on the higheſt part of the Capitoline Mount, ſtronger and better fortified than the reſt, with towers and pinnated walls: in which was alſo the temple of Jupiter Capitolinus.

ARX alſo denoted a conſecrated place on the Palatine Mount, where the augurs publicly performed their office. Some will have the arx to have been the augural temple; but Varro expreſsly diſtinguiſhes between the two.

ARX was particularly uſed for a public place in Rome, ſet apart for the operations of the augurs. In which ſenſe arx amounts to the ſame with what is otherwiſe called *auguraculum* and *auguratorium*, and in the camp *augurale*. Out of this arx it was that the *feciales*, or heralds, gathered the graſs uſed in the ceremony of making leagues and treaties.

ARX Britannica, a citadel of Batavia, whoſe foundation is ſeen at low water, near the old mouth of the middle Rhine: ſome imagine it the pharos or high tower of Caligula, as Suetonius calls it; a monument of Caligula's ſham conqueſt of Britain. Others, that it was built by Druſus, with an altar afterwards by Claudius, on his expedition into Britain. But the uſual paſſage was from Geſſoriacum; and Suetonius expreſsly ſays, Claudius paſſed over thence. The ancient name of this citadel, now covered by the ſea, is no where expreſſed: Now commonly called *'t Huis Britten*, or *Brittenburg*; that is, *Arx Britannica*; but from what authority does not appear.

ARYTENOIDES, in anatomy, the name of two cartilages which, together with others, conſtitute the head of the larynx. It is alſo applied to to ſome muſcles of the larynx.

ARYTHMUS, in medicine, the want of a juſt modulation in the pulſe. It is oppoſed to *eurythmus*, a pulſe modulated agreeably to nature.

ARZILLA, a very ancient maritime town of Africa, in the kingdom of Fez, about five leagues from Tangiers. It is built at the mouth of a river, and inhabited by Moors and Jews, who carry on no trade. It was formerly a Roman colony; afterwards fell under the government of the Goths, and was next taken by the Mahometans. Alphonſo of Portugal, ſurnamed the African, took it by aſſault in 1471, and brought away the preſumptive heir of the crown. After that prince came to the throne, he beſieged it, in 1508, with 100,000 men; but was obliged to abandon the undertaking. However, at length the Portugueſe forſook it of their own accord. W. Long. 5. 30. N. Lat. 35. 30.

AS, in antiquity, a particular weight, conſiſting of 12 ounces; being the ſame with *libra*, or the Roman pound. The word is derived from the Greek αις, which in the Doric dialect is uſed for εις, *one*, q. d. an entire thing; though others will have it named *as* quaſi *æs*, becauſe made of braſs.

As was alſo the name of a Roman coin, which was of different weights and different matter in different ages of the commonwealth.—Under Numa Pompilius, according to Euſebius, the Roman money was either of wood, leather, or ſhells. In the time of Tullus Hoſtilius it was of braſs: and called *as*, *libra*, *libella*, or *pondo*, becauſe actually weighing a pound or 12 ounces. Four hundred and twenty years after, the firſt Punic war having exhauſted the treaſury, they reduced the *as* to two ounces. In the ſecond Punic war, Hannibal preſſing very hard upon them, they reduced the *as* to half its weight, viz. to one ounce. And laſtly, by the Papirian law, they took away half an ounce more, and conſequently reduced the *as* to the diminutive weight of half an ounce: and it is generally thought that it continued the ſame during the commonwealth, and even till the reign of Veſpaſian. The *as* therefore was of four different weights in the commonwealth. Its original ſtamp was that of a ſheep, ox, or ſow: but from the time of the emperors, it had on one ſide a Janus with two faces, and on the reverſe the roſtrum or prow of a ſhip.

As was alſo uſed to denote any integer or whole. Whence the Engliſh word *ace*.—Thus *as* ſignified the whole inheritance; whence *hæres ex aſſe*, the heir to the whole eſtate.

ASA, king of Judah, ſucceeded his father Abijam. He pulled down the altars erected to idols, reſtored the worſhip of the true God, and, with the aſſiſtance of Benhadad king of Syria, took ſeveral tows from the king of Iſrael. He died 917 years before the Chriſtian æra, and was ſucceeded by Jehoſhaphat.

ASA, among naturaliſts. The writers of the later ages have formed this word *aſa* from the laſar of the ancients, and attributed it to a gum very different from that anciently known by the name they have thus corrupted.

The aſa of the ancients was an odoriferous and fragrant gum; and the aſa of the after-ages had ſo little title to this epithet, that they diſtinguiſhed it by one, expreſſing its being of an offenſive or ſtinking ſmell. The Arabian writers, according to this diſtinction, deſcribe two kinds of aſa, the one ſtinking, the other aromatic; and the modern Greeks preſerved the name *aſa*, or *laſa*, to the ſtinking gum the Latins called by that name, but added a diſtinctive epithet to expreſs its ſmell, and called it *ſcardolaſarum*.

Asa or **Assa**, in the materia medica, a name given to two very different ſubſtances, called *aſa-dulcis* and *aſa-fœtida*.

Asa-Dulcis is the ſame with Benzoin.

Asa-Fœtida is the concrete juice of a large umbelliferous plant growing in ſeveral parts of Aſia; the properties of which are deſcribed under the article Ferula.

ASAPH (St), a city in Flintſhire, with a biſhop's ſee; on which account principally it deſerves notice, being in itſelf but a poor place. As a biſhoprick, it is of great antiquity, and was founded about the year 560, by Kentigern, a Scotſman, biſhop of Glaſgow. He began the church on the banks of the river Elwy, whence it is called by the Welſh *Land Elwy*, and in Latin *Elwenſis*. Kentigern returning into Scotland, left a holy man his ſucceſſor, St Aſaph. Who was his ſucceſſor is uncertain, as there are no records that mention it; and it ſeems rather probable that the religious ſettled here had been neceſſitated to remove to ſome more peaceful abode, as the country was frequently the ſeat of war between the Engliſh and the Welſh. This ſee was formerly a very wealthy one; but its revenues were greatly leſſened by the profuſion of biſhop Parfew, who alienated much of the lands belonging to this biſhoprick.

This dioceſe doth not contain any one whole county; but conſiſts of part of Denbigh, Flint (where its church is), Montgomery, and Merioneth ſhires, and a ſmall part of Shropſhire; wherein are 121 pariſhes, and 131 churches and chapels, moſt of which are in the immediate patronage of the biſhop. This ſee hath but one archdeaconry, viz. that of St Aſaph, which is united to the biſhoprick, for the better maintenance thereof. This ſee is valued in the king's books at L. 187 : 11, 6, but computed to the worth annually L. 1500. The tenth of the clergy comes to L. 186 : 19 : 6¾. To this cathedral belongs a biſhop, a dean, archdeacon, chancellor, &c.

ASAPPES, or Azapes, an order of ſoldiers in the Turkiſh army, whom they always expoſe to the firſt ſhock of the enemy; to the end that the enemy being thus fatigued, and their ſwords blunted, the ſpahis and janiſaries may fall on and find an eaſy conqueſt. The word is derived from the Turkiſh *ſaph*, which ſignifies *rank*, from whence they have formed *aſphaph*, "to range in battle." The aſappes are ſaid to be held of ſo little value, that they frequently ſerve as bridges for the cavalry to paſs over in bad roads, and as faſcines to fill up the ditches of places beſieged. They travel on foot, and have no pay but the plunder they can get from the enemy.

ASAR-addon, or Esar-Haddon, the ſon of Sennacherib, ſucceeded his father about 712 years before the Chriſtian æra, and united the kingdoms of Nineveh and Babylon. He rendered himſelf maſter of Syria; ſent a colony to Samaria; and his generals took king Maneſſes, and carried him loaded with chains to Babylon. Aſar-Addon died after a reign of 12 years.

ASARINA. See Chelone.

ASAROTA, ασαρωτα, from α and σαιρω, *I ſweep*, a kind of painted pavements in uſe before the invention of moſaic work. The moſt celebrated was that at Pergamus, painted by Seſus, and exhibiting the appearance of crumbs, as if the floor had not been ſwept after dinner, whence, according to Pliny, the denomination. Perrault ſuppoſes them to have been a black kind of pavements of a ſpongy matter.

ASARUM, asarabacca: A genus of the monogynia order, belonging to the dodecandria claſs of plants. The calyx is trifid or quadrifid, and reſts on the germen; there is no corolla; the capſule is leathery and crowned.—The ſpecies are three; the Europeum, the Canadenſe, and Virginicum. The firſt ſpecies grows naturally in ſome parts of England. It hath thick fleſhy jointed roots; the leaves grow ſingly upon ſhort foot-ſtalks, which ariſe immediately from the root: the flowers grow upon very ſhort foot-ſtalks cloſe to the ground, ſo are hid under the leaves. They have a bell-ſhaped impalement, of a worn-out purple colour, which is cut in three at the top, where it turns backward. It delights in a moiſt ſhady place, and may be propagated by parting the roots in autumn. The two other ſpecies have no remarkable properties.

Medicinal Uſes. The dried roots of this plant have been generally brought from the Levant; thoſe of our own growth being ſuppoſed weaker. Both the roots and leaves have a nauſeous, bitter, acrimonious, hot taſte; their ſmell is ſtrong, and not very diſagreeable. Given in ſubſtance from half a dram to a dram, they evacuate powerfully both upwards and downwards. It is ſaid, that tinctures made in ſpirituous menſtrua, poſſeſs both the emetic and cathartic virtues of the plant; that the extract obtained by inſpiſſating theſe tinctures, acts only by vomit, and with great mildneſs; that an infuſion in water proves cathartic, rarely emetic; that aqueous decoctions made by long boiling, and the watery extract, have no purgative or emetic quality, but prove notable diaphoretics, diuretics, and emmenagogues.

The principal uſe of this plant among us is as a ſternutatory. The root of aſarum is perhaps the ſtrongeſt of all the vegetable errhines, white hellebore itſelf not excepted. Snuffed up the noſe, in the quantity of a grain or two, it occaſions a large evacuation of mucus, and raiſes a plentiful ſpitting. The leaves are conſiderably milder, and may be uſed to the quantity of three, four, or five grains. Geoffroy relates, that after ſnuffing up a doſe of this errhine at night, he has frequently obſerved the diſcharge from the noſe to continue for three days together; and that he has known a paralyſis of the mouth and tongue cured by one doſe. He recommends this medicine in ſtubborn diſorders of the head proceeding from viſcid tenacious matter, in palſies, and in ſoporific diſtempers. The leaves are the principal ingredient in the *pulvis ſternutatorius* or *pulvis aſari compoſitus*, as it is now called, of the ſhops.

ASBAMEA, a fountain of Cappadocia, near Tyana, ſacred to Jupiter, and to an oath. Though this fountain bubbled up, as in a ſtate of boiling, yet its water was cold; and never ran over, but fell back again: (Philoſtratus, Ammian).

ASBESTOS, a ſort of native foſſile ſtone, which may be ſplit into threads and filaments, from one inch to ten inches in length, very fine, brittle, yet ſomewhat tractable, ſilky, and of a greyiſh colour, not unlike talc of Venice. It is almoſt inſipid to the taſte, indiſſoluble in water, and endued with the wonderful property of remaining unconſumed in the fire, which only whitens it. There are ſome ſorts of aſbeſtos whoſe filaments are rigid and brittle; others more flexible.

The induſtry of mankind has found a method of working this untoward mineral, and employing it in divers manufactures, chiefly cloth and paper. The manufacture is undoubtedly difficult enough. Pliny calls the aſbeſtos *inventu rarum, textu difficilimum.* Wormius aſſures us, that the method of making cloth of aſbeſtos is now entirely unknown. And indeed one would ſcarce imagine the thing practicable, without the mixture of ſome other pliant matter, as wool, hemp, or flax, along with the aſbeſtos, the filaments of this latter appearing too coarſe and brittle to make any tolerable fine work. However this be, Bapt. Porta aſſures us, that in his time the ſpinning of aſbeſtos was a thing known to every body at Venice. Sig. Caſtagnatta, ſuperintendant of ſome mines in Italy, is ſaid to have carried the manufacture to ſuch perfection, that his aſbeſtos was ſoft and tractable, much reſembling lamb-ſkin dreſſed white: he could thicken and thin it at pleaſure, and thus either make it into a very white ſkin or a very white paper.

This kind of linen cloth was chiefly eſteemed by the ancients; though then better known and more common than among us, being held equally precious with the richeſt pearls: nor is it now of mean value, even in the country where it is moſt generally made, a China cover (i. e. a piece of 23 inches and three-quarters long) being worth 80 tale, i. e. L. 36 : 13 : 4. Pliny ſays, he himſelf had ſeen napkins thereof, which, being taken foul from the table after a feaſt, were thrown into the fire, and by that means were better ſcoured than if they had been waſhed in water, &c. But its principal uſe, according to Pliny, was for the making of ſhrouds for royal funerals, to wrap up the corpſe, ſo that the aſhes might be preſerved diſtinct from thoſe of the wood, &c. whereof the funeral pile was compoſed: and the princes of Tartary, according to the accounts in the Philoſophical Tranſactions, ſtill uſe it at this day in burning their dead. Some of the ancients are ſaid to have made themſelves clothes of it, particularly the Brachmans among the Indians. The wicks for their perpetual lamps, according to Dr Liſter, were alſo made of it: ſome to this day uſe it for the wicks of ſuch lamps as they would not have any trouble with; becauſe the aſbeſtos never waſting, there is no occaſion for ſhifting the wick. Septalla, canon of Milan, had thread, rope, nets, and paper, made of the aſbeſtos. A handkerchief or pattern of this linen was long ſince preſented to the Royal Society, a foot long and half a foot broad. This gave two proofs of its reſiſting fire; though, in both experiments, it loſt above three drams in its weight. When taken out red-hot, it did not burn a piece of white paper on which it was laid. Mr. Villette pretends that his large burning concave uſually vitrifies the aſbeſtos.

The method of preparing the incombuſtible paper and cloth is thus deſcribed by Ciampini: The ſtone is laid to ſoak in warm water; then opened and divided by the hands, that the earthy matter may be waſhed out. The ablution being ſeveral times repeated, the flax-like filaments are collected and dried; and they are moſt conveniently ſpun with an addition of flax. Two or three filaments of the aſbeſtos are eaſily twiſted along with the flaxen thread, if the operator's fingers are kept oiled. The cloth alſo, when woven, is beſt preſerved by oil from breaking or waſting. On expoſure to the fire, the flax and the oil burn out, and the cloth remains pure and white. Probably from the diſſipation of ſome extraneous matter of this kind proceeded the diminution of weight in the handkerchief juſt recited; for pure aſbeſtos leaves nothing. The ſhorter filaments which ſeparate in waſhing the ſtone may be made into paper in the common manner.

The aſbeſtos is found in Crete and Cyprus; in Tartary; at Namur in the Low Countries; in Thuringia among the mines; in the Old Noricum; in Egypt; in the mountains of Arcadia; at Puteoli; in the iſland of Corſica; in the iſland of Angleſey in Wales; in Aberdeenſhire in Scotland: at Montauban in France; and in the kingdom of Siberia.

ASCALON, an ancient city, and one of the five ſatrapies or principalities of the Philiſtines; ſituated on the Mediterranean, 43 miles to the ſouth-weſt of Jeruſalem (Antonine), between Azotus to the north and Gaza to the ſouth. The birth-place of Herod the Great, thence ſurnamed *Aſcalonita* (Stephanus). Famous for its ſcallions, which take name from this town (Strabo, Pliny). Now *Scalona.* E. Long. 34. 30. Lat. 31. 30.

ASCANIUS, the ſon of Æneas and Creuſa, ſucceeded his father in the kingdom of the Latins, and defeated Mezentius king of the Tuſcans, who had refuſed to conclude a peace with him. At length he founded Alba Longa; and died about 1139 years before the Chriſtian æra, after a reign of 38 years.

ASCARIS, in zoology, a genus of inſects belonging to the order of vermes inteſtina. The body of the aſcaris is cylindrical, filiform, and tapers at both ends. The ſpecies are two, viz. 1. The vermicularis, with faint annular rugæ, and the mouth tranſverſe, is about a quarter of an inch long, and thicker at one end than the other. It is found in boggy places, in the roots of putrid plants, and very frequently in the rectum of children and horſes. It emaciates children greatly, and is ſometimes vomited up. 2. The lumbricoides is about the ſame length with the lumbricus terreſtris, or common earth-worm; but it wants the protuberant ring towards the middle of the body, the only mark by which they can properly be diſtinguiſhed. The body of the lumbricoides is cylindrical, and ſubulated at each extremity; but the tail is ſomewhat triangular. The lumbricoides is the worm which is moſt commonly found in the human inteſtines. It is viviparous, and produces vaſt numbers. For the method of expelling theſe two kinds of inſects, ſee MEDICINE-*Index.*

Plate LV.

ASCENDANT, in aſtrology, denotes the horoſcope, or the degree of the ecliptic which riſes upon the horizon at the time of the birth of any one. This is ſuppoſed to have an influence on the perſon's life and fortune, by giving him a bent and propenſity to one thing more than another.

In the celeſtial theme, this is alſo called the *firſt houſe*, the *angle of the Eaſt* or *Oriental angle*, and the *ſignificator of life.*—Such a planet ruled in his *aſcendant*: Jupiter was in his *aſcendant*, &c.—Hence the word is alſo uſed in a moral ſenſe, for a certain ſuperiority which one man has over another, from ſome unknown cauſe.

ASCENDANTS, in law, are oppoſed to deſcendants in ſucceſſion; i. e. when a father ſucceeded his ſon, or an uncle his nephew, &c. heritage is ſaid to aſcend, or go to aſcendants.

ASCENDING, in aſtronomy, is ſaid of ſuch ſtars as are riſing above the horizon in any parallel of the equator.

Ascending Latitude, is the latitude of a planet when going towards the north pole.

Ascending Node, is that point of a planet's orbit wherein it paſſes the ecliptic, to proceed northward. This is otherwiſe called the *northern node*, and repreſented by this character ☊.

Ascending Veſſels, in anatomy, thoſe which carry the blood upwards; as the aörta aſcendens. See Anatomy, n° 123.

ASCENSION, in aſtronomy, is either right or oblique. Right aſcenſion of the ſun, or a ſtar, is that degree of the equinoctial, counted from the beginning of aries, which riſes with the ſun or ſtar in a right ſphere. Oblique aſcenſion is an arch of the equator intercepted betwen the firſt point of aries and that point of the equator which riſes together with a ſtar in an oblique ſphere.

Ascension Day, a feſtival of the Chriſtian church, held ten days before Whitſuntide, in memory of our Saviour's aſcenſion into heaven after his reſurrection.

Ascension Iſland, a barren iſland on the coaſt of Africa, lying in W. Long. 17. 20. S. Lat. 7. 5. The following account is given of it by Mr Forſter. "This iſland was firſt diſcovered in 1501, by Joaõ de Nova Galego, a Portugueſe navigator, who named it *Ilha de Noſſa Senhora de Conceiçao*. The ſame admiral, on his return to Portugal in 1502, diſcovered the iſland of St Helena, which obtained that name from the day of the diſcovery. Aſcenſion was ſeen a ſecond time by Alfonſo d'Albuquerque on his voyage to India in 1503, and then received the name it now bears; but was already at that time in the ſame deſolate condition as at preſent. "We ſent ſeveral parties on ſhore, who paſſed the night on the watch for turtles, which came to lay their eggs on the ſandy ſhores. The drearineſs of this iſland ſurpaſſed all the horrors of Eaſter Iſland and Tierra del Fuego, even without the aſſiſtance of ſnow. It was a ruinous heap of rocks, many of which, as far as we could diſcern from the ſhip, ſeemed to be totally changed by the fire of a volcano. Nearly in the centre of the iſland riſes a broad white mountain of great height, on which we diſcerned ſome verdure by the help of our glaſſes, from whence it has obtained the name of *Green Mountain*.

"We landed early in the morning among ſome rocks, the ſurf being always immenſely high on the great beach; which conſiſts of minute ſhell-ſand, chiefly of a ſnowy white, very deep, dry, and intolerable to the eyes when the ſun ſhines. We aſcended among heaps of black cavernous ſtone, which perfectly reſembles the moſt common lavas of Veſuvius and Iceland, and of which the broken pieces looked as if they had been accumulated by art. The lava currents cooling very ſuddenly, may eaſily be imagined to produce ſuch an effect. Having aſcended about 12 or 15 yards perpendicular, we found ourſelves on a great level plain of ſix or eight miles in circuit; in the different corners of which we obſerved a large hill of an exact conical ſhape, and of reddiſh colour, ſtanding perfectly inſulated. Part of the plain between theſe conic hills was covered with great numbers of ſmaller hillocks, conſiſting of the ſame wild and ragged lava as that near the ſea, and ringing like glaſs when two pieces are knocked together. The ground between the heaps of lava was covered with a black earth, on which we walked very firmly; but when theſe heaps did not appear, the whole was a red earth, which was ſo looſe, and in ſuch dry minute particles, that the wind raiſed clouds of duſt upon it. The conic hills conſiſted of a very different ſort of lava, which was red, ſoft, and crumbling into earth. One of theſe hills ſtands directly in front of the bay, and has a wooden croſs on its ſummit, from whence the bay is ſaid to take its name. Its ſides are very ſteep, but a path near three quarters of a mile long winds round it to the ſummit. After examining this remarkable country a little longer, we concluded, with a great degree of probability on our ſide, That the plain on which we ſtood was once the crater or ſeat of a volcano, by the accumulation of whoſe cinders and pumice-ſtones the conic hills had been gradually formed: that the currents of lava which we now ſaw divided into many heaps, had perhaps been gradually buried in freſh cinders and aſhes; and the waters coming down from the interior mountain in the rainy ſeaſon had ſmoothened every thing in their way, and filled up by degrees the cavity of the crater. The rocky black lava was the reſidence of numberleſs men-of-war birds and boobies, which ſat on their eggs, and ſuffered us to come cloſe to them.

"About eight in the evening, it being then quite dark, a ſmall veſſel came into the bay, and anchored directly within us. Captain Cook having hailed her repeatedly, received in anſwer that ſhe was the Lucretia, a New-York ſloop, which had been at Sierra Leon, and was now come to catch turtles, in order to ſell them at the windward iſlands of the Weſt Indies. A lieutenant was ſent on board, who learned from the maſter, that he had taken our ſhip to be a French Indiaman, and was very deſirous of trading with Engliſh India-ſhips, in which he was diſappointed by the company's regulations. He dined with our officers the next day, but on the 31ſt at day-break left the iſland. On the 30th in the morning, we landed a ſecond time; and croſſing the plain, arrived at a prodigious lava-current, interſected by many channels from ſix to eight yards deep, which bore ſtrong marks of being worn by vaſt torrents of water, but were at preſent perfectly dry, the ſun being in the northern hemiſphere. In theſe gullies we found a ſmall quantity of ſoil conſiſting of a black volcanic earth, mixed with ſome whitiſh particles gritty to the touch. Here we ſaw ſome ſmall bunches of purſlane, and a ſpecies of graſs (*panicum ſanguineum*) which found ſufficient nutriment in the dry ſoil. Having at laſt, with great fatigue, climbed over this extenſive and tremendous current of lava, which was much more ſolid than the heaps nearer to the ſea, we came to the foot of the Green Mountain, which even from the ſhip's place in the bay we had plainly diſtinguiſhed to be a different nature from all the reſt of the country. Thoſe parts of the lava which ſurrounded it were covered with a prodigious quantity of purſlane, and a kind of new fern (*lonchites Adſcenſionis*), where ſeveral flocks of wild goats were feeding. The great mountain is divided in its extremities, by various clefts, into ſeveral bodies; but in the centre they all run together, and form one broad maſs of great height. The whole appears to conſiſt of a gritty tophaceous lime-ſtone, which has never been attacked by the volcano, but probably exiſted prior to its eruption; its ſides are covered with a kind of graſs, peculiar to the iſland, which Linnæus has named *ariſtida Adſcenſionis*. We likewiſe obſerved ſeveral flocks of goats feeding on it; but they were all exceſſively ſhy, and ran with ſurpriſing velocity along tremendous precipices, where it was impoſſible to follow them. The maſter of the New-York ſloop acquainted us, that there is a ſpring of water on one part of this mountain, which falls down a great precipice, and is afterwards abſorbed in the ſand. I am almoſt perſuaded, that with a little trouble, Aſcenſion might ſhortly be made fit for the reſidence of men. The introduction of furze (*ulex Europæus*), and of a few other plants which thrive beſt in a parched ſoil, and are not likely to be attacked by rats or goats, would ſoon have the ſame affect as at St Helena. The moiſture attracted from the atmoſphere by the high mountains in the centre of the iſland, would then no longer be evaporated by the violent action of the ſun, but collect into rivulets, and gradually ſupply the whole iſland. A ſod of graſſes would every where cover the ſurface of the ground, and annually increaſe the ſtratum of mould, till it could be planted with more uſeful vegetables.

"We returned gradually to Croſs Bay, in the heat of noon, over the plain; having a ſpace of more than five miles to traverſe, where the ſun burnt and bliſtered our faces and necks, and heated the ſoil to ſuch a degree, that our feet were likewiſe extremely ſore. About three o'clock we arrived at the water's ſide; and after bathing in a ſmall cove among a few rocks, we made the ſignal for a boat, and were taken on board. The next forenoon we made another ſmall excurſion, in company with Captain Cook, towards the Green Mountain; but we were all of us ſo much fatigued, that we could not reach it. We made no new obſervations in the courſe of this day, the nature of the iſland being dreary beyond deſcription in its outſkirts."

ASCENSIONAL DIFFERENCE, the difference between the right and oblique aſcenſion of the ſame point to the ſurface of the ſphere.

ASCENT, in a general ſenſe, implies the motion of a body upwards, or the continual receſs of a body from the earth. The Peripatetics attribute the ſpontaneous *aſcent* of bodies to a principle of levity inherent in them. The moderns deny any ſuch thing as ſpontaneous levity; and ſhew, that whatever *aſcends*, does it in virtue of ſome external impulſe or extruſion. Thus it is that ſmoke and other rare bodies *aſcend* in the atmoſphere; and oil, light woods, &c. in water; not by any external principle of levity, but by the ſuperior gravity or tendency downwards of the parts of the medium wherein they are. The *aſcent* of light bodies in heavy mediums is produced after the ſame manner as the *aſcent* of the lighter ſcale of a balance. It is not that ſuch ſcale has an internal principle whereby it immediately tends upwards; but it is impelled upwards by the preponderancy of the other ſcale; the exceſs of the weight of the one having the ſame effect, by augmenting its impetus downwards, as ſo much real levity in the other; by reaſon the tendencies mutually oppoſe each other, and that action and reaction are always equal.

Ascent of Bodies on Inclined Planes, the reader will find explained under MECHANICS; *Aſcent of Fluids*, under HYDROSTATICS; and *Aſcent of Vapours*, under the article EVAPORATION.

ASCESIS, properly denotes exerciſe of the body. It is formed from the verb ασκειν, uſed by the ancients in ſpeaking of the ſports and combats of the athletæ.

ASCESIS is alſo uſed by philoſophers, to denote an exerciſe, conducive to virtue, or to the acquiring a greater degree of virtue. This is particularly denominated the *philoſophical aſceſis*, becauſe practiſed chiefly by philoſophers, who make a more peculiar profeſſion of improving themſelves in virtue; on the model whereof, the ancient Chriſtians introduced a religious Aſceſis.

ASCETERIUM, in eccleſiaſtical writers, is frequently uſed for a monaſtery, or place ſet apart for the exerciſes of virtue and religion. The word is formed from *aſceſis*, "exerciſe;" or *aſcetra*, "one who performs exerciſe." Originally is ſignified a place where the athletæ or gladiators performed their exerciſes.

ASCETIC, an ancient appellation given to ſuch perſons as, in the primitive times, devoted themſelves more immediately to the exerciſes of piety and virtue, in a retired life; and particularly to prayer, abſtinence, and mortification. The word is derived from ασκεω, *exercio*, "I exerciſe." Afterwards, when the monks came in faſhion, this title was beſtowed upon them; eſpecially upon ſuch of them as lived in ſolitude.

ASCETIC is alſo a title of ſeveral books of ſpiritual exerciſes.—As, the *Aſciatics*, or devout exerciſes of St Baſil, archbiſhop of Cæſarea in Cappadocia.

We alſo ſay the *aſcetic* life, meaning the exerciſe of prayer, meditation, and mortification.

ASCHAFENBURG, a town of Germany, ſeated on the river Maine, in the circle of the Lower Rhine, and territory of the elector of Mentz, who has a palace there. It is memorable for being the place where the king of Great Britain took up his quarters the night before the battle of Dettingen. E. Long. 9. 35. N. Lat. 50. 14.

ASCHAM (Roger), was born at Kirby-Wiſke, near North-Allerton in Yorkſhire, in the year 1516. His father was ſteward to the noble family of Scroop. Our author Roger was educated in the family of Sir Anthony Wingfield, who, about the year 1530, ſent him to St John's College, Cambridge, where he was ſoon diſtinguiſhed for his application and abilities. He took his degree of Bachelor of Arts at the age of 18, was ſoon after elected fellow of his college, and in 1536 proceeded Maſter of Arts. In 1544, he was choſen univerſity orator; and, in 1548, was ſent for to court, to inſtruct the lady Elizabeth (afterwards queen) in the learned languages. In the year 1550, he attended Sir Richard Moryſine, as ſecretary, on his embaſſy to the emperor Charles V. at whoſe court he continued three years, and in the mean time was appointed Latin ſecretary to King Edward VI. But, upon the death of that prince, he loſt his preferment and all his hopes, being profeſſedly of the reformed religion; yet, contrary to his expectations, he was ſoon after, by the intereſt of his friend lord Paget, made Latin ſecretary to the king and queen. In June 1554, he married Mrs Margaret How, a lady of a good family, with whom he had a conſiderable fortune. It is very remarkable of Mr Aſcham, that, tho' he was known to be a Proteſtant, he continued in favour not only with the miniſtry of thoſe times, but with queen Mary herſelf. Upon the acceſſion of queen Elizabeth, he was not only confirmed in his poſt of Latin ſecretary, but was conſtantly employed as preceptor to her Majeſty in the Greek and Latin languages. He died in the year 1568, much regretted, eſpecially by the queen, who ſaid ſhe had rather have loſt L. 10,000. Camden and ſome other writers tell us, that he had a great propenſity to dice and cock-fighting. He certainly died poor.—He wrote,

1. Toxophilus. The ſchole or partitions of ſhooting, contayned in two bookes, written by Roger Aſcham, 1544, and now newly peruſed. Pleaſaunt for all gentlemen and yeomen of England, &c. Lond. 1571. Whilſt at the univerſity he was fond of archery by way of exerciſe and amuſement, for which he was cenſured; and on that account he ſat down to write this book, which was dedicated to Henry VIII. who ſettled a penſion of L. 10 per annum, on the author. It is rather whimſical; but is admirably well written, and full of learning. 2. A report and diſcourſe, written by Roger Aſcham, of the affairs and ſtate of Germany, and the emperor Charles his court, &c. 4to. A valuable curioſity. 3. The ſchoolmaſter. Firſt printed in 1573, 4to. Mr Upton publiſhed an edition with notes in 1711. It has uncommon merit; abounding in great good ſenſe, as well as knowledge of ancient and modern hiſtory: it is alſo expreſſive of the great humanity of the author, who was for making the paths of knowledge as level and pleaſant as poſſible, and for trying every gentle method of enlarging the mind and winning the heart. 4. Latin epiſtles. Firſt publiſhed by Mr Grant in 1576; have ſince paſſed many editions: the beſt is that of Oxford in 1703. Much admired on account of the ſtyle, and eſteemed almoſt the only claſſical work of that kind written by an Engliſhman. 5. Apologia contra miſſam. 1577, 8vo.

ASCIBURGIUM (anc. geog.), mentioned by Tacitus, ſuppoſed to be one of the 50 citadels built on the Rhine; who adds, ſome imagined it was built by Ulyſſes. Here was a Roman camp and a garriſon. To its ſituation on the banks of the Rhine anſwers a ſmall hamlet, now called *Aſburg*, not far from Meurs, in the duchy of Cleves.

ASCIDIA, a genus of animals belonging to the order of vermes Molluſca. The body is cylindrical, and fixed to a ſhell, rock, &c. It has two appertures; one on the ſummit, the other lower, forming a ſheath. There are ſix ſpecies of this animal, viz. the papilloſum, gelatinoſum, inteſtinalis, quadridentata, ruſtica, and echinata; only one of which, viz. the ruſtica*, is found in the Britiſh ſeas. Animals of this genus have the faculty of ſquirting out the water they take in. The expanſion and contraction of their bodies occaſion their aſſuming various forms.

*Pl. LVI.

ASCII, among geographers, an appellation given to thoſe inhabitants of the earth who, at certain ſeaſons of the year, have no ſhadow; ſuch are all the inhabitants of the torrid zone, when the ſun is vertical to them.

ASCITÆ (from ασκος, a *bag* or *bottle*), in antiquity, a ſect or branch of Montaniſts, who appeared in the ſecond century, they were ſo called, becauſe they introduced a kind of Bacchanals into their aſſemblies, who danced round a bag or ſkin blowed up; ſaying, they were thoſe new bottles filled with new wine whereof our Saviour makes mention, Matth. ix. 17.—They are ſometimes alſo called *Aſcodrogitæ*.

ASCITES, in medicine, the dropſy of the abdomen. See MEDICINE-*Index*.

ASCLEPIA, a feſtival of Æſculapius the god of phyſic, obſerved particularly at Epidaurus, where it was attended with a conteſt between the poets and muſicians, whence it was likewiſe called Ιερος Αγων, *the ſacred contention.*

ASCLEPIAD, in ancient poetry, a verſe compoſed of four feet, the firſt of which is a ſpondee, the ſecond a choriambus, and the two laſt dactyls; or of four feet and a cæſura, the firſt a ſpondee, the ſecond a dactyl, after which comes the cæſura, then the two dactyls; as, *Mæcenas atavis edite regibus*

ASCLEPIADES, one of the moſt celebrated phyſicians among the ancients, was a native of Pruſa, in Bithynia; and practiſed phyſic at Rome, under Pompey, 96 years before the Chriſtian æra. He was the head of a new ſect; and, by making uſe of wine and cold water in the cure of the ſick, acquired a very great reputation. He wrote ſeveral books, which are frequently mentioned by Galen, Celſus, and Pliny; but they are now loſt.

ASCLEPIADES, a famous phyſician under Hadrian, of the ſame city with the former. He wrote ſeveral books concerning the compoſition of medicines, both internal and external.

ASCLEPIAS, SWALLOW-WORT; A genus of the digynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 30th order, *Contortæ*. The generic character is taken from five oval, concave, horn-like nectaria which are found in the flower. The

Species are 19; of which the following are the moſt remarkable. 1. The alba, or common ſwallow-wort, has a root compoſed of many ſtrong fibres connected at top like thoſe of aſparagus, from whence ariſe many ſtalks, in number proportional to the ſize of the roots, which grow two feet high, and are very ſlender at the top: the leaves are placed oppoſite by pairs; the flowers are white, growing in umbels near the top of the ſtalk, from whence are ſent out ſmaller umbels. After the flower is paſt, the two germens become long pointed pods, incloſing many compreſſed ſeeds lying imbricatim, which are crowned with a ſoft white down. It flowers in June, and the ſeeds ripen in September. It is a native of the ſouth of France, Spain, and Italy. 2. The Syriaca, or greater Syrian dogſbane, is a perennial plant, which ſends up ſeveral upright ſtalks in the ſpring, about two feet high, garniſhed with oval leaves growing oppoſite; at the top of the ſtalks the umbels of flowers are produced, which are of a bright purple colour, making a pretty appearance, but are not ſucceeded by pods in England. 3. The curraſſavica, or baſtard ipecacuanha, is a native of the warm parts of America. It riſes to the height of five or ſix feet, with upright ſtems, and ſmooth oblong leaves placed oppoſite. Toward the top of the branches the umbels of flowers come out, which ſtand erect: the petals of the flowers are of a ſcarlet colour, and the horny nectariums in the middle are of a bright ſaffron colour, which make a pretty appearance; and there is a ſucceſſion of flowers on the ſame plant from June to October. The flowers are ſucceeded by long taper pods, filled with ſeeds crowned with ſoft down, which ripen late in autumn. The firſt two ſpecies are hardy; but the laſt one is tender, and therefore muſt be preſerved in a ſtove.

Medicinal Uſes, &c. The root of the firſt ſpecies is uſed in medicine. It is reckoned by botaniſts a ſpecies of dogſbane; from all the poiſonous ſorts of which it may be diſtinguiſhed, by yielding a limpid juice, whilſt that of the others is milky. The root has a ſtrong ſmell, eſpecially when freſh, approaching to that of Valerian, or nard; the taſte is at firſt ſweetiſh and aromatic, but ſoon becomes bitteriſh, ſubacrid, and nauſeous. This root is eſteemed ſudorific, diuretic, and emmenagogue: it is alſo frequently employed by the French and German phyſicians as an alexipharmic, and ſometimes as a ſuccedaneum to contrayerva, whence it has received the name of *contrayerva Germanorum.* Among us it is very rarely made uſe of: it appears from its ſenſible qualities to be a medicine of much the ſame kind with valerian, which is indiſputably preferable to it. The root of the third ſpecies has been ſometimes ſent over from America inſtead of that of ipecacuanha, and miſchievous effects have been produced by it. Thoſe who cultivate this plant ought to be careful that none of its milky juice mix with any thing which is taken inwardly.

ASCODUTÆ, in antiquity, a ſect of heretics, in the ſecond century, who rejected the uſe of ſymbols and ſacraments, on this principle, That incorporeal things cannot be communicated by things corporeal, nor divine myſteries by any thing viſible.

ASCOLI, formerly *Aſculum Apulum*, a pretty large and populous town of Italy, in the marche of Ancona, and territory of the church; it is a biſhop's ſee, and ſeated on a mountain, at the bottom of which runs the river Fronto. E Lon. 15. 20. N. Lat. 42. 47.

Ascoli de Satriano, formerly *Aſculum Picenum*, an epiſcopal city of Italy, in the kingdom of Naples; ſeated on a mountain. E. Long. 15. 5. N. Lat. 42. 8.

ASCOLIA, in Grecian antiquity, a feſtival celebrated by the Athenian huſbandmen in honour of Bacchus, to whom they ſacrifice a he-goat, becauſe it deſtroys the vines (*Ovid Faſt.* i. 357); and, to ſhew the greater indignity to an animal hated by Bacchus, the peaſants, after having killed him, made a foot-ball of his ſkin. Virgil has beautifully deſcribed the occaſion of the ſacrifice, and manner of celebrating the feſtival, *Georg.* ii. 380.

ASCRIPTITII, or Adscriptitii, were a kind of villains, who, coming from abroad, ſettle in the lands of ſome new lord, whoſe ſubjects or ſervants they commence; being ſo annexed to the lands, that they may be transferred and ſold with the ſame. Aſcriptitii is ſometimes alſo uſed in ſpeaking of aliens or foreigners newly admitted to the freedom of a city or country.

Ascriptitii was alſo uſed in the military laws for the recruits appointed to ſupply the loſſes of the legions, called alſo *Accenſi.*

ASCRIVIUM (anc. geog.), a town of Dalmatia, on the Sinus Rhizicus (Pliny, Ptolemy): Now *Cattaro* (Harduin); the capital of the territory of Cattaro, in Venetian Dalmatia. E. Long. 19. 20. Lat. 45. 25.

ASCULUM apulum (anc. geog.) a town of Apulia, much mentioned in the war with Pyrrhus (Florus, Plutarch): Now called *Aſcoli;* a city of the Capitanata, in the kingdom of Naples. E. Long. 16. 30. Lat. 41. 15.

Asculum Picenum (anc. geog.), a town of the Piceni (Cæſar); and the capital (Florus): Now *Aſcoli*, in the marche of Ancona, on the river Tronto. E. Long. 15. 5. Lat. 42 50.

ASCYRUM, peter's-wort: A genus of the polyandria order, belonging to the polydelphia claſs of plants; and in the natural method ranking under the 20th order, *Rotaceæ.* The calyx conſiſts of four leaves; the corolla has four petals; the filaments are numerous, and divided into four bundles. There are three ſpecies, the crux andreæ, the hypericoides, and the villoſum, all natives of the Weſt Indies or America, but poſſeſſing no property worthy of notice.

ASDRUBAL, the name of ſeveral Carthaginian generals. See Carthage.

ASEKI, or Asekai, the name which the Turks give to the favourite ſultaneſſes who have brought forth ſons. Theſe are greatly diſtinguiſhed above others in their apartments, attendants, penſions, and honours. They have ſometimes ſhared the government. The ſultana who firſt preſents the emperor with a male child, is reckoned the chief favourite, is called *buyuk aſeki*, and ranks as a legitimate wife: though, from the time of Bajazet I. the ſultans are forbid to marry by a public law, which Solyman II. violated in favour of Roxalana.

ASELLUS, in zoology, the trivial name of a ſpecies of oniſcus. See Oniscus.

ASGILL, (John), a late humorous writer, was bred to the law, and practiſed in Ireland with great ſucceſs. He was there elected a member of the houſe of commons, but was expelled for writing a treatiſe on the poſſibility of avoiding death; and being afterwards choſen a member for the borough of Bramber in Suſſex, he was alſo on the ſame account expelled the parliament of England. After this he continued 30 years a priſoner in the Mint, Fleet, and King's-bench; during which time he publiſhed a multitude of ſmall political pamphlets, ſeveral of which were in defence of the ſucceſſion of the houſe of Hanover, and againſt the Pretender. He died in the rules of the King's-bench, in the year 1738, when he was upwards of fourſcore.

ASH, in botany. See Fraxinus.

Ash-Hole, among chemiſts, is the loweſt part of a furnace; and is intended to receive the aſhes falling from the fire, and to give a paſſage to the air which is to be introduced into the furnace, to keep up the combuſtion.

Ash-Wedneſday, the firſt day of Lent; ſuppoſed to have been ſo called from a cuſtom in the church, of ſprinkling aſhes that day on the heads of penitents then admitted to penance. See Lent.

ASHBORN, a town in Derbyſhire, ſeated between the rivers Dove and Compton, over which there is a ſtone bridge, in a rich ſoil. It is a pretty large town, though not ſo flouriſhing as formerly. W. Long. 1. 35. N. Lat. 53. 0.

ASHBURTON, a town in Devonſhire. It ſends two members to parliament, and is one of the four ſtannery towns. It is ſeated among the hills, which are remarkable for tin and copper; and has a very handſome church; as alſo a chapel, which is turned into a ſchool. It gives title of Baron to Dunning the late ſolicitor-general, whoſe ſon now enjoys it. W. Long. 3. 10. N. Lat. 50. 30.

ASHBY DE LA ZOUCH a market-own in Leiceſterſhire, ſituated in W. Long. 1. 20. N. Lat. 52. 40. It had a caſtle, which was long in the poſſeſſion of the family of de la Zouch. It afterwards fell into the hands of Edward IV. who granted it to Sir Edward Haſtings, created baron Haſtings, with licence to make a caſtle of the manorhouſe, to which he adjoined a very high tower. It was demoliſhed in 1648; but a great part of the tower is ſtill ſtanding. It now belongs to the Earl of Huntingdon.

ASHDOD, or AZOTUS. See AZOTUS.

ASHES, the earthy particles of combuſtible ſubſtances after they have been burnt.

If the aſhes are produced from vegetable bodies, they contain a conſiderable quantity of fixed ſalt, blended with the terrene particles: and from theſe aſhes the fixed alkaline ſalts called *pot-aſh*, *pearl-aſh*, &c. are extracted. See POTASH, &c.

The aſhes of all vegetables are vitrefiable, and found to contain iron. They are alſo excellent manure for cold and wet grounds. See AGRICULTURE, n° 20.

Several religious ceremonies depend upon the uſe of aſhes. St Jerome relates, that the Jews in his time rolled themſelves in aſhes, as a ſign of mourning. To repent in ſackcloth and aſhes, is a frequent expreſſion in Scripture for mourning and being afflicted for our ſins. There was a ſort of lye and luſtral water made with the aſhes of an heifer ſacrificed upon the great day of expiation; the aſhes whereof were diſtributed to the people, and this water was uſed in purifications as often as any touched a dead body, or was preſent at funerals, (Numb. xix. 17.) Tamar after the injury received from her brother Amnon, covered her head with aſhes, (2 Sam. xiii. 19.) The Pſalmiſt in great ſorrow ſays, that he had eaten aſhes as if it were bread, (Pſ. cii. 9.); which, however is to be conſidered as an hyperbole. He ſat on aſhes, he threw aſhes on his head; his food, his bread, was ſpoiled with the aſhes wherewith he was covered.

The ancient Perſians had a ſort of puniſhment for ſome great criminals, which conſiſted in executing them in aſhes. The criminal was thrown headlong from a tower 50 cubits high, which was filled with aſhes to a particular height, (2 Mac. xiii. 5, 6.) The motion which the criminal uſed to diſengage himſelf from this place, plunged him ſtill deeper into it, and this agitation was farther increaſed by a wheel which ſtirred the aſhes continually about him till at laſt he was ſtifled.

ASHFORD, a market-town of Kent, ſituated about 12 miles ſouth-weſt of Canterbury, in E. Long. 45. and N. Lat. 51. 15.

ASHLAR, a term uſed among builders, by which they mean common or free ſtones, as they come out of the quarry, of different lengths and thickneſſes.

ASHLERING, among builders, ſignifies quartering, to lath to, in garrets, about two and a half, or three feet high, perpendicular to the floor, up to the under ſide of the rafters.

ASHMOLE (Elias), a great antiquary and herald, founder of the Aſhmolean muſæum at Oxford, was born at Litchfield in Staffordſhire, 1617. In the early part of his life, he practiſed in the law; and in the civil war had a captain's commiſſion under the king, and was alſo comptroller of the ordnance. He married the lady Mainwaring in 1649, and ſettled at London; where his houſe was frequented by all the learned and ingenious men of the time. Mr Aſhmole was a diligent and curious collector of manuſcripts. In the year 1650, he publiſhed a treatiſe written by Dr Arthur Dee, relating to the philoſopher's ſtone; together with another tract on the ſame ſubject, by an unknown author. About the ſame time he was buſied in preparing for the preſs a complete collection of the works of ſuch Engliſh chemiſts as had till then remained in manuſcript. This undertaking coſt him great labour and expence; and at length the work appeared, towards the cloſe of the year 1652. He propoſed at firſt to have carried it on to ſeveral volumes; but he afterwards dropped this deſign, and ſeemed to take a different turn in his ſtudies. He now applied himſelf to the ſtudy of antiquity and records: he was at great pains to trace the Roman road, which in Antoninus's Itinerary is called *Bennevanna*, from Weedon to Litchfield, of which he gave Mr Dugdale an account in a letter. In 1658, he began to collect materials for his hiſtory of the order of the garter, which he lived to finiſh, and thereby did no leſs honour to the order than to himſelf. In September following, he made a journey to Oxford, where he ſet about giving a full and particular deſcription of the coins preſented to the public library by Archbiſhop Laud.

Upon the reſtoration of King Charles II. Mr Aſhmole was introduced to his majeſty, who received him very graciouſly; and on the 18th of June 1660, beſtowed on him the place of Windſor herald A few days after, he appointed him to give a deſcription of his medals, which were accordingly delivered into his poſſeſſion, and King Henry VIII's cloſet was aſſigned for his uſe. On the 15th of February Mr Aſhmole was admitted a fellow of the royal ſociety: and, on the 9th of February following, the king appointed him ſecretary of Surinam, in the Weſt Indies. On the 19th of July 1699, the univerſity of Oxford, in conſideration of the many favours they had received from Mr Aſhmole, created him Dr of phyſic by diploma, which was preſented to him by Dr Yates, principal of Brazen Noſe college. On the 8th of May 1672, he preſented his "Inſtitution, laws, and ceremonies of the moſt noble order of the garter," to the king; who received it very graciouſly, and, as a mark of his approbation, granted him a privy ſeal for L.400 out of the cuſtom of paper. On the 26th of January 1679, a fire broke out in the Middle Temple, in the next chamber to Mr. Aſhmole's, by which he loſt a noble library, with a collection of 9000 coins, ancient and modern, and a vaſt repoſitory of ſeals, charters, and other antiquities and curioſities;

but his manuſcripts and his moſt valuable gold medals were luckily at his houſe at Lambeth. In 1683, the univerſity of Oxford having finiſhed a magnificent repoſitory near the theatre, Mr Aſhmole ſent thither his curious collection of rarities; which benefaction was conſiderably augmented by the addition of his manuſcripts and library at his death, which happened at Lambeth, the 18th of May, in the 76th year of his age. He was interred in the church of Great-Lambeth, in Surry, on the 26th of May 1692, and a black marble ſtone laid over his grave, with a Latin inſcription.

Beſides the works which we have mentioned, Mr Aſhmole left ſeveral which were publiſhed ſince his death, and ſome which remain ſtill in manuſcript.

ASIA, is one of the three general parts of our continent, and one of the four of the whole earth. It is ſeparated from Europe by the Mediterranean ſea, the Archipelago, the Black Sea, the Palus Meotis, the Don, and the Dwina, which fall into the White Sea; and from Africa, by the Arabic Gulph or Red Sea, and the Iſtmus of Suez. All the other parts are ſurrounded by the ocean. The late diſcoveries ſhow that it does not join to America, though it extends very near it: (See AMERICA, n° 105.). It is ſituated between 44 and 196 degrees of eaſt longitude, and 1 and 74 degrees of north latitude. From the Dardanelles to the moſt eaſtern ſhore of Tartary, it is 4740 miles in length; and from the moſt ſouthern point of Malacca to the moſt northern point of Nova Zembla, it is 4380 miles in breadth.

This vaſt extent of territory was ſucceſſively governed in paſt times by the Aſſyrians, the Medes, the Perſians, and the Greeks; but the immenſe regions of India and China were little known to Alexander, or the conquerors of the ancient world. Upon the decline of thoſe empires, great part of Aſia ſubmitted to the Roman arms; and afterwards, in the middle ages the ſucceſſors of Mahomet, or, as they are uſually called, Saracens, founded in Aſia, in Africa, and in Europe, a more extenſive empire than that of Cyrus, Alexander, or even the Roman when in its height of power. The Saracen greatneſs ended with the death of Tamerlane; and the Turks, conquerors on every ſide, took poſſeſſion of the middle regions of Aſia, which they ſtill enjoy. Beſides the countries poſſeſſed by the Turks and Ruſſians, Aſia contains at preſent three large empires, the Chineſe, the Mogul, and the Perſian; upon which the leſſer kingdoms and ſovereignties of Aſia generally depend. The prevailing form of government in this diviſion of the globe is abſolute monarchy. If any of them can be ſaid to enjoy ſome ſhare of liberty, it is the wandering tribes, as the Tartars and Arabs. Many of the Aſiatic nations, when the Dutch firſt came among them, could not conceive how it was poſſible for any people to live under any other form of government than that of a deſpotic monarchy. Turkey, Arabia, Perſia, part of Tartary, and part of India, profeſs Mahometaniſm. The Perſian and Indian Mahometans are of the ſect of Hali, and the others of that of Omar; but both own Mahomet for their law-giver, and the Koran for their rule of faith and life. In the other parts of Tartary, India, China, Japan, and the Aſiatic Iſlands, they are generally heathens and idolaters. Jews are to be found every where in Aſia. Chriſtianity, though planted here with wonderful rapidity by the apoſtles and primitive fathers, ſuffered an almoſt total eclipſe by the conqueſts of the Saracens, and afterwards of the Turks. Incredible indeed have been the hazards, perils, and ſufferings of popiſh miſſionaries, to propagate their doctrines in the moſt diſtant regions and among the groſſeſt idolaters; but their labours have hitherto failed of ſucceſs, owing in a great meaſure to their own avarice, and the avarice and profligacy of the Europeans, who reſort thither in ſearch of wealth and dominion.

Aſia may be divided into the following parts: Turkey in Aſia, Arabia, Perſia, the Mogul's Empire, with the two peninſulas of the Indies; Tibet, China, and Corea; Great and Little Buckaria, with Koraſin; Tartary, Siberia, and the iſlands. The principal languages ſpoken in Aſia are, the modern Greek, the Turkiſh, the Ruſſian, the Tartarian, the Perſian, the Arabic, the Malayan, the Chineſe, and the Japaneſe. The European languages are alſo ſpoken upon the coaſts of India and China.

Aſia is looked upon as that part of the world which, of all others, has been moſt peculiarly diſtinguiſhed by heaven. There it was the firſt man was created; there the patriarchs lived, the law was given to Moſes, and the greateſt and moſt celebrated monarchies were formed; from thence the firſt founders of cities and nations in other quarters of the world brought their colonies. Laſtly, in Aſia, Jeſus Chriſt appeared: there it was that he wrought the ſalvation of mankind, that he died and roſe again; and from thence it is that the light of the goſpel was diffuſed over all the world. Laws, arts, ſciences, and religion, almoſt all had their original in Aſia.

As Aſia exceeds the other two parts of our continent, Europe and Africa, ſo it is ſuperior to them in the ſerenity of its air, the fertility of its ſoil, the deliciouſneſs of its fruits, the fragrancy and balſamic qualities of its plants, ſpices, and gums; the ſalubrity of its drugs; the quantity, variety, beauty, and value of gems; the richneſs of its metals, and the fineneſs of its ſilks and cottons. A great change indeed hath happened in that part of it called Turkey, which hath loſt much of its ancient ſplendor, and from the moſt populous and beſt cultivated ſpot in Aſia, is become a wild and uncultivated deſart. The other parts of Aſia continue much in their former condition; the ſoil being as remarkable for its fertility, as moſt of the inhabitants for their indolence, effeminacy, and luxury. This effeminacy is chiefly owing to the warmth of the climate, though in ſome meaſure heightened by cuſtom and education; and the ſymptoms of it are more or leſs viſible as the ſeveral nations are ſeated nearer or farther from the north. Hence the Tartars, who live near the ſame latitudes with us, are as brave, hardy, ſtrong, and vigorous, as any European nation. What is wanting in the robuſt frame of their bodies among the Chineſe, Mogul-Indians, and all the inhabitants of the more ſouthern regions, is in a great meaſure made up to them by the vivacity of their minds, and ingenuity in various kinds of workmanſhip, which our moſt ſkilful mechanics have in vain endeavoured to imitate.

The chief rivers of Aſia are, the Euphrates and Tigris, in Turkey; the Indus and Ganges, in India; the Kiang and Hoang-ho, in China: the Sir Amu and Wolga, in Weſtern Tartary; the Saghalia Ula or Amur, in Eaſtern Tartary; the Irtiſh, Oby, Jeniſea, and Lena, in Siberia. The lakes are, that prodigious one called the *Caſpian Sea*; and near that another very large one, but lately known to us, called *Aral*, or the lake of eagles. The Baykal is in Siberia, the Kokonor near Tibet, and the Tong Ping in China. The chief mountains are, the Taurus in Turkey and Perſia; the Imaus, between India and Tibet; and the Altay, in Tartary.

The Aſiatic iſlands are very numerous, inſomuch that ſome reckon 150,000; but of this there is no certainty. However, they may be divided into thoſe of the eaſt, weſt, ſouth, and ſouth-eaſt. Thoſe that lie on the eaſt of Aſia are, the iſlands of Jeſſo or Yedſo, and Japan, with ſeveral ſmall ones on the coaſt of Korea, the iſland of Formoſa, and the Phillippines. Thoſe on the weſt are, the iſland of Cyprus, in the Mediterranean; Scanderoon, off Natolia, and the iſle of Rhodes, off Phiſchio, on the ſame coaſt. Thoſe on the ſouth are, the iſles of the Maldives, in the Indian Sea; the iſle of Ceylon, off cape Komorin; with a great many ſmall ones in the gulph of Bengal. Thoſe on the ſouth-eaſt are, the iſles of Sandi, as Sumatra, the iſles of Java, Borneo, &c. the Moluccas, the iſles of Kumbava, Timor, &c.

Asia Minor, or *Leſſer Aſia*; the ſame with Natolia. See Natolia.

ASIARCHÆ, (termed by St Paul, *Chief of Aſia*, Acts xix. 31.) were the Pagan Pontiffs of Aſia, choſen to ſuperintend and have the care of the public games; which they did at their own expence: for which reaſon they were always the richeſt and moſt conſiderable men of the towns.

ASIDE, in the drama, ſomething ſaid by an actor, which ſome, or even all the other actors preſent, are ſuppoſed not to hear; a circumſtance juſtly condemned as being unnatural and improbable.

ASIITO, a town of Italy, in Perugia, and in the Pope's territories. E. Long. 23. 40. N. Lat. 43. 0.

ASILIUS, or Honey-fly, a genus of inſects belonging to the order of inſecta diptera. It has two wings; and a horny, ſtrait, two-valved beak. There are 17 ſpecies of this inſect. Many of them wound in a very painful manner, and are particularly troubleſome to cattle in low meadows; others of them are quite harmleſs. See Plate LVI.

ASINARA, an iſland of Italy, on the weſtern coaſt of Sardinia. E. Long. 8. 30. N. Lat. 41. 0.

ASINIUS (Pollio), conſul and Roman orator, diſtinguiſhed himſelf under Auguſtus by his exploits and his literary works. He is frequently mentioned with praiſes by Horace and Virgil, and is ſaid to have collected the firſt library at Rome. He died at Freſcati, at 80 years of age.

ASIONGABER, Esiongeber, or Eziongeber a town of Arabia Petræa, on the bay of Elath, a part of the Arabian Gulf; the dock or ſtation of the ſhips of Solomon and Jehoſaphat; an ancient town, mentioned alſo by Moſes. It was afterwards called *Berenice* (Joſephus).

ASISIA, or Assisia, a town of Liburnia (Ptolemy, Antonine), now in ruins, but exhibiting many monuments of antiquity. It is the Aſſeſia or Aſſeria of Pliny. This author, after having ſpecified the Liburnian cities that were obliged to attend the congreſs or diet of Scardona, adds to the catalogue the free Aſſerians, *immuneſque Aſſeriates*; and this people, who created their own magiſtrates, and were governed by their own municipal laws, were no doubt more rich and powerful than their neighbours.

The veſtiges of the walls of Aſſeria that ſtill remain, are a ſufficient proof of this; for their circumference is clearly diſtinguiſhable above ground, and meaſures 3600 Roman feet. The ſpace incloſed by them forms an oblong polygon, and they are built with common Dalmatian marble; but not taken from the hill on which they ſtand, for that furniſhes only ſoft ſtone. The walls are inveſted, both inſide and out, with this marble: ſome of the ſtones are ten feet long, and they are all of conſiderable dimenſions. The thickneſs of theſe fortifications is commonly about eight feet: but at the narroweſt extremity, which falls towards the foot of the hill, they are eleven feet thick; and, in ſome parts, their height ſtill above ground reaches to near 30 feet. An antiquary, or even a ſimple lover of the fine arts, or of erudition, the Abbe Fortis obſerves, cannot help wiſhing at Podgraje (the modern name of Aſſeria), that ſome powerful hand *quicquid ſub terra eſt in apricum proferit*: and ſuch a wiſh becomes ſtronger when he reflects, that ſince the deſtruction of that city no ſearch has ever been made under ground, with a view to diſcover any thing curious; and yet theſe walls without doubt incloſe a valuable depoſite of antiquities, thrown down in heaps, who knows by what cauſe; perhaps naturally, by an earthquake, or perhaps by a ſudden inundation of barbarians, which is ſtill worſe. The gate now demoliſhed, the conſiderable height of the walls to be ſeen in ſeveral places from without, ſome pieces of thick walls that ſtill appear levelled to the ground among the buſhes, are circumſtances which give ground to hope that many coſtly monuments might be recovered out of theſe ruins. The magnificence of the remaining wall, and the many pieces of well-cut ſtone and fine marble ſcattered over the contiguous fields, afford ſufficient proof that both good taſte and grandeur once flouriſhed in that country. In the midſt of the rubbiſh which covers the remains of Aſſeria, the pariſh church of the little village ſtands inſolated; it is built of broken pieces of ancient ruins, taken as they happened to be neareſt, mixed with mutilated inſcriptions, and fragments of noble cornices.

ASKELON. See Ascalon.

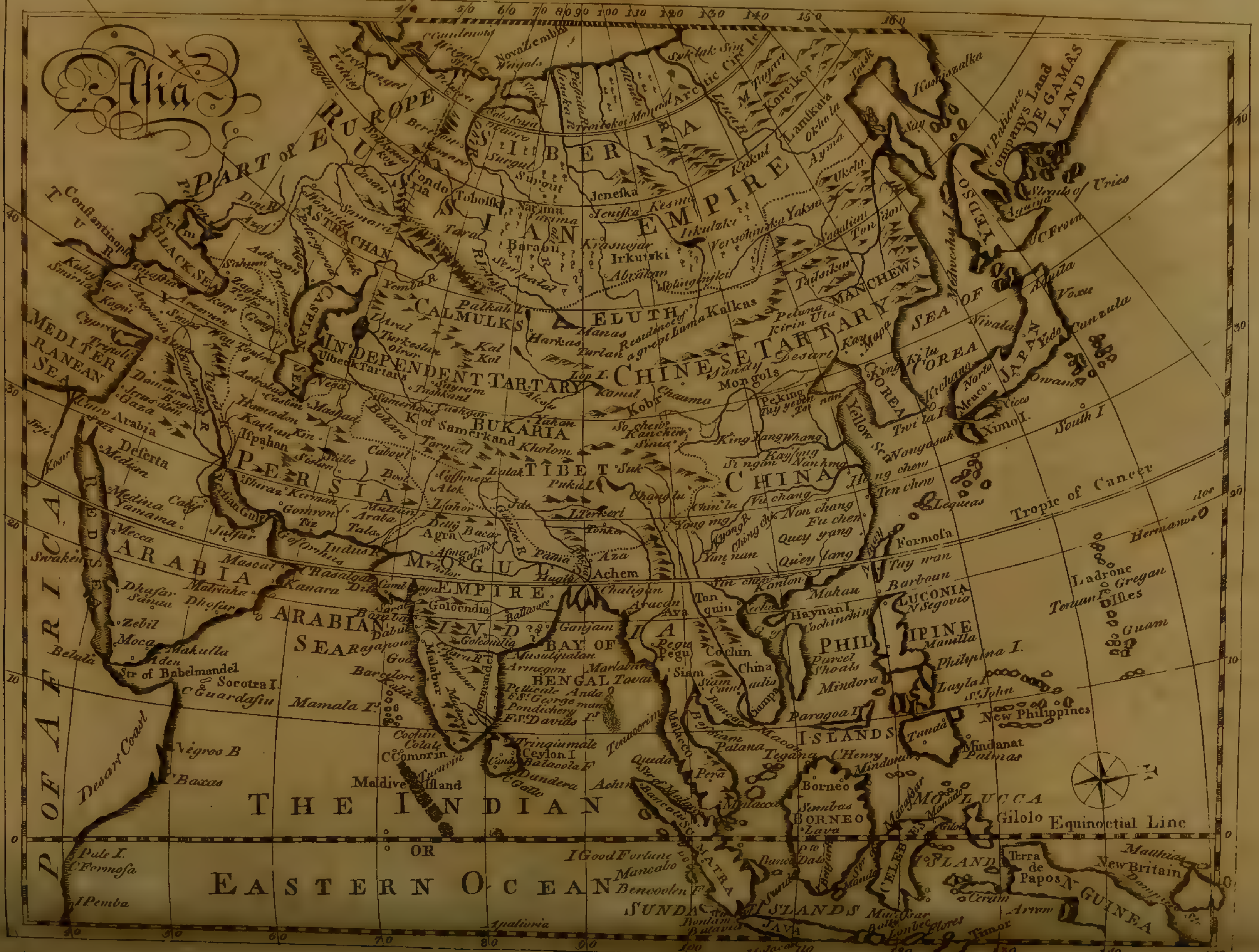
ASKERON, a place five miles from Doncaſter, noted for a medicinal ſpring. It is a ſtrong ſulphureous water, and is ſlightly impregnated with a purging ſalt. It is recommended internally and externally in ſtrumous and other ulcers, ſcabs, leproſy, and ſimilar complaints. It is good in chronic obſtuctions, and in caſes of worms and foulneſs of the bowels.

ASISIO, or Asitio, a city of the Pope's territories in Italy, ſituated about 16 miles eaſt of Perugia. E. Long. 13. 35. N. Lat. 43.

ASKRIG, a town in the N. Riding of Yorkſhire. W. Long. 0. 5. N. Lat. 53. 50.

ASLANI, in commerce, a ſilver coin, worth from 115 to 120 aſpers. See Asper.

Plate LIX.


Asia
PART of EUROPE
SIBERIA
RUSSIAN EMPIRE
ASTRACHAN
CASPIAN SEA
BLACK SEA
TURKEY
MEDITERRANEAN SEA
CALMUKS
INDEPENDENT TARTARY
ELUTH
CHINESE TARTARY
MANCHEWS
BUKARIA
TIBET
PERSIA
ARABIA
RED SEA
AFRICA
PART OF AFRICA
Desart Coast
MOGUL EMPIRE
INDIA
ARABIAN SEA
BAY OF BENGAL
CHINA
COREA
SEA OF JAPAN
JAPAN
YEDSO
Companys Land
DE GAMAS LAND
Yellow Sea
Tropic of Cancer
Formosa
PHILIPINE ISLANDS
Ladrone Isles
Guam
New Philippines
BORNEO
MOLUCCA
Gilolo
Equinoctial Line
SUMATRA
JAVA
SUNDA ISLANDS
CELEBES
Terra de Papos
N. GUINEA
New Britain
THE INDIAN OR EASTERN OCEAN
Maldive Island
Ceylon I.
Socotra I.
Str of Babelmandel
Persian Gulf
Tobolski
Irkutski
Peking
Canton
Achem
Ispahan
Samarkand
Mecca
Medina
Aden
Goa
Calicut
Siam
Pegu
Malacca
Nova Zembla
Arctic Circle
Kamtschatka
Constantinople
Lop L.
Aral
40
50
60
70
80
90
100
110
120
130
140
150
160
0
10
20
30

ASMONEUS, or Assamoneus, the father of Simon, and chief of the Aſmoneans, a family that reigned over the Jews during 126 years.

ASNA, or Esna, a town in Upper Egypt, ſeated upon the Nile, believed by ſome authors to be the ancient Syena, though others ſay the ruins of it are ſtill to be ſeen near Aſſuan. It is ſo near the cataracts of the Nile, that they may be heard from thence. It contains ſeveral monuments of antiquity; and among the reſt an ancient Egyptian temple, pretty entire, all painted throughout, except in ſome places that are effaced by time. The columns are full of hieroglyphic figures. This ſuperb ſtructure is now made uſe of for a ſtable, wherein they put oxen, camels, and goats. A little way from thence are the ruins of an ancient nunnery, ſaid to be built by St Helena, ſurrounded with tombs.—Aſna is the principal town in theſe parts, and the inhabitants are rich in corn and cattle. They drive a conſiderable trade into Lower Egypt and Nubia, by means of the Nile, and alſo by the caravans that paſs over the Deſart. The inhabitants are all Arabs, except about 200 Copts, the ancient inhabitants, and a ſort of Chriſtians. They are under the government of the Turks, who have a cadi, and the Arabs have two ſheriffs of their own nation. E. Long. 31. 40. N. Lat. 28. 15.

ASOLA, a town of the Breſſan in Italy, belonging to the republic of Venice. E. Long. 14. 18. N. Lat. 45. 15.

ASOLO, a town of Italy, in the Treviſan, ſeated on a mountain 17 miles north-weſt of Treviſan, and 10 north-eaſt of Baſſano. E. Long. 12. 2. N. Lat. 45. 49.

ASOPH, a town of Coban Tartary, in Aſia, ſeated on the river Don, near its mouth, a little to the eaſt of the Palus Mœotis, or Sea of Azoph. It has been ſeveral times taken and retaken of late years; but in 1739, the contending powers agreed that the fortifications ſhould be demoliſhed, and the town remain under the dominion of Ruſſia. E. Long. 41. 30. N. Lat. 47. 18.

ASOPUS, a river of Phrygia Major, which, together with the Lycus, waſhes Laodicea, (Pliny).—Another of Bœotia, which running from mount Cithæron, and watering the territory of Thebes, ſeparates it from the territory of Platæa, and falls with an eaſt courſe into the Euripus, at Tanagra. On this river Adraſtus king of Sicyon built a temple to Nemeſis, thence called *Adraſteia*. From this river Thebae came to be ſurnamed *Aſopides*, (Strabo). It is now called *Aſopo*.—A third Aſopus, a river of Peloponneſus, which runs by Sicyon, (Strabo); and with a north-weſt courſe falls into the Sinus Corinthiacus, to the weſt of Corinth.—A fourth, a ſmall river of the Locri Epicnemidii, on the borders of Theſſaly, (Pliny); riſing in Mount Oeta, and falling into the Sinus Maliacus.

Asopus, a town of Laconica, (Pauſanias); on the Sinus Laconicus, with a port in a peninſula, between Boæ to the eaſt, and the mouth of the Eurotas to the weſt. The citadel only remains ſtanding, now called by the ſailors *Caſtel Rampano*.

ASOR, or Hazor (anc. geog.), a town of the tribe of Judah, to the ſouth-weſt, on the borders of Aſcalon, (Joſhua); as alſo Haſor-Hadata, tranſlated by the ſeventy Ασωρη Καινη (id).—Another Aſor, Aſorus, or Hazor, a town of Galilee; called the capital of all the kingdoms to the north of Paleſtine. It was taken by Joſhua; the inhabitants were put to the ſword, and their houſes burnt. It was afterwards rebuilt (Judges, 1 Sam.); but remained ſtill in the hands of the Canaanites, though in the lot of the tribe of Naphthali, (Joſhua). It lay to the north of the Lacus Samachonites, called in Scripture the *Waters of Merom*, (Joſephus).

ASOW, a celebrated and important fortreſs of Ruſſia, once a place of conſiderable trade, but now demoliſhed. It was ſituated in the diſtrict of Bachmut, near the place where the Greeks many centuries ago built the city of Tanais, which was very famous for its trade, and underwent many viciſſitudes. The Genoeſe, who ſettled a trade with Ruſſia ſoon after the diſcovery of Archangel by Captain Chancellor, became maſters of this place, and gave it the name of *Tana*, or *Catana*: but the Tartars, who were very powerful in theſe parts, ſeem to have been in poſſeſſion of it long before; for, as Buſching informs us, there are Aſow coins yet extant, on which is the name of *Taktamyſs-Kan*. From the Genoeſe it fell into the hands of the Turks, loſt its trade, and became an inconſiderable town. In 1637, it was taken by the Coſſacks, who defended it againſt the Turks in 1641, and next year ſet fire to it, and blew it up. The Turks rebuilt it with ſtrong fortifications. The Ruſſians laid claim to it in 1672, and took it in 1696; but, by the treaty of Pruth in 1711, it was reſtored to the Turks. In 1736, the Ruſſians became maſters of Aſow; but by the treaty of Belgrade they were obliged to relinquiſh it, and entirely deſtroy the place.

ASP, in natural hiſtory, a ſmall poiſonous kind of ſerpent, whoſe bite gives a ſpeedy but eaſy death. It is ſaid to be thus denominated from the Greek ασπις, *ſhield*, in regard to the manner of its lying convolved in a circle, in the centre of which is the head, which it exerts, or raiſes, like the umbo or umbilicus of a buckler. This ſpecies of ſerpent is very frequently mentioned by authors; but ſo careleſsly deſcribed, that it is not eaſy to determine which, if any of the ſpecies known at preſent, may properly be called by this name. It is ſaid to be common in Africa, and about the banks of the Nile; and Bellonius mentions a ſmall ſpecies of ſerpent which he had met with in Italy, and which had a ſort of callous excreſcence on the forehead, which he takes to have been the aſpis of the ancients. It is with the aſp that Cleopatra is ſaid to have diſpatched herſelf, and prevented the deſigns of Auguſtus, who intended to have carried her captive to adorn his triumphal entry into Rome. But the fact is conteſted: Brown places it among his vulgar errors. The indications of that queen's having uſed the miniſtry of the aſp, were only two almoſt inſenſible pricks found in her arm; and Plutarch ſays it is unknown what ſhe died of. At the ſame time, it muſt be obſerved, that the ſlightneſs of the pricks found in her arm furniſhes no preſumption againſt the fact; for no more than the prick of a needle-point dipt in the poiſon was neceſſary for the purpoſe. See the article Serpent.

Lord Bacon makes the aſp the leaſt painful of all the inſtruments of death. He ſuppoſes it to have an affinity to opium, but to be leſs diſagreeable in it operation; and his opinion ſeems to correſpond with the

3 D 2 account,

accounts of moſt writers, as well as with the effects deſcribed to have been produced upon Cleopatra; for which ſee the article already referred to.

The ancients had a plaſter called δι' Ἀσπίδων, made of this terrible animal, of great efficacy as a diſcutient of ſtrumæ and other indurations, and uſed likewiſe againſt pains of the gout. The fleſh and ſkin, or exuviæ, of the creature, had alſo their ſhare in the ancient materia medica.

ASPA, a town of Parthia, (Ptolemy); now *Iſpahan*, (Holſtenius). In Ptolemy the latitude ſeems to agree, being 33°; but whether the longitude does, is a queſtion. E. Long. 51. Lat. 32. 30.

ASPALATHUS, AFRICAN BROOM: A genus of the decandria order, belonging to the diadelphia claſs of plants; and in the natural method raking under the 32d order, *Papilionaceæ*. The calyx conſiſts of 5 diviſions: the pod is oval, and contains 2 ſeeds. Of this genus there are 19 ſpecies; all of which are natives of warm climates, and muſt be preſerved in ſtoves by thoſe who would cultivate them here. The roſe-wood, whence the oleum rhodii is obtained, is one of the ſpecies, but of which we have yet had no particular deſcription. The wood is heavy, oleaginous, ſomewhat ſharp and bitter to the taſte, of a ſtrong ſmell and purple colour. It is called *roſe-wood* or *lignum Rhodium*, either on account of its ſweet ſmell, or of its growth in the iſland of Rhodes. It was anciently in much repute as an aſtringent, ſtrengthener, and drier; but it is now diſuſed in internal practice. It affords an oil of an admirable ſcent, reputed one of the beſt of perfumes: it is chiefly uſed in ſcenting pomatums and liniments.

ASPARAGUS, SPARAGUS, SPERAGE, or SPARROWGRASS: A genus of the monogynia order, belonging to the hexandria claſs of plants; and in the natural method ranking under the 11th order, *Sarmentaceæ*. The calyx is quinquepartite, and erect; the 3 inferior petals are bent outwards; the berry has 3 cells, and contains 2 ſeeds.—The ſpecies are 10; but the only one cultivated in the gardens is that with an upright herbaceous ſtalk, briſtly leaves, and equal ſtipula, or the common aſparagus. The other ſpecies are kept only in the gardens of the curious for the ſake of variety.

Culture. The garden aſparagus is with great care cultivated for the uſe of the table. The propagation of this uſeful plant is from ſeed; and as much of the ſucceſs depends upon the goodneſs of the ſeed, it is much better to ſave it than to buy it at the ſhops. The manner of ſaving it is this: Mark with a ſtick ſome of the faireſt buds; and when they are run to berry, and the ſtalks begin to dry and wither, cut them up; rub off the berries into a tub, and pouring water upon them, rub them about with your hands; the huſks will break and let out the ſeed, and will ſwim away with the water in pouring it off; ſo that in repeating this two or three times, the ſeeds will be clean waſhed, and found at the bottom of the tub. Theſe muſt be ſpread on a mat to dry, and in the beginning of February muſt be ſown on a bed of rich earth. They muſt not be ſown too thick, and muſt be trod into the ground, and the earth raked over them ſmooth: the bed is to be kept clear of weeds all the ſummer; and in October, when the ſtalks are withered and dry, a little rotten dung muſt be ſpread half an inch thick over the whole ſurface of the bed. The ſpring following, the plants will be fit to plant out for good; the ground muſt therefore be prepared for them by trenching it well, and burying a large quantity of rotten dung in the trenches, ſo that it may lie at leaſt ſix inches below the ſurface of the ground: when this is done, level the whole plot exactly, taking out all the looſe ſtones. This is to be done juſt at the time when the aſparagus is to be planted out; which muſt be in the beginning of March, if the ſoil is dry and the ſeaſon forward; but in a wet ſoil it is better to wait till the beginning of April, which is about the ſeaſon that the plants are beginning to ſhoot. The ſeaſon being now come, the roots muſt be carefully taken up with a narrow-pronged dunk-fork, ſhaking them out of the earth, ſeparating them from each other, and obſerving to lay all their heads even for the more convenient planting them; which muſt be done in this manner. Lines muſt be drawn, at a foot diſtance each, ſtraight acroſs the bed; theſe muſt be dug into ſmall trenches of ſix inches deep, into which the roots muſt be laid, placing them againſt the ſides of the trench with their buds in a right poſition upwards, and ſo that, when the earth is raked over them, they may be two inches under the ſurface of the ground. Between every four rows a ſpace of two feet and a half ſhould be left for walking in, to cut the aſparagus. When the aſparagus is thus planted, a crop of onions may be ſown on the ground, which will not at all hurt it. A month after this, the aſparagus will come up, when the crop of onions muſt be thinned, and the weeds carefully cleared away. About Auguſt the onions will be fit to pull up. In October following, cut off the ſhoots of the aſparagus within two inches of the ground, clear well all weeds away, and throw up the earth upon the beds, ſo as to leave them five inches above the level of the alleys. A row of colworts may be planted in the middle of the alleys, but nothing muſt be now ſown on the beds. In the ſpring the weeds muſt be hoed up, and all the ſummer the beds kept clear of weeds. In October they muſt be turned up, and earthed again, as the preceeding ſeaſon. The ſecond ſpring after planting, ſome of the young aſparagus may be cut for the table. The larger ſhoots ſhould only be taken, and theſe ſhould be cut at two inches under ground, and the beds every year managed as in the ſecond year. But as ſome people are very fond of early aſparagus, the following directions are given by which it may be obtained any time in winter: Plant ſome good roots at one year old in a moiſt rich ſoil, about eight inches apart; the ſecond and third years after planting, they will be ready to take up for the hot-beds; theſe ſhould be made pretty ſtrong, about three feet thick, with new ſtable-dung that has fermented a week or more; the beds muſt be covered with earth ſix inches thick; then againſt a ridge made at one end, begin to lay in your plants, without trimming or cutting the fibres, and between every row lay a little ridge of fine earth, and proceed thus till the bed is planted; then cover the bed two inches thick with earth, and encompaſs it with a ſtraw-band, and in a week, or as the bed is in the temper, put on the frames and glaſſes, and lay on three inches thick of freſh earth over the beds, and give them air and add freſh heat to them as it requires. Theſe beds may be made from November till March, which will laſt till the natural graſs comes on.

Medicinal Uſes. The roots have a bitteriſh mucilaginous taſte, inclining to ſweetneſs; the fruit has much the ſame kind of taſte; the young ſhoots are more agreeable than either. Aſparagus promotes appetite, but affords little nouriſhment. It gives a ſtrong ill ſmell to the urine in a little time after eating it, and for this reaſon chiefly is ſuppoſed to be diuretic: it is likewiſe eſteemed aperient and deobſtruent; the root is one of the five called *opening roots*. Some ſuppoſe the ſhoots to be moſt efficaceous; others, the root; and others the bark of the root. Stahl is of opinion that none of them have any great ſhare of the virtues uſually aſcribed to them. Aſparagus appears from experience to contribute very little either to the exciting of urine when ſuppreſſed, or increaſing its diſcharge; and in caſes where aperient medicines generally do ſervice, this has little or no effect.

ASPASIA *of* Miletus, a courtezan, who ſettled at Athens under the adminiſtration of Pericles, and one of the moſt noted ladies of antiquity. She was of admirable beauty; yet her wit and eloquence, ſtill more than her beauty, gained her extraordinary reputation among all ranks in the republic. In eloquence ſhe ſurpaſſed all her contemporaries, and her converſation was ſo entertaining and inſtructive, that notwithſtanding the diſhonourable commerce ſhe carried on in female virtue, perſons of the firſt diſtinction, male and female, reſorted to her houſe as to an academy: ſhe even numbered Socrates among her hearers and admirers. She captivated Pericles in ſuch a manner, that he diſmiſſed his own wife, in order to eſpouſe her; and, by her univerſal knowledge, irreſiſtible elocution, and intriguing genius, ſhe in a great meaſure influenced the adminiſtration of Athens. She was accuſed of having excited, from motives of perſonal reſentment, the war of Peloponneſus; yet, calamitous as that long and obſtinate conflict proved to Greece, and particularly to Athens, it may be ſuſpected that Aſpaſia occaſioned ſtill more incurable evils to both. Her example, and ſtill more her inſtructions, formed a ſchool at Athens, by which her dangerous profeſſion was reduced into a ſyſtem. The companions of Aſpaſia ſerved as models for painting and ſtatuary, and themes for poetry and panegric. Nor were they merely the objects, but the authors of many literary works, in which they eſtabliſhed rules for the behaviour of their lovers, particularly at table; and explained the art of gaining the heart and captivating the affections. The dreſs, behaviour, and artifices of this claſs of women, became continually more ſeductive and dangerous; and Athens thenceforth remained the chief ſchool of vice and pleaſure, as well as of literature and philoſophy.

Aspasia, among ancient phyſicians, a conſtrictive medicine for the *pudenda muliebria*. It conſiſted only of wool, moiſtened with an infuſion of unripe galls.

ASPATICUM, (from ασπαζομαι, "I ſalute," in eccleſiaſtical writers), a place, or apartment, adjoining to the ancient churches, wherein the biſhop and Preſbyters ſat, to receive the ſalutations of the perſons who came to viſit them, deſire their bleſſing, or conſult them on buſineſs.—This is alſo called *aſpaticum diaconicum, receptorium, metatorium,* or *meſatorium,* and *ſalutatorium*; in Engliſh, "greeting-houſe."

ASPECT, in aſtronomy, denotes the ſituation of the planets and ſtars with reſpect to each other.

There are five different aſpects. 1. Sextile aſpect is when the planets or ſtars are 60° diſtant, and marked thus ✱. 2. The quartile, or quadrate, when they are 90° diſtant, marked □. 3. Trine, when 120° diſtant, marked △. 4. Oppoſition, when 180° diſtant, marked ☍. And, 5. Conjunction, when both in the ſame degree, marked ☌.

Kepler, who added eight new ones, defines aſpect to be the angle formed by the rays of two ſtars meeting on the earth, whereby their good or bad influence is meaſured: for it is to be obſerved, that theſe aſpects being firſt introduced by aſtrologers, were diſtinguiſhed into benign, malignant, and indifferent; the quartile and oppoſition being accounted malign; the trine and ſextile, benign or friendly; and the conjunction indifferent.

ASPEN-tree, in botany. See Populus.

ASPER, in grammar, an accent peculiar to the Greek language, marked thus (ʽ); and importing, that the letters over which it is placed ought to be ſtrongly aſpirated, or pronounced as if an *h* were joined with them.

Asper, or *Aſpre,* in commerce, a Turkiſh coin, three of which make a Medine.

ASPERA arteria, in anatomy, the ſame with the windpipe or trachea. See Anatomy, n° 116.

ASPERIFOLIATE, or Asperifolious, among botaniſts, ſuch plants as are rough-leaved, having their leaves placed alternately on their ſtalks, and a monopetalous flower divided into five parts.—They conſtitute an order of plants in the *Fragmenta methodi naturalis* of Linnæus, in which are theſe genera, viz. tournefortia, cerinthe, ſymphytum, pulmonaria, anchuſa, lithoſpermum, myoſotis, heliotropium, cynogloſſum, aſperugo, lycopſis, echium, borrago: *magis minuſve oleraceæ, mucilaginoſæ, & glutinoſæ ſunt.* Lin. In the preſent ſyſtem, theſe are among the pentandria monogynia.

ASPERIFOLIÆ plantæ, rough-leaved plants. The name of a claſs in Hermanus, Boerhaave, and Ray's methods, conſiſting of plants which have four naked ſeeds, and whoſe leaves are rough to the touch.

In Tournefort's Syſtem, theſe plants conſtitute the third ſection or order of the ſecond claſs; and in Linnæus's Sexual Method, they make a part of the pentandria monogynia.

ASPERITY, the inequality of the ſurface of any body, which hinders the hand from paſſing over it freely.—From the teſtimony of ſome blind perſons, it has been ſuppoſed that every colour hath its particular degree of aſperity: though this has been denied by others. See the article Blind.

ASPEROSA, a town of Turkey, in Europe; it is a biſhop's ſee, ſituated on the coaſt of the Archipelago. E. Long. 25. 20. N. Lat. 40. 58.

ASPERUGA, small wild bugloss, in botany: A genus of the pentandria mongynia claſs; and in the natural method ranking under the 49th order, *Aſperifoliæ.* The calyx of the fruit is compreſſed, with folds flatly parallel, and ſinuous. There are two ſpecies, viz. the procumbens, or wild bugloſs, a native of

Britain; and the Egyptiaca, a native of Egypt. Horſes, goats, ſheep, and ſwine eat the firſt-ſpecies; cows are not fond of it.

ASPERULA, WOODROOF: A genus of the monogynia order, belonging to the hexandria claſs of plants; and in the natural method ranking under the 47th order, *Stellatæ*. The corolla is infundibuliform; and the capſule contains two globular ſeeds. There are two ſpecies, the cynanchica and the odorata. Both of them grow wild in Britain, ſo are ſeldom admitted into gardens. The firſt is found on chalky hills. The latter is a low umbelliferous plant, growing wild in woods and copſes, and flowering in May. It has an exceeding pleaſant ſmell, which is improved by moderate exſiccation; the taſte is ſubſaline, and ſomewhat auſtere. It imparts its flavour to vinous liquors. Aſperula is ſuppoſed to attenuate viſcid humours, and ſtrengthen the tone of the bowels; it is recommended in obſtructions of the liver and biliary ducts, and by ſome in epilepſies and palſies; modern practice has nevertheleſs rejected it. The ſmell of it is ſaid to drive away ticks and other inſects. The roots of the firſt are uſed in Sweden to dye red.

ASPHALTITES, ſo called from the great quantity of bitumen it produces; called alſo the *Dead Sea*, and from its ſituation, the *Eaſt Sea*; the *Salt Sea*, the *Sea of Sodom*, the *Sea of the Deſart*, and the *Sea of the Plain*, by the ſacred writings: A lake of Judea.

Many things have been ſaid and written of this famed, or, if they were indeed true, rather infamous lake; ſuch as that it aroſe from the ſubmerſion of the vale of Siddim, where once ſtood, as is commonly reported, the three cities which periſhed in the miraculous conflagration, with thoſe of Sodom and Gomorrah, for their unnatural and deteſtable wickedneſs: on which account this lake has been looked upon as a laſting monument of the juſt judgment of God, to deter mankind from ſuch abominations. Hence it is added, that the waters of the lake are ſo impregnated with ſalt, ſulphur, and other bituminous ſtuff, that nothing will ſink or live in it; and that it caſts ſuch ſtench and ſmoke, that the very birds die in attempting to fly over it. The deſcription likewiſe of the apples that grew about, fair without, and only aſhes and bitterneſs within, were looked upon as a farther monument of God's anger. So likewiſe the deſcription which many travellers give not only of the lake, but of all the country round about, of the whole appearing dreadful to behold, all ſulphureous, bituminous, ſtinking, and ſuffocating: and laſtly, what hath been farther affirmed of the ruins of the five cities being ſtill to be ſeen in clear weather, and having been actually ſeen in theſe latter times; all theſe ſurpriſing things, and ill-grounded notions, tho' commonly, and ſo long, received among Chriſtians, have been of late ſo much exploded, not only by the teſtimony of very credible witneſſes, but even by arguments drawn from Scripture, that we muſt give them up as inventions, unleſs we will ſuppoſe the face and nature of all theſe to have been entirely changed. Thoſe, in particular, of bodies not ſinking in the water, and of birds being ſtifled by the exhalations of it, appear now falſe in fact. It is true, the quantity of ſalt, alum and ſulphur, with which it is impregnated, render it ſo much ſpecifically heavier (Dr Pococke ſays one-fifth) than freſh water, that bodies will not ſo eaſily ſink: yet that author and others, aſſure us, they have ſwam and dived in it; and, as to the birds, we are told likewiſe, that they will fly over it without any harm. To reconcile theſe things with the experiments which Pliny* tells us had been made by Veſpaſian, is impoſſible, without ſuppoſing that thoſe ingredients have been ſince much exhauſted, which is not at all improbable; ſuch quantities of them, that is, of the bitumen and ſalt, having been all along, and being ſtill taken off, and ſuch ſtreams of freſh water continually pouring into it, as may reaſonably be ſuppoſed to have conſiderably diminiſhed its gravity and denſeneſs. For, with reſpect to its ſalt, we are told, the Arabs made quantities of it from that lake, in large pits about the ſhores, which they fill with that water, and leave to be chriſtalized by the ſun. This ſalt is in ſome caſes much commended by Galen, as very wholeſome, and a ſtrengthener of the ſtomach, &c. on account of its unpleaſant bitterneſs.

What likewiſe relates to the conſtant ſmoke aſcending from the lake, its changing the colour of its water three times a-day, ſo confidently affirmed by Joſephus† and other ancients, and confirmed by prince Radziville and other moderns, who pretend to have been eye-witneſſes of it, is all now in the ſame manner exploded by others of more modern date, and of at leaſt equal candour. The unhealthineſs of the air about the lake was affirmed by Joſephus and Pliny, eſpecially on the weſt: the monks that live in the neighbourhood confirm the ſame, and would have diſſuaded Dr Pococke from going to it on that account; and, as he ventured to go and bath in it, and was, two days after, ſeized with a dizzineſs, and violent pain in the ſtomach, which laſted near three weeks, they made no doubt but it was occaſioned by it; and he doth not ſeem to contradict them. As to the water, it is, though clear, ſo impregnated with ſalt, that thoſe who dive into it come out covered with a kind of ſaline matter. There is one remarkable thing relating to this lake, generally agreed on by all travellers and geographers; viz. that it receives the waters of Jordan, a conſiderable river, the brooks of Jabbok, Kiſhon, Arnon, and other ſprings, which flow into it from the adjacent mountains, and yet never overflows, though there is no viſible way to be found by which it diſcharges that great influx. Some naturaliſts have been greatly embarraſſed to find a diſcharge for theſe waters, and have therefore been inclined to ſuſpect the lake had a communication with the Mediterranean. But, beſides that we know of no gulph to corroborate this ſuppoſition, it has been demonſtrated by accurate calculations, that evaporation is more than ſufficient to carry off the waters brought by the river. It is, in fact, very conſiderable; and frequently becomes ſenſible to the eye, by the fogs with which the lake is covered at the riſing of the ſun, and which are afterwards diſperſed by the heat. It is incloſed on the eaſt and weſt with exceeding high mountains, many of them craggy and dreadful to behold. On the north it has the plains of Jericho; or, if we take in both ſides of the Jordan, it has the Great Plain, properly ſo called, on the ſouth; which is open, and extends beyond the reach of the eye. Joſephus gives this lake 580 furlongs in length, from the mouth of the Jordan to the town of Segor, on the oppoſite end, that is about 22 leagues; and about 150 furlongs, or five leagues, in its largeſt breadth: but our modern accounts commonly give it 24 leagues in length and 6 or 7 in breadth. On the weſt ſide of it is a kind of promontory, where they pretend to ſhow the remains of Lot's metamorphoſed wife. Joſephus ſays it was ſtill ſtanding in his time; but when Prince Radziville inquired after it, they told him there was no ſuch ſalt pillar or ſtatue to be found in all that part. However, they have found means, about a century after him, to recover, as they pretended to aſſure Mr Maundrell, a block or ſtump of it, which may in time grow up, with a little art, into its ancient bulk.

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* *Nat. Hiſt.* lib. v. cap. 15.

† *Bel. Jud.* lib. v. cap. 5.

It is to be obſerved here, that the name of *Dead Sea* is not to found in the ſacred writings; but hath been given to this lake becauſe no creature will live in it, on account of its exceſſive ſaltneſs, or rather bituminous quality; for the Hebrews rank ſulphur, nitre, and bitumen, under the general name of *ſalt*. However, ſome late travellers have found cauſe to ſuſpect the common report of its breeding no living creature; one of them having obſerved, on the ſhore, two or three ſhells of fiſh like thoſe of an oyſter, and which he ſuppoſes to have been thrown up by the waves, at two hours diſtance from the mouth of the Jordan, which he there takes notice of, leſt they ſhould be ſuſpected to have been brought into the lake by that way. And Dr Pococke, though he neither ſaw fiſh nor ſhells, tells us, on the authority of a monk, that ſome ſort of fiſh had been caught in it; and gives us his opinion, that as ſo many ſorts live in ſalt-water, ſome kind may be ſo formed as to live in a bituminous one. Mr Volney, however, affirms, that it contains neither animal nor vegetable life. We ſee no verdure on its banks, nor a fiſh to be found within its waters. But he adds, that it is not true that its exhalations are peſtiferous, ſo as to deſtroy birds flying over it. "It is very common (ſays he) to ſee ſwallows ſkimming its ſurface, and dipping for the water neceſſary to build their neſts. The real cauſe which deprives it of vegetables and animals is the extreme ſaltneſs of the water, which is infinitely ſtronger than that of the ſea. The ſoil around it, equally impregnated with this ſalt, produces no plants; and the air itſelf, which becomes loaded with it from evaporation, and which receives alſo the ſulphureous and bituminous vapours, cannot be favourable to vegetation: hence the deadly aſpect which reigns around this lake. In other reſpects, the ground about it, however, is not marſhy; and its waters are limpid and incorruptible, as muſt be the caſe with a diſſolution of ſalt. The origin of this mineral is eaſy to be diſcovered; for on the ſouth-weſt ſhore are mines of foſſil ſalt, of which I have brought away ſeveral ſpecimens. They are ſituated in the ſide of the mountains which extend along that border; and, for time immemorial, have ſupplied the neighbouring Arabs, and even the city of Jeruſalem. We find alſo on this ſhore fragments of ſulphur and bitumen, which the Arabs convert into a trifling article of commerce; as alſo hot fountains, and deep crevices, which are diſcovered at a diſtance by little pyramids built on the brink of them. We likewiſe find a ſort of ſtone, which, on rubbing, emits a noxious ſmell, burns like bitumen, receives a poliſh like white alabaſter, and is uſed for the paving of court-yards. At intervals, we alſo meet with unſhapen blocks, which prejudiced eyes miſtake for mutilated ſtatues, and which paſs with ignorant and ſuperſtitious pilgrims for monuments of the adventure of Lot's wife; though it is no where ſaid ſhe was metamorphoſed into ſtone like Niobe, but into ſalt, which muſt have melted the enſuing winter."

It is on account of this bitumen that it hath had the name of *Aſphaltite Lake*, it being reported to have thrown up great quantities of that drug, which was much in uſe among the Egyptians, and other nations, for embalming of dead bodies. Joſephus aſſures us, that in his days it roſe in lumps as big as an ox without its head, and ſome even larger. But, whatever it may have formerly done, we are aſſured by Mr Maundrell and others, that it is now to be found but in ſmall quantities along the ſhore, though in much greater near the mountains on both ſides the lake. But the contrary is ſince affirmed by two or more late* travellers; the one of whom tells us, that it is obſerved to float on the ſurface of the water, and to come on the ſhore, after windy weather, where the Arabians gather it, and put it to all the uſes that common pitch is uſed for, even in the compoſitions of ſome medicines: and another† tells us, he was there informed, that it was raiſed at certain times from the bottom, in large hemiſpheres, which, as ſoon as they touch the ſurface, and are acted upon by the external air, burſt at once, with great noiſe and ſmoke, like the *pulvis fulminans* of the chemiſts, diſperſing themſelves about in a thouſand pieces. From both theſe judicious authors we may conclude the reaſon of Mr Maundrell's miſtake, both as to the lake's throwing it up only on certain ſeaſons (that reverend gentleman might chance to be there at the wrong time); and likewiſe as to his not obſerving it about the ſhores, ſeeing the Arabs are there ready to gather it as ſoon as thrown up; all of them deſcribe it as reſembling our black pitch, ſo as not to be diſtinguiſhed from it but by its ſulphureous ſmoke and ſtench when ſet on fire; and it hath been commonly thought to be the ſame with that which our druggiſts ſell under the name of *bitumen Judaicum*, or *Jewiſh pitch*, though we have reaſon to think that this laſt is factitious, and that there is now none of the aſphaltum brought from Judea.

It hath, moreover, been confounded with a ſort of blackiſh combuſtible ſtone thrown on the ſhore, and called by ſome *Moſes's* ſtone, which, being held in the flame of a candle, will ſoon burn, and caſt a ſmoke and intolerable ſtench; but with this extraordinary property, that though it loſes much of its weight and colour, it becoming in a manner white, yet it diminiſhes nothing of its bulk. But theſe, Dr Pococke tells us, are found about two or three leagues from the ſhore. He concludes, however, from it, that a *ſtratum* of that ſtone under the lake is probably one part of the matter that feeds the ſubterraneous fire, and cauſes the bitumen to boil up out of it.

ASPHALTUM, BITUMEN JUDAICUM, or JEWS PITCH, is a light ſolid bitumen, of a duſky colour on the outſide, and a deep ſhining black within; of very little taſte; and having ſcarcely any ſmell, unleſs heated, when it emits a ſtrong pitchy one. It is found in a ſoft or liquid ſtate on the ſurface of the Dead Sea, and by age grows dry and hard. The ſame kind of bitumen is met with likewiſe in the earth, in other parts of the world, in China, America, and in ſome places of Europe, as the Carpathian hills, France, Neufchatel, &

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* *Pococke's Travels*, p. 56.

† *Shaw's Travels*, p. 374.

&c. There are ſeveral kinds of Jews pitch in the ſhops: but none of them are the genuine ſort, and have little other title to their name, than their being artificially compounded by Jews; and as they are a medley of we know not what ingredients, their medicinal uſe begins to be deſervedly laid aſide, notwithſtanding the diſcutient, reſolvent, practoral, and other virtues, attributed to this bitumen by the ancients. The true aſphaltum was formerly uſed in embalming the bodies of the dead. The thick and ſolid aſphalta are at preſent employed in Egypt, Arabia, and Perſia, as pitch for ſhips; as the fluid ones, for burning in lamps, and for varniſhes. Some writers relate, that the walls of Babylon, and the temple of Jeruſalem, were cemented with bitumen inſtead of mortar. Thus much is certain, that a true natural bitumen, that for inſtance, which is found in the diſtrict of Neufchatel, proves an excellent cement for walls, pavements, and other purpoſes, uncommonly firm, very durable in the air, and not penetrable by water. The watch and clock makers uſe a compoſition of aſphaltum, fine lamp-black, and oil of ſpike or turpentine, for drawing the black figures on dial-plates: this compoſition is prepared chiefly by certain perſons at Augſburg and Nuremberg. See the preceding article.

ASPHODELUS, ASPHODEL, or KING'S SPEAR: A genus of the monogynia order, belonging to the hexandria claſs of plants. The calyx is divided into ſix parts; and the nectarium conſiſts of ſix valves covering the nectarium.—The

Species are five. 1. The luteus, or common yellow aſphodel, hath roots compoſed of many thick fleſhy fibres, which are yellow, and joined into a head at the top; from whence ariſe ſtrong round ſingle ſtalks near three feet high, garniſhed on the upper part with yellow ſtar-ſhaped flowers, which appear in June, and the ſeeds ripen in autumn. 2. The ramoſus, or branching aſphodel, hath roots compoſed of fleſhy fibres, to each of which is faſtened an oblong bulb as large as a ſmall potatoe; the leaves are long and flexible, having ſharp edges; between theſe come out the flower-ſtalks, which ariſe more than three feet high, ſending forth many lateral branches. The upper parts of theſe are adorned with many white ſtar-ſhaped flowers, which grow in long ſpikes flowering gradually upward. They come out in the beginning of June, and the ſeeds ripen in autumn. 3. The ramoſus, or unbranched aſphodel, hath roots like the ſecond, but the leaves are longer and narrower; the ſtalks are ſingle, never putting out any ſide branches. The flowers appear at the ſame time with the former, are of a purer white, and grow in longer ſpikes. 4. The albus, with keel-ſhaped leaves, hath roots compoſed of ſmaller fibres than the two laſt, nor are the knobs at bottom half ſo large; the leaves are long, almoſt triangular, and hollow like the keel of a boat; the ſtalks ſeldom riſe above two feet high, and divide into ſeveral ſpreading branches; theſe are terminated by looſe ſpikes of white flowers ſmaller than thoſe of the former. 5. The ſtuloſus, or annual branching ſpiderwort, hath roots compoſed of many yellow fleſhy fibres: the leaves are ſpread out from the crown of the root, cloſe to the ground, in a large cluſter; theſe are convex on their under ſide, but plain above. The flower-ſtalks riſe immediately from the root, and grow about two feet high, dividing into three or four branches upward, which are adorned with white ſtarry flowers, with purple lines on the outſide. Theſe flower in July and Auguſt, and their ſeeds ripen in October.

Culture. The way to increaſe theſe plants is by parting their roots in Auguſt, before they ſhoot up their freſh green leaves. They may alſo be raiſed from ſeeds ſown in Auguſt; and the Auguſt following the plants produced from theſe may be tranſplanted into beds, and will produce flowers the ſecond year. They muſt not be planted in ſmall borders, among tender flowers; for they will draw away all the nouriſhment, and ſtarve every thing elſe.

The Lancaſhire aſphodel is thought to be very noxious to ſheep, whenever, through poverty of paſture, they are neceſſitated to eat it; although they are ſaid to improve much in their fleſh at firſt, they afterwards die with ſymptoms of a diſeaſed liver. This is the plant of which ſuch wonderful tales have been told by Pauli, Bartholine, and others, of its ſoftening the bones of ſuch animals as ſwallow it; and which they thence called *gramen oſſifragum.* Horned cattle eat it without any ill effect.

ASPHURELATA, in natural hiſtory, are ſemimetallic foſſils, fuſible by fire, and not malleable in their pureſt ſtate, being in their native ſtate intimately mixed with ſulphur and other adventitious matter, and reduced to what are called *ores.*

Of this ſeries of foſſils, there are only five bodies, each of which makes a diſtinct genus; viz. antimony, biſmuth, cobalt, zinc, and quickſilver.

ASPICUETA (Martin de), commonly called the Doctor of Navarre, or *Doctor Navarrus*, was deſcended of a noble family, and born the 13th of December 1491, at Varaſayn, a ſmall city of Navarre, not far from Pampeluna. He entered very young into the monaſtery of Regular canons at Roncevaux, where he took the habit which he continued to wear after he left the convent. He ſtudied claſſical learning, natural and moral philoſophy, and divinity, at Alcala, in New-Caſtile, adopting chiefly the ſyſtem of Petrus Lombardus, commonly called the *Maſter of the Sentences.* He applied to the ſtudy of the law at Ferrara, and taught it with applauſe at Toulouſe and Cahors. After being firſt profeſſor of canon low at Salamanca for 14 years, he quitted that place to be profeſſor of law at Coimbra, with a larger ſalary. The duties of this office he diſcharged for the ſpace of 20 years, and then reſigned it to retire into his own country, where he took care of his nieces, the daughters of his deceaſed brothers. Having made a journey to Rome to plead the cauſe of Bartholomeo de Caranza archbiſhop of Toledo, who had been accuſed of hereſy before the tribunal of the inquiſition in Spain, and whoſe cauſe was, by the Pope's order, to be tried in that city, Aſpiceuta's writings, which were well known, procured him a moſt honourable reception. Pope Pius V. made him aſſiſtant to cardinal Francis Aciat, his vice-penitentiary; and Gregory XIII. never paſſed by his door without calling for him, and ſtopped ſometimes a whole hour to talk with him in the ſtreet. His name became ſo famous, that even in his lifetime the higheſt encomium on a learned man was to call him a *Navarrus.* He was conſulted as an oracle. By temperance he prolonged his life to a great length. His œconomy enabled him to give ſubſtantial proofs of his charity. Being very old, he uſed to ride on a mule through the city, and relieved all the poor he met; to which his mule was ſo well accuſtomed, that it ſtopped of its own accord at the ſight of every poor man till its maſter had relieved him. He refuſed ſeveral honourable poſts in church and ſtate, that he might have leiſure to correct and improve the works he had already written, and compoſe others. He died at the age of 94, on the 21ſt of June 1586. He wrote a vaſt number of treatiſes, all which are either on morality or canon law.

ASPIRATE, in grammar, denotes words marked with the ſpiritus aſper. See Asper.

ASPIRATION, among grammarians, is uſed to denote the pronouncing a ſyllable with ſome vehemence.

ASPLENIUM, ceterach: A genus of the order of filices, belonging to the cryptogamia claſs of plants. The parts of fructification are ſituated in the ſmall ſparſe line under the diſk of the leaves. There are 24 ſpecies. Two of theſe are natives of Britain, and grow upon old walls or moiſt rocks; one is called *ſcolopendrium*, or *hart's tongue*: the other is properly *ceterach*, alſo called *ſpleenwort*. It has an herbaceous, ſomewhat mucilaginous, roughiſh taſte: it is recommended as a pectoral, and for promoting urine in nephritic caſes. The virtue which it has been moſt celebrated for is that which it has the leaſt title to, viz. diminiſhing the ſpleen.

ASS, in zoology, is ranked as a ſpecies of equus, or horſe. See Equus.

Coronation of the Ass, in antiquity, was a part of the ceremony of the feaſt of Veſta, wherein the bakers put bread crowns on the heads of theſe quadrupeds; *Ecce coronatis panis dependet aſellis* *. Hence, in an ancient calendar, the ides of June are thus denoted: *Feſtum eſt Veſtæ. Aſinus coronatur!*—This honour, it ſeems was done the beaſt, becauſe, by its braying, it had ſaved Veſta from being raviſhed by the Lampſacan god. Hence the formula, *Veſtæ delicium eſt aſinus*.

ASSAI, in muſic, ſignifies quick; and, according to others, that the motion of the piece be kept in a middle degree of quickneſs or ſlowneſs. As, *Aſſai allegro, aſſai preſto*. See Allegro and Presto.

ASSANCALA, a ſtrong town in Armenia, near the river Arras, in the road between Erzerum and Erivan, and noted for its hot baths. It ſtands on a high hill; the walls are built in a ſpiral line all round the rock and ſtrengthened with ſquare towers. The ditches are about two fathoms over, cut out of hard rock. E. Long. 41. 30. N. Lat. 39. 46.

ASSANCHIF, a town of Aſia, in Diarbekir, ſeated on the river Tigris. E. Long. 42. 30. N. Lat. 37. 20.

ASSANS. See Assens.

ASSARIUM, in antiquity, denotes a ſmall copper coin, being a part or diminutive of the *as*. The word ἀσσάριον is uſed by Suidas indifferently with ὀβολὸς and νόμισμα, to denote a ſmall piece of money; in which he is followed by Cujacius, who defines ασσαριον by *Minimus æris nummus*. We find mention of the aſſarion in the goſpel of St Matthew, chap. x. verſe 29.

ASSARON, or Omer, a meaſure of capacity, in uſe among the Hebrews, containing five pints. It the meaſure of manna which God appointed for every Iſraelite.

ASSASIN, or Assassin, a perſon who kills another with the advantage either of an inequality in the weapons, or by means of the ſituation of the place, or by attacking him at unawares.

The word *aſſaſſin* is ſaid by ſome to have been brought from the Levant, where it took its riſe from a certain prince of the family of the *Arſacidæ*; popularly called *Aſſaſſins*, living in a caſtle between Antioch and Damaſco, and bringing up a number of young men, ready to pay a blind obedience to his commands; whom he employed in murdering the princes with whom he was at enmity. But according to Mr Volney, the word *Haſſaſſin* (from the root *haſs*, "to kill, aſſaſſinate, to liſten, to ſurpriſe,") in the vulgar Arabic ſignifies "Robbers of the night," perſons who *lie in ambuſh to kill*; and is univerſally underſtood in this ſenſe at Cairo and in Syria. Hence it was applied to the *Batenians*, who ſlew by ſurpriſe. See the next article.

There was a certain law of nations, an opinion received in all the republics of Greece and Italy, whereby he that aſſaſſinated an uſurper of the ſupreme power was declared a virtuous man. At Rome eſpecially, after the expulſion of the kings, the law was formal and ſolemn, and inſtances of it admitted. The commonwealth armed the hand of any citizen, and created him magiſtrate for that moment.

Assassins, a tribe or clan in Syria, called alſo *Iſmaelians* and *Bataniſts* or *Batenians*. Theſe people probably owed their origin to the Kirmatians, a famous heretical ſect among the Mahometans, who ſettled in Perſia about the year 1090; whence, in proceſs of time, they ſent a colony into Syria, where they became poſſeſſed of a conſiderable tract of land among the mountains of Lebanon, extending itſelf from the neighbourhood of Antioch to Damaſcus.

The firſt chief and legiſlator of this remarkable tribe appears to have been Haſſan Sabah, a ſubtle impoſtor, who by his artifices made fanatical and implicit ſlaves of his ſubjects. Their religion was compounded of that of the Magi, the Jews, the Chriſtians, and the Mahometans: but the capital article of their creed was to believe that the Holy Ghoſt reſided in their chief; that his orders proceeded from God himſelf, and were real declarations of his divine pleaſure. To this monarch the orientals gave the name of *Scheik*: but he is better known in Europe by the name of the *Old Man of the Mountain*. His dignity, inſtead of being hereditary, was confirmed by election; where merit, that is, a ſuperior multiplicity and enormity of crimes, was the moſt effectual recommendation to a majority of ſuffrages.

This chief, from his exalted reſidence on the ſummit of mount Lebanon, like a vindictive deity, with the thunderbolt in his hand, ſent inevitable death to all quarters of the world; ſo that from one end of the earth to the other, kalifs, emperors, ſultans, kings, princes, Chriſtians, Mahometans, and Jews, every nation and people, execrated and dreaded his ſanguinary power, from the ſtrokes of which there was no ſecurity. At the leaſt ſuggeſtion or whiſper that he had threatened the death of any potentate, all immediately doubled their guards, and took every other precaution in their power.

* Ovid Faſt. vi. 311.

power. It is known that Philip Auguſtus king of France, on a premature advice that the Scheik intended to have him aſſaſſinated, inſtituted a new body-guard of men diſtinguiſhed for their activity and courage, called *ſergens d'Armes*, with braſs clubs bows and arrows; and he himſelf never appeared without a club, fortified either with iron or gold. Moſt ſovereigns paid ſecretly a penſion to the Scheik, however ſcandalous and derogatory it might be to the luſtre of majeſty, for the ſafety of their perſons. The Knights Templars alone dared to defy his ſecret machinations and open force. Indeed they were a permanent diſperſed body, not to be cut off by maſſacres or aſſaſſinations.

This barbarous prince was furniſhed with reſources unknown to all other monarchs even to the moſt abſolute deſpotic tyrant. His ſubjects would proſtrate themſeves at the foot of his throne, requeſting to die by his hand or order, as a favour by which they were ſure of paſſing in paradiſe. On them if danger made any impreſſion, it was an emulation to preſs forward; and if taken in any enterpriſe, they went to the place of execution with a magnanimity unknown to others. Henry count of Champaigne, who married Iſabella daughter of Amaury king of Jeruſalem, paſſing over part of the territory of the Aſſaſſins in his way to Syria, and talking highly of his power, their chief came to meet him, "Are your ſubjects (ſaid the old man of the mountain) as ready in their ſubmiſſion as mine?" and, without ſtaying for an anſwer, made a ſign with his hand, when ten young men in white, who were ſtanding on an adjacent tower, inſtantly threw themſelves down. On another occaſion, Sultan Malek-Shah ſummoning the Scheik to ſubmit himſelf to his government, and threatening him with the power of his arms, ſhould he heſitate to comply; the latter, very compoſedly turning himſelf towards his guards, ſaid to one of them, "Draw your dagger and plunge it into your breaſt;" and to another, "Throw yourſelf headlong from yonder rock." His orders were no ſooner uttered than they were joyfully obeyed: and all the anſwer he deigned to give the ſultan's envoy was, "Away to thy maſter, and let him know I have many thouſand ſubjects of the ſame diſpoſition." Men ſo ready to deſtroy themſelves were equally alert and reſolute in being the miniſters of death to others. At the command of their ſovereign, they made no difficulty of ſtabbing any prince, even on his throne; and being well verſed in the different dialects, they conformed to the dreſs and even the external religion of the country, that they might with leſs difficulty ſtrike the fatal blow required by their chief. With the Saracens they were Mahometans; with the Franks, Chriſtians; in one place they joined with the Mamaluks; in another, with the eccleſiaſtics or religious; and under this diſguiſe ſeized the firſt opportunity of executing their ſanguinary commiſſion. Of this we meet with an inſtance in the hiſtory of Saladin, while he was beſieging Manbedge, the celebrated Hieropolis of antiquity. Being one day, with a few attendants, and they at ſome diſtance, reconnoitring the place for the better diſpoſition of the attack, a man ruſhed on him with a dagger in his hand, and wounded him in the head; but the ſultan, as he was endeavouring to repeat his ſtroke, wreſted the dagger from him, and, after receiving ſeveral wounds, laid him dead at his feet. Before the ſultan had well recovered himſelf, a ſecond encountered him to finiſh the treachery of the former; but he met with the ſame fate: he was ſucceeded with equal fury by a third, who alſo fell by the hand of that magnanimous prince whom he was ſent to aſſaſſinate. And it was obſerved, that theſe wretches dealt about their fruitleſs blows as they lay in the agonies of death. With ſuch rapidity was this tranſacted, that it was over before Saladin's guards could come to his aſſiſtance. He retired to his tent, and in great perturbation throwing himſelf on his ſopha, ordered his ſervants to take a ſtrict view of his houſehold, and to caſhier all ſuſpected perſons; at the ſame time aſking with great earneſtneſs, "Of whom have I deſerved ſuch treacherous uſage?" But it afterwards appeared, that theſe villains had been ſent by the old man of the mountain; of whom the vizir Kamſchlegin had purchaſed the murder of Saladin, to free himſelf from ſo great a warrior whom he could not meet in the field. To animate them in their frantic obedience, the Scheik, before their departure on ſuch attempts, uſed to give them a ſmall foretaſte of ſome of the delights which he aſſured them would be their recompenſe in paradiſe. Delicious ſoporific drinks were given them; and while they lay aſleep, they were carried into beautiful gardens, where very allurement invited their ſenſes to the moſt exquiſite gratifications. From theſe ſeats of voluptuouſneſs, inflamed with liquor and enthuſiaſtic views of perpetual enjoyments, they ſallied forth to perform aſſaſſinations of the blackeſt dye.

This people once had, or at leaſt they feigned to have, an intention of embracing the Chriſtian religion. They reigned a long time in Perſia and on Mount Lebanon. Hulaku, a khan of the Mogul Tartars, in the year 655 of the Hegira, or 1254 of the Chriſtian æra, entered their country and diſpoſſeſſed them of ſeveral places; but it was not till the year 1272 that they were totally conquered. This atchievement was owing to the conduct and intrepidity of the Epyptian forces ſent againſt them by the ſultan Bibaris. It has, however, been thought that the Druſes, who ſtill reſide among the eminences of Mount Lebanon, and whoſe religion and cuſtoms are ſo little known, are a remnant of thoſe barbarians.

ASSAULT, in law, is an attempt or offer to beat another, without touching him: as if one lifts up his cane or his fiſt in a threatening manner at another; or ſtrikes at him, but miſſes him; this is an aſſault, *inſultus*, which Finch deſcribes to be "an unlawful ſetting upon one's perſon." This alſo is an inchoate violence, amounting conſiderably higher than bare threats; and therefore, though no actual ſuffering is proved, yet the party injured may have redreſs by action of *treſpaſs vi et armis*, wherein he ſhall recover damages as a compenſation for the injury.

Assault, in the military art, a furious effort made to carry a fortified poſt, camp, or fortreſs, wherein the aſſailants do not ſcreen themſelves by any works: while the aſſault continues, the batteries ceaſe, for fear of killing their own men.—The *enfans perdus* march firſt to the aſſault. See *Enfans Perdus*.

ASSAY, Essay, or Say, in metallurgy, the proof or trial of the goodneſs, purity, value, &c. of metals and metalline ſubſtances. See Essay.

In ancient ſtatutes this is called *touch;* and thoſe who had the care of it, *Keepers of the touch.*—Under Henry VI. divers cities were appointed to have touch for wrought ſilver-plate, 2 Hen. VI. c. 14.—By this, one might imagine they had no better method of aſſaying than the ſimple one by the touch-ſtone; but the caſe is far otherwiſe. In the time of King Henry II. the biſhop of Saliſbury, then treaſurer, conſidering that though the money paid into the king's exchequer for his crown-rents did anſwer *numero et pondere,* it might nevertheleſs be mixed with copper or braſs: wherefore a conſtitution was made, called the *trial by combuſtion*; which differs little or nothing from the preſent method of aſſaying ſilver. See a deſcription of it in the Black Book in the Exchequer, written by Gervaſe of Tilbury, c. xxi. This trial is alſo there called *eſſaium,* and the officer who made it is named *fuſor.* The method ſtill in uſe of aſſaying gold and ſilver was firſt eſtabliſhed by an act of the Engliſh parliament 1354.

Assaying, *ars docimaſtica,* in its extent, comprehends particular manners of examining every ore, or mixed metal, according to its nature, with the beſt-adapted fluxes; ſo as to diſcover, not only what metals, and what proportions of metal, are contained in ores; but likewiſe how much ſulphur, vitriol, alum, arſenic, ſmelt, &c. may be obtained from every one reſpectively. See Blow-pipe, Metallurgy, and Mineralogy.

Aſſaying is more particularly uſed by moneyers and goldſmiths, for the making a proof or trial by the cuppel, or teſt, of the fineneſs or purity of the gold and ſilver to be uſed in the coining of money, and manufacture of plate, &c. or that have been already uſed therein.

There are two kinds of aſſaying; the one before metals are melted, in order to bring them to their proper fineneſs; the other after they are ſtruck, to ſee that the ſpecies be ſtandard. For the firſt aſſay, the aſſayers uſe to make 14 or 15 grains of gold, and half a dram of ſilver, if it be for money; and 18 grains of the one, and a dram of the other, if for other occaſions. As to the ſecond aſſay, it is made of one of the pieces of money already coined, which they cut in four parts. The quantity of gold for an aſſay among us is ſix grains: In France, nearly the ſame; and in Germany, about three times as much.

The proper ſpelling of that word, however, is essay; under which article, therefore, the reader will find the ſubject more particularly treated.

Assay-Balance, or *Eſſay-Balance,* the flat pieces of glaſs often placed under the ſcales of an aſſay-balance, ſeem, by their power of electricity, capable of attracting, and thereby making the lighter ſcale preponderate, where the whole matter weighed is ſo very ſmall. See *Eſſay-Balance.*

The electricity of a flat ſurface of about three inches ſquare has been known to hold down one ſcale, when there were about 200 grains weight in the other. See Balance.

Assay-Maſter, or *Eſſay-Maſter,* an officer under certain corporations entruſted with the care of making true touch, or aſſay, of the gold and ſilver brought to him; and giving a juſt report of the goodneſs or badneſs thereof. Such is the aſſay-maſter of the mint in the Tower, called alſo *aſſayer of the king.*

The aſſay-maſter of the goldſmiths company is a ſort of aſſiſtant-warden, called alſo a *touch-warden,* appointed to ſurvey, aſſay, and mark all the ſilver-work, &c. committed to him. There are alſo aſſay-maſters appointed by ſtatute at York, Exeter, Briſtol, Cheſter, Norwich, Newcaſtle, and Birmingham, for aſſaying wrought plate. The aſſay-maſter is to retain eight grains of every pound Troy of ſilver brought to him; four whereof are to be put in the pix, or box of deal, to be re-aſſayed the next year, and the other four to be allowed him for his waſte and ſpillings.

Note, The number of pennyweights ſet down in the aſſay-maſter's report, is to be accounted as per pound, or ſo much in every pound of 12 ounces Troy. For every 20 penny-weight, or ounce Troy, the ſilver is found by the aſſay to be worſe than ſtandard, or ſterling, ſixpence is to be deducted; becauſe every ounce will coſt ſo much to reduce it to ſtandard goodneſs, or to change it for ſterling.

In gold, for every carat it is ſet down to be worſe than ſtandard, you muſt account that in the ounce Troy it is worſe by ſo many times 3 s. 8 d.; and for every grain it is ſet down worſe, you muſt account it worſe by ſo many times 11 d. in the ounce Troy; and for every half grain 5½d.: for ſo much it will coſt to make it of ſtandard goodneſs, &c.

ASSELYN (John), a famous Dutch painter, was born in Holland, and became the diſciple of Iſaiah Vandevelde, the battle-painter. He diſtinguiſhed himſelf in hiſtory-paintings, battles, landſcapes, animals, and particularly horſes. He travelled into France and Italy; and was ſo pleaſed with the manner of Bambochio, that he always followed it. He painted many pictures at Lyons, where he married the daughter of a merchant of Antwerp, and returned with her to Holland. Here he firſt diſcovered to his countrymen a freſh and clear manner of painting landſcapes, like Claude Lorraine; upon which all the painters imitated his ſtyle, and reformed the dark brown they had hitherto followed. Aſſelyn's pictures were ſo much admired at Amſterdam, that they ſold there at a high price. He died in that city in 1660. Twenty-four pieces of landſcapes and ruins, which he painted in Italy, have been engraved by Perelle.

ASSEMBLAGE, the uniting or joining of things together; or the things themſelves ſo united or joined. It is alſo uſed, in a more general ſenſe, for a collection of various things ſo diſpoſed and diverſified, that the whole produces ſome agreeable effect.

ASSEMBLY, the meeting of ſeveral perſons, in the ſame place, upon the ſame deſign.

Assembly, in the beau monde, an appointed meeting of faſhionable perſons of both ſexes, for the ſake of play, dancing, gallantry, converſation, &c.

Assembly, in the military art, the ſecond beating of a drum before a march; at which the ſoldiers ſtrike their tents, roll them up, and ſtand to arms.

Assemblies of the clergy are called *convocations, ſynods, councils.* The annual meeting of the church of Scotland is called a *General Aſſembly:* In this aſſembly his Majeſty is repreſented by his Commiſſioner, who diſſolves one meeting, and calls another, in the name of the *King,* while the Moderator does the ſame in the name of the *Lord Jeſus Chriſt.*

Assemblies of the Roman people were called *comitia.*

Under the Gothic governments, the ſupreme legiſlative power was lodged in an aſſembly of the ſtates of the kingdom, held annually for the like purpoſes as the Britiſh parliament. Some feeble remains of this uſage ſtill ſubſiſt in the annual aſſemblies of the ſtates of Languedoc, Bretagne, and a few other provinces of France; but theſe are no more than ſhadows of the ancient aſſemblies. It is only in Great Britain, Sweden, and Poland, that ſuch aſſemblies retain their ancient powers and privileges.

ASSENS, a ſea-port town of Denmark, ſituated upon the Little Belt, a ſtrait of the Baltic, which ſeparates the iſle of Funen from the continent. It is the common paſſage from the duchy of Sleſwick to Copenhagen. E. Long. 10. 30. N. Lat. 55. 15.

ASSENT, in a general ſenſe, implies an agreement to ſomething propoſed or affirmed by another.

Royal Assent, the approbation given by the king to a bill in parliament, after which it becomes a law.

ASSER (John), or Asserius Menevensis, that is, *Aſſer of St David's*, biſhop of Shirburn in the reign of Alfred the Great. He was born in Pembrokeſhire, in South Wales; and educated in the monaſtery of St David's by the archbiſhop Aſſerius, who, according to Leland, was his kinſman. In this monaſtery he became a monk, and by his aſſiduous application ſoon acquired univerſal fame as a perſon of profound learning and great abilities. Alfred, the munificent patron of genius, about the year 880, ſent for him to court. The king was then at Dean in Wiltſhire. He was ſo charmed with Aſſer, that he made him his preceptor and companion. As a reward for his ſervices, he appointed him abbot of two or three different monaſteries; and at laſt promoted him to the epiſcopal ſee of Shirburn, where he died and was buried in the year 910. He was, ſays Pits, a man of a happy genius, wonderful modeſty, extenſive learning, and great integrity of life. He is ſaid to have been principally inſtrumental in perſuading the king to reſtore the univerſity of Oxford to its priſtine dignity and luſtre.—He wrote, *De vita et rebus geſtis Alfredi*, &c. Lond. 1574, publiſhed by Archbiſhop Parker, in the old Saxon character, at the end of *Walſinghami hiſt.*——Francf. 1602. fol. Oxf. 1722, 8vo. Many other works are aſcribed to this author by Gale, Bale, and Pits, but all doubtful.

ASSERIA. See Asisia.

ASSERTION, in the language of the ſchools, a propoſition advanced by the aſſertor, who avows the truth of it, and is ready to defend it.

ASSESSOR, an inferior officer of juſtice, appointed chiefly to aſſiſt the ordinary judge with his opinion and advice.

Assessor is alſo one who aſſeſſes or ſettles taxes and other public dues.

ASSETS, in law, ſignifies goods enough to diſcharge that burden which is caſt upon the executor or heir, in ſatisfying the debts and legacies of the teſtator or anceſtor. Aſſets are real or perſonal. Where a man hath lands in fee ſimple, and dies ſeiſed thereof, the lands which come to his heir are aſſets real; and where he dies poſſeſſed of any perſonal eſtate, the goods which come to the executors are aſſets perſonal. Aſſets are alſo divided into *aſſets per deſcent*, and *aſſets inter maines*. Aſſets by deſcent is where a perſon is bound in an obligation, and dies ſeiſed of lands which deſcend to the heir, the land ſhall be aſſets, and the heir ſhall be charged as far as the land to him deſcended will extend. *Aſſets inter maines* is when a man indebted makes executors, and leaves them ſufficient to pay his debts and legacies; or where ſome commodity or profit ariſeth to them in right of the teſtator, which are called *aſſets in their hands*.

ASSEVERATION, a poſitive and vehement affirmation of ſomething.

ASSHETON (William), doctor of divinity, and rector of Beckenham, in Kent, was born in the year 1641, and was educated at Brazen-noſe college, Oxford. After entering into orders, he became chaplain to the Duke of Ormond, and was admitted doctor of divinity in 1673. Soon after, he was nominated to a prebend in the church of York, preſented to the living of St Antholin, London, and to the rectory of Beckenham in Kent. He was the firſt projector of the ſcheme for providing for clergymens widows, and others, by a jointure payable out of the mercers company. He wrote ſeveral pieces againſt the Papiſts and Diſſenters, and ſome devotional tracts. He died at Beckenham in September 1711, in the 70th year of his age.

ASSIDEANS, or Chassidæans, (from the Hebrew *chaſidim*, "merciful, pious"); thoſe Jews who reſorted to Mattathias to fight for the law of God and the liberties of their country. They were men of great valour and zeal, having voluntarily devoted themſelves to a more ſtrict obſervation of the law than other men. For, after the return of the Jews from the Babyloniſh captivity, there were two ſorts of men in their church; thoſe who contented themſelves with that obedience only which was preſcribed by the law of Moſes, and who were called *Zadikim*, i. e. the *righteous*; and thoſe who, over and above the law, ſuperadded the conſtitutions and traditions of the elders, and other rigorous obſervances: theſe latter were called *Chaſidim*, i. e. the *pious*. From the former ſprung the Samaritans, Sadducees, and Caraites; from the latter, the Phariſees and the Eſſenes.

ASSIDENT signs, in medicine, are ſymptoms which uſually attend a diſeaſe but not always; hence differing from *pathognomic* ſigns, which are inſeparable from the diſeaſe: *e. gr.* In the pleuriſy, a pungent pain in the ſide; in an acute fever, difficulty of breathing, &c. collectively taken, are pathognomic ſigns; but that the pain extends to the hypochondrium or clavicle, or that the patient lies with more eaſe on one ſide than on the other, are *aſſident* ſigns.

ASSIDUUS, or Adsiduus, among the Romans, denoted a rich or wealthy perſon. The word in this ſenſe is derived from *as aſſis*, q. d. a monied man. Hence we meet with *aſſiduous* ſureties, *aſſidui fidejuſſores*; anſwering to what the French now call city ſureties or ſecurities, *cautions bourgeois*.

When Servius Tullius divided the Roman people into five claſſes, according as they were aſſeſſed or taxed to the public, the richer ſort who contributed aſſes were denominated *aſſidui*; and as theſe were the chief people of buſineſs who attended all the public concerns, thoſe who were diligent in attendances came to be denominated *aſſidui*.

ASSIENTO, a Spaniſh word ſignifying a *farm*, in commerce, is uſed for a bargain between the king of

Spain and other powers, for importing negroes into the Spaniſh dominions in America, and particularly to Buenos Ayres. The firſt aſſiento was made with the French Guinea-company; and, by the treaty of Utrecht, transferred to the Engliſh, who were to furniſh 4800 negroes annually.

ASSIGN, in common law, a perſon to whom a thing is aſſigned or made over.

ASSIGNATION, an appointment to meet. The word is generally underſtood of love-meetings.

ASSIGNEE, in law, a perſon appointed by another to do an act, tranſact ſome buſineſs, or enjoy a particular commodity.

ASSIGNING, in a general ſenſe, implies the making over the right of one perſon to another. In a particular ſenſe, it ſignifies the pointing out of ſomething; as, an error, falſe judgment, or waſte.

ASSIGNMENT, the transferring the intereſt one has in a leaſe, or other thing, to another perſon.

ASSIMILATION, in phyſics, is that motion by which bodies convert other bodies related to them, or at leaſt ſuch as are prepared to be converted, into their own ſubſtance and nature. Thus, flame multiplies itſelf upon oily bodies, and generates new flame; air upon water, and produces new air; and all the parts, as well ſimilar as organical, in vegetables and animals, firſt attract with ſome election or choice, nearly the ſame common or not very different juices for aliment, and afterwards aſſimilate or convert them to their own nature.

ASSISE, in old Engliſh law-books, is defined to be an aſſembly of knights, and other ſubſtantial men, together with a juſtice, in a certain place, and at a certain time: but the word, in its preſent acceptation, implies a court, place or time, when and where the writs and proceſſes, whether civil or criminal, are decided by judge and jury.

All the counties of England are divided into ſix circuits; and two judges are aſſigned by the king's commiſſion, who hold their aſſiſes twice a-year in every county (except London and Middleſex, where courts of *niſi prius* are holden in and after every term, before the chief or other judge of the ſeveral ſuperior courts; and except the four northern counties, where the aſſiſes are taken only once a year) to try by a jury of the reſpective counties the truth of ſuch matters of fact as are then under diſpute in the courts of Weſtminſter-hall. Theſe judges of aſſiſe came into uſe in the room of the ancient juſtices in eyre, *juſticiarii in itinere:* who were regularly eſtabliſhed, if not firſt appointed, by the parliament of Northampton, A. D. 1176, 22 Hen. II. with a delegated power from the king's great court or *aula regia*, being looked upon as members thereof: and they afterwards made their circuit round the kingdom once in ſeven years for the purpoſe of trying cauſes. They were afterwards directed by *magna charta*, c. 12. to be ſent into every county once a-year to take or try certain actions then called *recognitions* or *aſſiſes;* the moſt difficult of which they are directed to adjorn into the court of common pleas to be there determined. The itinerant juſtices were ſometimes mere juſtices of aſſiſe, or of dower, or of gaol-delivery, and the like; and they had ſometimes a more general commiſſion, to determine all manner of cauſes, *juſticiarii ad omnia placita:* but the preſent juſtices of aſſiſe and *niſi prius* are more immediately derived from the ſtatute Weſtm. 2, 13 Edw. I. c. 30. explained by ſeveral other acts, particularly the ſtatute 14 Edw. III. c. 16. and muſt be two of the king's juſtices of the one bench or the other, or the chief baron of the exchequer, or the king's ſergeants ſworn. They uſually make their circuits in the reſpective vacations after Hilary and Trinity terms; aſſiſes being allowed to be taken in the holy time of Lent by conſent of the biſhops at the king's requeſt, as expreſſed in ſtatute Weſtm. 1. 3 Edw. I. c. 51. And it was alſo uſual, during the times of Popery, for the prelates to grant annual licenſes to the juſtices of aſſiſe to adminiſter oaths in holy times: for oaths being of a ſacred nature, the logic of thoſe deluded ages concluded that they muſt be of eccleſiaſtical cognizance. The prudent jealouſy of our anceſtors ordained that no man of law ſhould be judge of aſſiſe in his own county: and a ſimilar prohibition is found in the civil law, which has carried this principle ſo far, that it is equivalent to the crime of ſacrilege, for a man to be governor of the province in which he was born, or has any civil connection.

The judges upon their circuits now ſit by virtue of five ſeveral authorities. 1. The commiſſion of the *peace*, in every county of the circuits; and all juſtices of the peace of the county are bound to be preſent at the aſſiſes; and ſheriffs are alſo to give their attendance on the judges, or they ſhall be fined. 2. A commiſſion of *oyer* and *terminer*, directed to them and many other gentlemen of the county, by which they are empowered to try treaſons, felonies, &c. and this is the largeſt commiſſion they have. 3. A commiſſion of general *gaol-delivery*, directed to the judges and the clerk of aſſiſe aſſociate, which gives them power to try every priſoner in the gaol committed for any offence whatſoever, but none but priſoners in the gaol; ſo that one way or other they rid the gaol of all the priſoners in it. 4. A commiſſion of *aſſiſe*, directed to the judges and clerk of aſſiſe, to take aſſiſes; that is, to take the verdict of a peculiar ſpecies of jury called *an aſſiſe*, and ſummoned for the trial of *landed* diſputes. The other authority is, 5. That of *niſi prius*, which is a conſequence of the commiſſion of *aſſiſe*, being annexed to the office of thoſe juſtices by the ſtatute of Weſtm. 2. 13 Edw. I. c. 30. And it empowers them to try all queſtions of fact iſſuing out of the courts of Weſtminſter, that are then ripe for trial by jury. The original of the name is this: all cauſes commenced in the courts of Weſtminiſter-hall are by the courſe of the courts appointed to be there tried, on a day fixed in ſome Eaſter or Michaelmas term, by a jury returned from the county wherein the cauſe of action ariſes; but with this proviſo, *niſi prius juſticiarii ad aſſiſas capiendas venerint; unleſs before* the day prefixed the judges of aſſiſe come into the county in queſtion. This they are ſure to do in the vacations preceding each Eaſter and Michaelmas term, and there diſpoſe of the cauſe; which ſaves much expence and trouble, both to the parties, the jury, and the witneſſes.

The word *aſſiſe* (from the French *aſſis*, ſeated, ſettled, or eſtabliſhed, and formed of the Latin verb *aſſideo*, I ſit by) is uſed in ſeveral different ſenſes. It is ſometimes taken for the ſittings of a court; ſometimes for its regulations or ordinances, eſpecially thoſe that fix the ſtandard of weights and meaſures; and ſometimes it ſignifies a jury, either becauſe juries conſiſted of a fixed determined number, or becauſe they continued ſitting till they pronounced their verdict. In Scots law, an aſſiſe or jury conſiſts of fifteen ſworn men *(juratores)*, picked out by the court from a greater number, not exceeding 45, who have been ſummoned for that purpoſe by the ſheriff, and given in liſt to the defender, at ſerving him with a copy of his libel.

ASSISIO, an epiſcopal town of Italy, in the duchy of Spoleto, built on the ſide of a very high mountain. The cathedral of St Francis is very magnificent, and compoſed of three churches one above another. E. Long. 13. 35. N. Lat. 43. 4.

ASSITHMENT, a wiregeld, or compenſation, by a pecuniary mulct; from the prepoſition *ad*, and the Sax. *ſithe, vicè: quod vicè ſupplicii ad expiandum delictum ſolvitur*.

ASSOCIATION, the act of aſſociating, or conſtituting a ſociety, or partnerſhip, in order to carry on ſome ſcheme or affair with more advantage.—The word is Latin, *aſſociatio*; and compounded of *ad*, to, and *ſocio*, to join.

Association of Ideas, is where two or more ideas conſtantly and immediately follow or ſucceed one another in the mind, ſo that one ſhall almoſt infallibly produce the other whether there be any natural relation between them or not. See METAPHYSICS.

Where there is a real affinity or connection in ideas, it is the excellency of the mind to be able to collect, compare, and range them in order, in its inquiries: but where there is none, nor any cauſe to be aſſigned for their accompanying each other, but what is owing to mere accident or habit; this unnatural aſſociation becomes a great imperfection, and is, generally ſpeaking, a main cauſe of error, or wrong deductions in reaſoning. Thus the idea of goblins and ſprights, it has been obſerved, has really no more affinity with darkneſs than with light; and yet let a fooliſh maid inculcate theſe ideas often on the mind of a child, and raiſe them there together, it is poſſible he ſhall never be able to ſeparate them again ſo long as he lives, but darkneſs ſhall ever bring with it thoſe frightful ideas. With regard to this inſtance, however, it muſt at the ſame time be obſerved, that the connection alluded to appears far from being either unnatural or abſurd. See the article APPARITION.

Such wrong combinations of ideas, Mr Locke ſhows, are a great cauſe of the irreconcileable oppoſition between the different ſects of philoſophy and religion: for we cannot imagine, that all who hold tenets different from, and ſometimes even contradictory to, one another, ſhould wilfully and knowingly impoſe upon themſelves, and refuſe truth offered by plain reaſon: but ſome looſe and independent ideas are by education, cuſtom, and the conſtant din of their party, ſo coupled in their minds that they always appear there together: theſe they can no more ſeparate in their thoughts, than if they were but one idea, and they operate as if they were ſo. This gives ſenſe to jargon, demonſtration to abſurdities, conſiſtency to nonſenſe, and is the foundation of the greateſt, and almoſt of all, the errors in the world.

Aſſociation forms a principal part of Dr Hartley's mechanical theory of the mind. He diſtinguiſhes it into ſynchronous and ſucceſſive; and aſcribes our ſimple and complex ideas to the influence of this principle or habit. Particular ſenſations reſult from previous vibrations conveyed through the nerves to the medullary ſubſtance of the brain; and theſe are ſo intimately aſſociated together, that any one of them, when impreſſed alone, ſhall be able to excite in the mind the ideas of all the reſt. Thus we derive the ideas of natural bodies from the aſſociation of the ſeveral ſenſible qualities with the names that expreſs them, and with each other. The ſight of part of a large building ſuggeſts the idea of the reſt inſtantaneouſly, by a ſynchronous aſſociation of the parts; and the ſound of the words, which begin a familiar ſentence, brings to remembrance the remaining parts, in order, by ſucceſſive aſſociation. Dr Hartley maintains, that ſimple ideas run into complex ones by aſſociation; and apprehends, that by purſuing and perfecting this doctrine, we may ſome time or other be enabled to analyſe thoſe complex ideas that are commonly called the *ideas of reflection*, or *intellectual ideas*, into their ſeveral component parts, i. e. into the ſimple idea of ſenſation of which they conſiſt; and that this doctrine may be of conſiderable uſe in the art of logic, and in explaining the various phenomena of the human mind.

Association of Parliament. In the reign of king William III. the Britiſh parliament entered into a ſolemn aſſociation to defend his majeſty's perſon and government againſt all plots and conſpiracies; and all perſons bearing offices civil or military, were enjoined to ſubſcribe the aſſociation to ſtand by king William, on pain of forfeitures and penalties, &c. by ſtat. 7 and 8 W. III. c. 27.

ASSOILZIE, in law, to abſolve or free.

ASSONANCE, in rhetoric and poetry, a term uſed where the words of a phraſe or a verſe have the ſame ſound or termination, and yet make no proper rhyme. Theſe are uſually accounted vicious in Engliſh; though the Romans ſometimes uſed them with elegancy: as, *Militem comparavit, exercitum ordinavit, aciem luſtravit*.

ASSONANT RHYMES, is a term particularly applied to a kind of verſes among the Spaniards, where a reſemblance of ſound ſerves inſtead of a natural rhyme. Thus, *ligera, cubierta, tierra, meſa*, may anſwer each other in a kind of *aſſonant* rhyme, having each an *e* in the penult ſyllable, and *a* in the laſt.

ASSUAN. See SYENE.

ASSUMPSIT, in the law of England, a voluntary or verbal promiſe, whereby a perſon aſſumes, or takes upon him to perform or pay any thing to another.

A promiſe is in the nature of a verbal covenant, and wants nothing but the ſolemnity of writing and ſealing to make it abſolutely the ſame. If therefore it be to do any explicit act, it is an expreſs contract, as much as any covenant: and the breach of it is an equal injury. The remedy indeed is not exactly the ſame: ſince, inſtead of an action of covenant, there only lies an action upon the caſe, for what is called an *aſſumpſit* or undertaking of the defendant; the failure of performing which is the wrong or injury done to the plaintiff, the damages whereof a jury are to eſtimate and ſettle. As, if a builder promiſes, undertakes, or aſſumes to Caius, that he will build and cover his houſe within a time limited, and fails to do it; Caius has an action on the caſe againſt the builder for this breach of his expreſs promiſe, undertaking, or aſſumpſit; and ſhall recover a pecuniary ſatisfaction for the injury ſuſtained by ſuch delay. So alſo in the caſe of a debt by ſimple contract, if the debtor promiſes to pay and does not, this breach of promiſe intitles the creditor to his action on the caſe, inſtead of being driven to an action of debt. Thus likewiſe a promiſſory note, or note of hand not under ſeal to pay money at a day certain, is an expreſs aſſumpſit; and the payee at common law, or by cuſtom and act of parliament the indorſee, may recover the value of the note in damages, if it remains unpaid. Some agreements indeed, though never ſo expreſsly made, are deemed of ſo important a nature, that they ought not to reſt in verbal promiſe only which cannot be proved but by the memory (which ſometimes will induce the perjury) of witneſſes. To prevent which, the ſtatute of frauds and perjuries, 29 Car. II. c. 3. enacts, that in the five following caſes no verbal promiſe ſhall be ſufficient to ground an action upon, but at the leaſt ſome note or memorandum of it ſhall be made in writing, and ſigned by the party to be charged therewith: 1. When an executor or adminiſtrator promiſes to anſwer damages out of his own eſtate. 2. Where a man undertakes to anſwer for the debt, default, or miſcarriage, of another. 3. Where any agreement is made upon conſideration of marriage. 4. Where any contract or ſale is made of lands, tenements, or hereditaments, or any intereſt therein. 5. And laſtly, where there is any agreement that is not to be performed within a year from the making thereof. In all theſe caſes, a mere verbal aſſumpſit is void.

From theſe expreſs contracts the tranſition is eaſy to thoſe that are only implied by law. Which are ſuch as reaſon and juſtice dictate, and which therefore the law preſumes that every man has contracted to perform; and, upon this preſumption, makes him anſwerable to ſuch perſons as ſuffer by his non-performance.

Thus, 1. If I employ a perſon to tranſact any buſineſs for me, or perform any work, the law implies that I undertook, or aſſumed, to pay him ſo much as his labour deſerved: and if I neglect to make him amends, he has a remedy for this injury by bringing his action on the caſe upon this implied aſſumpſit; wherein he is at liberty to ſuggeſt that I promiſed to pay him ſo much as he reaſonably deſerved, and then to aver that his trouble was really worth ſuch a particular ſum, which the defendant has omitted to pay. But this valuation of his trouble is ſubmitted to the determination of a jury; who will aſſeſs ſuch a ſum in damages as they think he really merited. This is called an *aſſumpſit* on a *quantum meruit.*

2. There is alſo an implied aſſumpſit on a *quantum valebat,* which is very ſimilar to the former; being only where one takes up goods or wares of a tradeſman, without expreſsly agreeing for the price. There the law concludes, that both parties did intentionally agree that the real value of the goods ſhould be paid; and an action on the caſe may be brought accordingly, if the vendee refuſes to pay that value.

3. A third ſpecies of implied aſſumpſit is when one has had and received money belonging to another without any valuable conſideration given on the receiver's part; for the law conſtrues this to be money had and received for the uſe of the owner only; and implies that the perſon ſo receiving, promiſed and undertook to account for it to the true proprietor. And, if he unjuſtly detains it, an action on the caſe lies againſt him for the breach of ſuch implied promiſe and undertaking; and he will be made to repair the owner in damages, equivalent to what he has detained in ſuch violation of his promiſe. This is a very extenſive and beneficial remedy, applicable to almoſt every caſe where the defendant has received money which *ex æquo et bono* he ought to refund. It lies for money paid by miſtake, or on a conſideration which happens to fail, or through impoſition, extortion, or oppreſſion, or where undue advantage is taken of the plaintiff's ſituation.

4. Where a perſon has laid out and expended his own money for the uſe of another at his requeſt, the law implies a promiſe of repayment, and an action will lie on this aſſumpſit.

5. Likewiſe, fifthly, upon a ſtated account between two merchants, or other perſons, the law implies that he againſt whom the balance appears has engaged to pay it to the other; though there be not any actual promiſe. And from this implication it is frequent for actions on the caſe to be brought, declaring that the plaintiff and defendant had ſettled their accounts together, *inſimul computaſſent,* (which gives name to this ſpecies of aſſumpſit); and that the defendant engaged to pay the plaintiff the balance, but has ſince neglected to do it. But if no account has been made up, then the legal remedy is by bringing a writ of *account de computo;* commanding the defendant to render a juſt account to the plaintiff, or ſhew the court good cauſe to the contrary. In this action, if the plaintiff ſucceeds, there are two judgments; the firſt is, that the defendant do account *(quod computet)* before auditors appointed by the court; and when ſuch account is finiſhed, then the ſecond judgment is, that he do pay the plaintiff ſo much as he is found in arrear.

6. The laſt claſs of contracts, implied by reaſon and conſtruction of law, ariſes upon this ſuppoſition, that every one who undertakes any office, employment, truſt, or duty, contracts with thoſe who employ or entruſt him, to perform it with integrity, diligence, and ſkill: and if by his want of either of thoſe qualities any injury accrues to individuals, they have therefore their remedy in damages, by a ſpecial action on the caſe. A few inſtances will fully illuſtrate this matter. If an officer of the public is guilty of neglect of duty, or a palpable breach of it, of non-feaſance or of miſ-feaſance; as, if the ſheriff does not execute a writ ſent to him, or if he wilfully makes a falſe return thereof; in both theſe caſes, the party aggrieved ſhall have an action *on the caſe,* for damages to be aſſeſſed by a jury. If a ſheriff or goaler ſuffers a priſoner who is taken upon meſne proceſs (that is, during the pendency of a ſuit) to eſcape, he is liable to an action *on the caſe.* But if after judgment, a goaler or a ſheriff permits a debtor to eſcape, who is charged in execution for a certain ſum; the debt immediately becomes his own, and he is compellable by action of *debt,* being for a ſum liquidated and aſcertained, to ſatisfy the creditor in his whole demand. An advocate or attorney that betray the cauſe of their client, or, being retained, neglect to appear at the trial, by which the cauſe miſcarries, are liable to an action on the caſe, for a reparation to their injured client. There is alſo in law always an

implied contract with a common innkeeper, to ſecure his gueſt's goods in his inn; with a common carrier or barge-maſter, to be anſwerable for the goods he carries; with a common farrier, that he ſhoes a horſe well, without laming him; with a common taylor, or other workman, that he performs his buſineſs in a workmanlike manner; in which if they fail, an action on the caſe lies to recover damages for ſuch breach of their general undertaking. Alſo if an innkeeper, or other victualler, hangs out a ſign and opens his houſe for travellers, it is an implied engagement to entertain all perſons who travel that way; and upon this univerſal *aſſumpſit* an action on the caſe will lie againſt him for damages, if he without good reaſon refuſes to admit a traveller. In contracts likewiſe for ſales, if the ſeller doth upon the ſale warrant it to be good, the law annexes a tacit contract to this warranty, that if it be not ſo, he ſhall make compenſation to the buyer: elſe it is an injury to good faith, for which an action on the caſe will lie to recover damages.

ASSUMPTION, a feſtival in the Romiſh church, in honour of the miraculous aſcent of the Virgin Mary into heaven: the Greek church, who alſo obſerve this feſtival, celebrate it on the 15th of Auguſt with great ceremony.

Assumption, in logic, is the minor or ſecond propoſition in a categorical ſyllogiſm.

Assumption is alſo uſed for a conſequence drawn from the propoſitions whereof an argument is compoſed.

Assumption, an iſland of North-America, in the gulph of St Lawrence, at the mouth of the great river of the ſame name. It is covered with trees. W. Long. 60. 40. N. Lat. 49. 30.

Assumption, a large and handſome town of Proper Paraguay, on the river of the ſame name in South America. It is a biſhop's ſee, is well peopled, and ſeated in a country fruitful in corn and fruits, whoſe trees are always green. There is likewiſe a quantity of paſture, and the air is temperate and ſalutary. W. Long. 60. 40. S. Lat. 34. 10.

ASSUMPTIVE arms, in heraldry, are ſuch as a perſon has a right to aſſume, with the approbation of his ſovereign, and of the heralds: thus, if a perſon, who has no right by blood, and has no coat of arms, ſhall captivate, in any lawful war, any gentleman, nobleman, or prince, he is, in that caſe, entitled to bear the ſhield of that priſoner, and enjoy it to him and his heirs for ever.

ASSURANCE, or Insurance, in commerce. See Insurance.

ASSUROR, a merchant, or other perſon, who makes out a policy of aſſurance, and thereby inſures a ſhip, houſe, or the like.

ASSUS, or Assos (anc. geog.), a town of Troas (though by others ſuppoſed to be of Myſia), and the ſame with Apollonia (Pliny); but different from the Apollonia on the river Rhyndacus. Ptolemy places it on the ſea-coaſt, but Strabo more inland; if he does not mean the head of an inland bay, as appears from Diodorus Siculus. It was the country of Cleanthes the ſtoic philoſopher, who ſucceeded Zeno. St Luke and others of St Paul's companions in his voyage (Acts xx. 13. 14), went by ſea from Troas to Aſſos: but St Paul went by land thither, and meeting them at Aſſos, they all went together to Mytelene. It is ſtill called *Aſſos*. E. Long. 27. 30. Lat. 38. 30.

ASSYRIA, an ancient kingdom of Aſia, concerning the extent, commencement, and duration of which, hiſtorians differ greatly in their accounts. Several ancient writers, in particular Cteſias and Diodorus Siculus, have affirmed, that the Aſſyrian monarchy, under Ninus and Semiramis, comprehended the greater part of the known world. Had this been the caſe, it is not likely that Homer and Herodotus would have omitted a fact ſo remarkable. The ſacred records intimate, that none of the ancient ſtates or kingdoms were of conſiderable extent; for neither Chederlaomer, nor any of the neighbouring princes, were tributary or ſubject to Aſſyria; and we find nothing of the greatneſs or power of this kingdom in the hiſtory of the Judges and ſucceeding kings of Iſrael, though the latter kingdom was oppreſſed and enſlaved by many different powers in that period. It is highly probable, therefore, that Aſſyria was originally of ſmall extent. According to Ptolemy, it was bounded on the north by Armenia Major; on the weſt by the Tigris; on the ſouth by Suſiana; and on the eaſt by Media.

It is probable, that the origin and revolutions of the Aſſyrian monarchy were as follows.—The founder of it was Aſhur, the ſecond ſon of Shem, who went out of Shinar, either by the appointment of Nimrod, or to elude the fury of a tyrant; conducted a large body of adventurers into Aſſyria, and laid the foundation of Nineveh (Gen. x. 11.) Theſe events happened not long after Nimrod had eſtabliſhed the Chaldæan monarchy, and fixed his reſidence at Babylon. The Perſian hiſtorians ſuppoſe that the kings of Perſia of the firſt dynaſty were the ſame with the kings of Aſſyria, of whom Zohah, or Nimrod, was the founder of Babel (Herbelot Orient. Bibl. v. *Bagdad*). It does not, however, appear, that Nimrod reigned in Aſſyria. The kingdoms of Babylon and Aſſyria, were originally diſtinct and ſeparate (Micah v. 6.), and in this ſtate they remained until Ninus conquered Babylon, and made it tributary to the Aſſyrian empire. Ninus, the ſucceſſor of Aſhur (Gen. x. 11. Diod. Sic. L. 1.), ſeized on Chaldæa, after the death of Nimrod, and united the kingdoms of Aſſyria and Babylon. This great prince is ſaid to have ſubdued Aſia, Perſia, Media, Egypt, &c. If he did ſo, the effects of his conqueſts were of no duration; for, in the days of Abraham, we do not find that any of the neighbouring kingdoms were ſubject to Aſſyria. He was ſucceeded by Semiramis; a princeſs of an heroic mind; bold, enterpriſing, fortunate; but of whom many fabulous things have been recorded. It appears, however, that there were two princeſſes of the ſame name, who flouriſhed at very different periods. One of them was the conſort of Ninus; and the other lived five generations before Nitocris queen of Nebuchadnezzar (Euſeb. Chron. p. 58. Herod. L. i. c. 184.) This fact has not been attended to by many writers.

Playfair's Chronology.

Whether there was an uninterrupted ſeries of kings from Ninus to Sardanapalus, or not, is ſtill a queſtion. Some ſuſpicion has ariſen, that the liſt which Cteſias has given of the Aſſyrian kings is not genuine; for many names in it are of Perſian, Egyptian, and Grecian extraction.

Nothing memorable has been recorded concerning the ſucceſſors of Ninus and Semiramis. Of that effeminate race of princes it is barely ſaid, that they aſcended the throne, lived in indolence, and died in their palace at Nineveh. Diodorus (L. ii.) relates, that, in the reign of Teutames, the Aſſyrians, ſolicited by Priam their vaſſal, ſent to the Trojans a ſupply of 20,000 foot and 200 chariots, under the command of Memnon, ſon of Tithonus preſident of Perſia: But the truth of this relation is rendered doubtful by the accounts of other writers.

Sardanapalus was the laſt of the ancient Aſſyrian kings. Contemning his indolent and voluptuous courſe of life, Arbaces, governor of Media, withdrew his allegiance, and roſe up in rebellion againſt him. He was encouraged in this revolt by the advice and aſſiſtance of Beleſis, a Chaldean prieſt, who engaged the Babylonians to follow the example of the Medes. Theſe powerful provinces, aided by the Perſians and other allies, who deſpiſed the effeminacy, or dreaded the tyranny of their Aſſyrian lords, attacked the empire on all ſides. Their moſt vigorous efforts were, in the beginning, unſucceſsful. Firm and determined, however, in their oppoſition, they at length prevailed, defeated the Aſſyrian army, beſieged Sardanapalus in his capital, which they demoliſhed, and became maſters of the empire, B. C. 821.

After the death of Sardanapalus, the Aſſyrian empire was divided into three kingdoms, viz. the Median, Aſſyrian, and Babylonian. Arbaces retained the ſupreme power and authority, and fixed his reſidence at Ecbatana in Media. He nominated governors in Aſſyria and Babylon, who were honoured with the title of *kings*, while they remained ſubject and tributary to the Median monarchs. Beleſis received the government of Babylon as the reward of his ſervices; and Phul was entruſted with that of Aſſyria. The Aſſyrian governor gradually enlarged the boundaries of his kingdom, and was ſucceeded by Tiglath-pileſer, Salmanaſar, and Sennacherib, who aſſerted and maintained their independency. After the death of Aſſar-haddon, the brother and ſucceſſor of Senacherib, the kingdom of Aſſyria was ſplit, and annexed to the kingdoms of Media and Babylon. Several tributary princes afterwards reigned in Nineveh; but no particular account of them is found in the annals of ancient nations. We hear no more of the kings of Aſſyria, but of thoſe of Babylon. Cyaxares king of Media, aſſiſted Nebuchadnezzar king of Babylon, in the ſiege of Nineveh, which they took and deſtroyed, B. C. 606. The Chaldean or Babyloniſh kingdom was transferred to the Medes, after the reign of Nabonadius, ſon of Evilmerodach, and grandſon of Nebuchadnezzar. He is ſtyled Belſhazzar in the ſacred records, and was conquered by Cyrus, B. C. 538.

ASSYTHMENT. See ASSITHMENT.

ASTA, an inland town of Liguria, a colony, (Ptolemy); on the river Tanarus: Now *Aſti.* E. Long. 8. 15. Lat. 44. 40.

ASTA Regia, a town of Bætica, (Pliny); ſituated at that mouth of the Bætis which was choaked up with mud, to the north of Cadiz; 16 miles diſtant from the port of Cadiz, (Antonine). Its ruins ſhow its former greatneſs. Its name is Phœnician, denoting a *frith* or arm of the ſea, on which it ſtood. It is ſaid to be the ſame with XERA; which ſee.

ASTABAT, a town of Armenia, in Aſia, ſituated near the river Aras, 12 miles ſouth of Nakſhivan. The land about it is excellent, and produces very good wine. There is a root peculiar to this country, called *ronas*; which runs in the ground like liquorice, and ſerves for dyeing red. It is very much uſed all over the Indies, and for it they have a great trade. E. Long. 46. 30. N. Lat. 39. 0.

ASTANDA, in antiquity, a royal courier or meſſenger, the ſame with ANGARUS.—King Darius of Perſia is ſaid by Plutarch, in his book on the fortune of Alexander, to have formerly been an *aſtanda.*

ASTAROTH, or ASHTAROTH, in antiquity, a goddeſs of the Sidonians.—The word is Syriac, and ſignifies *ſheep*, eſpecially when their udders are turgid with milk. From the fecundity of theſe animals, which in Syria continue to breed a long time, they formed the notion of a deity, whom they called *Aſtaroth*, or *Aſtarte*. See ASTARTE.

ASTAROTH, (anc. geog.) the royal reſidence of Og king of Baſhan; whether the ſame with Aſtaroth Carnaim, is matter of doubt: if one and the ſame, it follows from Euſebius's account, that it lay in Baſhan, and to the eaſt of Jordan, becauſe in the confines of Arabia.

ASTARTE, in Pagan mythology (the ſingular of Aſtaroth), a Phœnician goddeſs, called in Scripture the *queen of heaven*, and the *goddeſs of the Sidonians.* —Solomon, in complement to one of his queens, erected an alter to her. In the reign of Ahab, Jezebel cauſed her worſhip to be performed with much pomp and ceremony: ſhe had 400 prieſts; the women were employed in weaving hangings or tabernacles for her; and Jeremiah obſerves, that "the children gathered the "wood, the fathers kindled the fire, and the women "kneaded the dough, to make cakes for the queen of "heaven."

ASTARTE, (anc. geog.) a city on the other ſide Jordan; one of the names of Rabbath Ammon, in Arabia Petræa, (Stephanus).

ASTEISM, in rhetoric, a genteel irony, or handſome way of deriding another. Such, *e. gr.* is that of Virgil:

> *Qui Bavium non odit, amet tua carmina, Mævi,* &c.

Diomed places the characteriſtic of this figure, or ſpecies of irony, in that it is not groſs and ruſtic, but ingenious and polite.

ASTELL (Mary), the great ornament of her ſex and country, was the daughter of —— Aſtell, an opulent merchant of Newcaſtle upon Tyne, where ſhe was born about the year 1668. She was educated in a manner ſuitable to her ſtation; and, amongſt other accompliſhments, was miſtreſs of the French, and had ſome knowledge of the Latin tongue. Her uncle, a clergyman, obſerving in her ſome marks of a promiſing genius, took her under his tuition, and taught her mathematics, logic, and philoſophy. She left the place of her nativity when ſhe was but 20 years of age, and ſpent the remaining part of her life at London and at Chelſea. Here ſhe purſued her ſtudies with great aſſiduity, made great proficiency in the abovementioned ſciences, and acquired a more complete knowledge of many claſſic authors. Among theſe Seneca, Epictetus, Hierocles, Antoninus, Tully, Plato, and Xenophon, were her principal favorites.

Her life was ſpent in writing for the advancement of learning, religion, and virtue; and in the practice of thoſe religious duties which ſhe ſo zealouſly and pathetically recommended to others, and in which perhaps no one was ever more ſincere and devout. Her ſentiments of piety, charity, humility, and other Chriſtian graces, were uncommonly refined and ſublime; and religion ſat gracefully upon her, unattended with any forbidding airs of ſourneſs or of gloom. Her mind was generally calm and ſerene; and her converſation was innocently facetious, and highly entertaining. She would ſay, "The good Chriſtian only hath reaſon, and he always ought, to be cheerful;" and, "That dejected looks and melancholy airs were very unſeemly in a Chriſtian." But theſe ſubjects ſhe hath treated at large in ſome of her excellent writings.

She was remarkably abſtemious; and ſeemed to enjoy an uninterrupted ſtate of health till a few years before her death; when, having one of her breaſts cut off, it ſo much impaired her conſtitution, that ſhe did not long ſurvive it. This painful operation ſhe underwent without diſcovering the leaſt timidity, or ſo much as uttering a groan; and ſhowed the ſame reſolution and reſignation during her whole illneſs. When ſhe was confined to her bed by a gradual decay, and the time of her diſſolution drew near, ſhe ordered her ſhroud and coffin to be made and brought to her bedſide; and there to remain in her view, as a conſtant memento of her approaching fate, and to keep her mind fixed on proper contemplation. She died in the year 1731, in the 63d year of her age, and was buried at Chelſea. She wrote, 1. A Serious Propoſal to the Ladies. 2. An Eſſay in Defence of the Female Sex. 3. Letters concerning the Love of God. 4. Reflections upon Marriage. 5. Moderation truly ſtated. 6. The Chriſtian Religion, as profeſſed by a Daughter of the Church of England; and ſome other works.

ASTER, STARWORT: A genus of the polygamia ſuperflua order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ diſcoides.* The receptacle is naked; the papus is ſimple; the rays of the corolla are 10; and the calyx is imbricated. There are above 30 ſpecies. All of them may be raiſed from ſeed ſown either in autumn or ſpring: but the greateſt part of them being perennial plants, and increaſing greatly at the roots, are generally propagated by parting their roots early in the ſpring, and they will grow in almoſt any ſoil or ſituation; and the larger ſorts increaſe ſo faſt, that, if not prevented, they will in a little time run over a large ſpace of ground. They grow beſt in the ſhade: the lower kinds do not run ſo much at the root, but ſhould be taken up and tranſplanted every other year; which will make them produce much fairer flowers. Some few ſorts, which are natives of warm climates, will require artificial heat to raiſe them, if not to preſerve them.

ASTER, or *Stella Marina*, in zoology. See ASTERIAS.

ASTERABAD, a province in the north-eaſt part of Perſia, having Tabriſtan on the weſt, part of the Caſpian Sea and part of Jorjan on the north, Koraſan on the weſt, and Koumas on the ſouth. It is a mountainous country, except near the banks of the rivers that almoſt ſurround it, where it is pleaſant, and fruitful, producing grapes of a prodigious ſize. In other parts the ſoil is ſandy and barren. Aſterabad is the chief town, which gives name to a gulph in the Perſian Sea, at the bottom of which it ſtands. E. Long. 54. 35. N. Lat. 36. 50.

ASTERIA, in zoology, a name by which ſome authors have called the *falco palumbarius*, or *goſhawk.* See FALCO.

ASTERIA is alſo the name of a gem, uſually called the *cat's eye*, or *oculus cati.* It is a very ſingular and very beautiful ſtone, and ſomewhat approaches to the nature of the opal, in having a bright included colour, which ſeems to be lodged deep in the body of the ſtone, and ſhifts about, as it is moved, in various directions: but it differs from the opal in all other particulars, eſpecially in its want of the great variety of colours ſeen in that gem, and in its ſuperior hardneſs. It is uſually found between the ſize of a pea and the breadth of a ſixpence; is almoſt always of a ſemicircular form, broad and flat at the bottom, and rounded and convex at the top; and is naturally ſmooth and poliſhed. It has only two colours, a pale brown and a white; the brown ſeeming the ground, and the white playing about in it, as the fire colour in the opal. It is conſiderably hard, and will take a fine poliſh, but is uſually worn with its native ſhape and ſmoothneſs. It is found in the Eaſt and Weſt Indies, and in Europe. The iſland of Borneo affords ſome very fine ones, but they are uſually ſmall; they are very common in the ſands of rivers in New Spain; and in Bohemia they are not unfrequently found immerſed in the ſame maſſes of jaſper with the opal.

ASTERIA is alſo the name of an extraneous foſſil, called in Engliſh the *ſtar-ſtone.* Theſe foſſils are ſmall, ſhort, angular, or ſulcated columns, between one and two inches long, and ſeldom above a third of an inch in diameter: compoſed of ſeveral regular joints; when ſeparated, each reſembles a radiated ſtar. They are, not without reaſon, ſuppoſed to be a part of ſome ſea-fiſh petrified, probably the aſterias or ſea-ſtar. The aſteria is alſo called *aſtrites, aſtroites,* and *aſteriſcus.* They may be reduced to two kinds: thoſe whoſe whole bodies make the form of a ſtar; and thoſe which in the whole are irregular, but are adorned as it were with conſtellations in the parts. Dr Liſter, for diſtinction's ſake, only gives the name *aſteria* to the former ſort, diſtinguiſhing the latter by the appellation of *aſtroites;* other naturaliſts generally uſe the two indiſcriminately. The aſteria ſpoken of by the ancients appears to be of this latter kind. The quality of moving in vinegar, as if animated, is ſcarce perceivable in the aſtroites, but is ſignal in the aſteria. The former muſt be broken in ſmall pieces before it will move; but the latter will move, not only in a whole joint, but in two or three knit together. The curious frequently meet with theſe ſtones in many parts of England: at Cleydan in Oxfordſhire they are found rather larger than common, but of a ſofter ſubſtance; for, on being left a ſmall ſpace of time in a ſtrong acid, they may eaſily be ſeparated at the joints in ſmall plates.

ASTERIAS, STAR-FISH, or SEA-STAR, in zoology, a genus of inſects of the order of vermes molluſca. It has a depreſſed body, covered with a coriaceous coat; is compoſed of five or more ſegments, running out from a central part, and furniſhed with numerous tentacula; and has the mouth in the centre.—The conformation of the mouth is this: The under part of each lobe runs towards a point with the reſt at the centre of the body; and theſe ſeveral productions of the rays make a ſort of lips, the ends of each of which are armed with a number of ſharp teeth, which ſerve to take and convey the food into the body. From this mouth there goes a ſeparate canal to all or many of the rays, which runs through their whole length, and becomes gradually narrower as it approaches the extremity. The tentacula reſembles the horns of ſnails, but ſerve the animal to walk with. They are capable of being contracted or ſhortened: and it is only at the creature's moving that they are ſeen of their full length; at other times, no part of them is ſeen but the extremity of each, which is formed like a ſort of button, being ſomewhat larger than the reſt of the horn.

Moſt of the ſpecies of aſterias are found in the Britiſh ſeas. 1. The glacialis, with five rays, depreſſed, broad at the baſe, yellow, and having a round ſtriated operculum on the back, is the moſt common; it feeds on oyſters, and is very deſtructive to the beds. 2. The clathatra, or cancellated ſea-ſtar, with five ſhort thick rays, hirſute beneath, cancellated above, is found with the former, but more rare. 3. The oculata, with five ſmooth rays, dotted or punctured, is of a fine purple colour, and is found about Angleſea. 4. The hiſpida, with five rays, broad, angulated at top, and rough with ſhort briſtles, is of a brown colour, and likewiſe found about Angleſea. 5. The placenta, with five very broad and membranaceous rays, extremely thin and flat, is found about Weymouth. 6. The ſpherulata, with a pentagonal indented body; a ſmall globular bead between the baſe of each ray; the rays ſlender, jointed, taper, and hirſute on their ſides; found off Angleſea. 7. The caput meduſæ, or aboreſcent ſea-ſtar, with five rays iſſuing from an angular body; the rays dividing into innumerable branches, growing ſlender as they recede from the baſe. Theſe the animal, in ſwimming, ſpreads like a net to their full length; and when he perceives any prey within them, draws them in again, thus catching it with all the dexterity of a fiſherman. It is an inhabitant of every ſea, and is called by ſome the *Magellanic ſtar-fiſh* and *baſket-fiſh*. When it extends its rays fully, it forms a circle of three feet diameter. The fragments of theſe rays furniſh the foſſile entrochi. If we drown this animal in brandy or ſpirits of wine, and keep the rays flat and expanded in the execution, it is eaſy to extract, by means of a pair of forceps, the ſtomach of the animal whole and entire through the mouth. The decacnemos, has ten ſlender rays, with numbers of long beards on the ſides: the body is ſmall, and ſurrounded beneath with ten ſmall filiform rays. It inhabits the weſtern coaſts of Scotland.—There are ſeveral other ſpecies mentioned by authors; ſome of them of 10, 12, 13, or even 14 rays.

Ariſtotle and Pliny called this genus αϛηρ, and *ſtella marina*, from their reſemblance to the pictured form of the ſtars of heaven; and they aſſerted that they were ſo exceedingly hot, as inſtantly to conſume whatſoever they touched.

The foſſil world has been greatly enriched by the fragments and remains of the ſeveral pieces of ſtar-fiſh which have been converted into ſtones. See **Asteria**.

Asterias, the ancient name of the bittern. See **Ardea**.

ASTERISK, a mark in form of a ſtar (*), placed over a word or ſentence, to refer the reader to the margin, or elſewhere, for a quotation, explanation, or the like.

ASTERIUS, or **Asturius**, a Roman conſul, in 449. We have under his name, *A Conference on the Old and New Teſtament*, in Latin verſe: in which each ſtrophe contains, in the firſt verſe, an hiſtorical fact in the Old Teſtament; and in the ſecond, an application of that fact to ſome point in the New.

ASTERN, a ſea-phraſe, uſed to ſignify any thing at ſome diſtance behind the ſhip, being the oppoſite of **Ahead**, which ſignifies the ſpace before her. See **Ahead**.

ASTEROPODIUM, a kind of extraneous foſſil, of the ſame ſubſtance with the aſteriæ or ſtar-ſtones, to which they ſerve as a baſe. See **Asteria** and **Star-stone**.

ASTHMA, See the *Index* ſubjoined to **Medicine**.

ASTI, a city of Montferrat in Italy, ſeated on the Tanaro, and capital of the county of the ſame name. It is a biſhop's ſee, and well fortified with ſtrong walls and deep ditches; and is divided into the city, borough, citadel, and caſtle. There are a great many churches and convents, as well as other handſome buildings; and its territory is well watered, abounding with groves, pleaſant hills, and ſpacious fields. It was taken by the French in 1745, and retaken by the king of Sardinia in 1746. E. Long. 8. 15. N. Lat. 54. 50.

ASTIGI, (anc. geog.), a colony, and conventus juridicus, of Bætica, ſurnamed *Auguſta Firma*, ſituated on the Singulus, which falls into the Bætis; called alſo *Colonia Aſtigitana* (Pliny): Now *Ecya*, midway between Seville and Corduba. W. Long. 5°. Lat. 37. 20.

ASTOMI, in anthropology, a people feigned without mouths. Pliny ſpeaks of a nation of Aſtomi in India, who lived only by the ſmell or effluvia of bodies taken in by the noſe.

ASTORGA, a very ancient city of Spain, in the kingdom of Leon, with a biſhop's ſee, is ſeated on the river Tuerta, and well fortified both by art and nature. It ſtands in a moſt agreeable plain, about 150 miles north-weſt of Madrid. There are excellent trouts in the river. W. Long. 6. 20. N. Lat. 42. 20.

ASTRACAN, a province of Ruſſia, and the moſt eaſterly part of Europe; bounded on the north by Bulgaria, and Baſkiria; on the ſouth, by the Caſpian Sea; on the weſt, by the Volga, which divides it from the Nagayan Tartars and Don Coſſacks; and on the eaſt; by the great ridge of mountains which part it from Great Tartary. The province extends from the 46th to the 52d degree of latitude. The ſummer is long, and intenſely hot: the winter continues about three months ſo ſevere, that the Volga is frozen hard enough to bear loaded ſledges. The ſoil is rich and fertile; but the Tartars who inhabit it are ſtrangers to agriculture. On the weſtern and ſouthern ſides of the Volga are heaths of a prodigious extent, ſandy, deſert, and uncultivated: theſe, however, produce vaſt quantities of fine tranſparent ſalt in pits, where the ſun bakes and incruſtates it to the thickneſs of an inch on the ſurface of the water. There are pits in the neighbourhood of Aſtracan which yield this excellent ſalt in ſuch abundance, that any perſon may carry it off, paying at the rate of one farthing a pooſt, which is equal to forty pounds. The metropolis Aſtracan, is ſituated within the boundaries of Aſia, on the iſland called *Dolgoi*, about 60 Engliſh miles above the place where the Volga diſembogues itſelf into the Caſpian Sea. The city derives its name from Hadgee Tarken, a Tartar, by whom it was founded. It was conquered by Iwan Baſilowitz, recovered by the Tartars in the year 1668, and retaken by the Czar, who employed for this purpoſe a great number of flat-bottomed veſſels, in which he tranſported his forces down the Volga from Caſan.

The city of Aſtracan is about two miles and a half in circumference, ſurrounded by a brick-wall, which is now in a ruinous condition: but if we comprehend the ſuburbs, the circuit will be near five miles. The number of inhabitants amounts to 70,000, including Armenians and Tartars, as well as a few Perſians and Indians. The garriſon conſiſts of ſix regiments of the beſt Ruſſian troops, who, when this place was alarmed from the ſide of Perſia, had in the adjacent plain erected a great number of ſmall batteries to ſcour the fields, and obſtruct the approach of the enemy. The houſes of Aſtracan are built of wood, and generally mean and inconvenient. The higher parts of the city command a proſpect of the Volga, which is here about three miles in breadth, and exhibits a noble appearance. The marſhy lands on the banks of it render the place very ſickly in the ſummer: the earth being impregnated with ſalt is extremely fertile, and produces abundance of fruit, the immoderate uſe of which is attended with epidemical diſtempers. Sickneſs is likewiſe the conſequence of thoſe annual changes in the atmoſphere produced by the floods in ſpring and autumn. All round the city of Aſtracan, at the diſtance of two miles, are ſeen a vaſt number of gardens, orchards, and vineyards, producing all ſorts of herbs and roots. The grapes are counted ſo delicious, that they are preſerved in ſand, and tranſported to court by land-carriage at a prodigious expence: yet the wine of Aſtracan is very indifferent. The ſummer being generally dry, the inhabitants water their gardens by means of large wheels worked by wind or horſes, which raiſe the water to the higheſt part of the garden, from whence it runs in trenches to refreſh the roots of every ſingle tree and plant. The neighbouring country produces hares and partridges, plenty of quails in ſummmer, with wild and water fowl of all ſorts in abundance.

About ten miles below Aſtracan is a ſmall iſland called *Boſmaiſe*, on which are built large ſtorehouſes for the ſalt, which is made about twelve miles to the eaſtward, and, being brought hither in boats, is conveyed up the Volga, in order to ſupply the country as far as Moſcow and Twere. The quantity of ſalt annually dug for theſe purpoſes amounts to ſome millions of pounds, the excluſive property of which is claimed by the crown, and yields a conſiderable revenue; for the ſoldiers and bulk of the people live almoſt entirely on bread and ſalt. The neighbourhood of theſe ſalt-works is of great advantage to the fiſheries, which extend from hence to the Caſpian Sea, and reach to the ſouth-eaſt as far as Yack, and even 100 miles above Zaritzen. The principal fiſh here caught are ſturgeon and belluga. Theſe being ſalted, are put on board of veſſels, and ſent away in the ſpring, for the uſe of the whole empire, even as far as Peterſburgh: but as fiſh may be kept freſh as long as it is frozen, the winter is no ſooner ſet in than they tranſport great quantities of it by land through all the provinces of Ruſſia. Of the roes of the fiſh called *belluga*, which are white, tranſparent, and of an agreeable flavour, the fiſhers here prepare the caviare; which is in ſo much eſteem all over Europe. Theſe fiſheries were firſt eſtabliſhed by one Tikon Demedoff, a carrier, who ſettled in this place about 60 years ago, his whole wealth conſiſting of two horſes. By dint of ſkill and induſtry, he ſoon grew the richeſt merchant in this country: but his ſucceſs became ſo alluring to the crown, that of late years it hath engroſſed ſome of the fiſheries as well as the ſalt-works.

From the latter end of July to the beginning of October, the country about Aſtracan is frequently infeſt-eſt with myriads of locuſts, which darken the air in their progreſſion from the northward to the ſouthward; and, wherever they fall, conſume the whole verdure of the earth. Theſe inſects can even live for ſome time under water; for when the wind blows acroſs the Volga, vaſt numbers of them fall in cluſters and are rolled aſhore; and their wings are no ſooner dry, than they riſe and take flight again.

Heretofore the inhabitants of Aſtracan traded to Khuva and Bokhara; but at preſent theſe branches are loſt, and their commerce is limited to Perſia and the dominions of Ruſſia. Even the trade of Perſia is much diminiſhed by the troubles of that country: nevertheleſs, the commerce of Aſtracan is ſtill conſiderable. Some years ago the city maintained about 40 veſſels, from 100 to 200 tons burden, for the Caſpian traffic. Some of theſe belong to the government, and are commanded by a commodore, under the direction of the admiralty. This office is generally well ſtocked with naval ſtores, which are ſold occaſionally to the merchants. The trading ſhips convey proviſions to the frontier towns of Terkie and Kiſlar, ſituated on the Caſpian Sea; and tranſport merchandize to ſeveral parts of Perſia. The merchants of Aſtracan export to Perſia, chiefly on account of the Armenians, red leather, linens, woollen cloths, and other European manufactures. In return, they import the commodities of Perſia, particularly thoſe manufactured at Caſan; ſuch as ſilk ſaſhes intermixed with gold, for the uſe of the Poles; wrought ſilks and ſtuffs mixed with cotton; rice, cotton; rhubarb, and a ſmall quantity of other drugs; but the chief commodity is raw ſilk. The government has engroſſed the article of rhubarb, the greater part of which is brought into Ruſſia by the Tartars of Yakutſki, bordering on the eaſtern Tartars belonging to China. They travel through Siberia to Samura, thence to Caſan, and laſtly to Moſcow. The revenue of Aſtracan is computed at 150,000 rubles, or 33,000 pounds, ariſing chiefly from ſalt and fiſh. The city is ruled by a governor, under the check of a chancery. He is nevertheleſs arbitrary enough, and exerciſes oppreſſion with impunity. The officers of the admiralty and cuſtom-houſe having very ſmall ſalaries, are open to corruption, and extremely rapacious. At chriſtening-feaſts which are attended with great intemperance, the gueſts drink a kind of cherry-brandy out of large goblets; and every perſon invited throws a preſent of money into the bed of the mother, who ſits up with great formality to be ſaluted by the company.

The Indians have a Pagan temple at Aſtracan, in which they pay their adoration, and make offerings of fruit to a very ugly deformed idol. The prieſts of this pagod uſe incenſe, beads, cups, and proſtrations. The Tartars, on the contrary, hold idol-worſhip in the utmoſt abomination.

ASTRÆA, in aſtronomy, a name which ſome give to the ſign Virgo, by others called *Erigone*, and ſometimes *Iſis*. The poets feign that juſtice quitted heaven to reſide on earth, in the golden age; but growing weary of the iniquities of mankind, ſhe left the earth, and returned to heaven, where ſhe commenced a conſtellation of ſtars, and from her orb ſtill looks down on the ways of men.

ASTRAGAL, in architecture, a little round moulding, which in the orders ſurround the top of the ſhaft or body of the column. It is alſo called the *talon* and *tondino*; it is uſed at the bottoms as well as tops of columns, and on other occaſions: it properly repreſents a ring, on whatever part of a column it is placed; and the original idea of it was that of a circle of iron put round the trunk of a tree, uſed to ſupport an edifice to prevent its ſplitting. See Plate XXXVI. fig. 2. The aſtragal is often cut into beads and berries, and is uſed in the ornamented entablatures to ſeparate the ſeveral faces of the architrave.

Astragal, in gunnery, a round moulding encompaſſing a cannon, about half a foot from its mouth.

ASTRAGALOMANCY, a ſpecies of divination performed by throwing ſmall pieces, with marks correſponding to the letters of the alphabet; the accidental diſpoſition of which formed the anſwer required. This kind of divination was practiſed in a temple of Hercules, in Achaia. The word is derived from αςραγαλος, and μαντεια, *divination*.

ASTRAGALLUS, Milk-vetch, or Liquorice-vetch: A genus of the decandria order, belonging to the diadelphia claſs of plants: and in the natural method ranking under the 32d order, *Papilionaceæ*. The pod is gibbous and bilocular. Of this genus there are 39 ſpecies. The common ſort grows wild upon dry uncultivated places, and is recommended by Mr Anderſon to be cultivated as proper food for cattle (See Agriculture, n° 60, 61.). The other ſpecies deſerving notice is the tragagantha, a thorny buſh growing in Crete, Aſia, and Greece, which yields the gum tragracanth. This is of ſo ſtrong a body, that a dram of it, will give a pint of water the conſiſtence of a ſyrup, which a whole ounce of gum Arabic is ſcarce ſufficient to do. Hence its uſe for forming torches, and the like purpoſes, in preference to the other gums.

Astragalus, in anatomy. See there n° 65.

ASTRANTIA, Masterwort: A genus of the digynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 45th order, *Umbellatæ*. The involucrum is lanceolated, open, equal, and coloured. The ſpecies are two, the major and minor, both natives of the Alps, and poſſeſſing no remarkable properties.

ASTRICTION, in law. See Thirlage.

Astriction, among phyſicians, denotes the operation of aſtringent medicines.

ASTRINGENTS, in the materia medica, ſubſtances diſtinguiſhed by a rough auſtere taſte, and changing ſolutions of iron, eſpecially thoſe made in the vitriolic acid, into a dark purple or black colour; ſuch are galls, tormentil root, biſtort root, balauſtines, terra Japonica, acacia, &c. See Materia Medica.

ASTROGNOSIA, the ſcience of the fixed ſtars, or the knowledge of their names, conſtellations, magnitudes, &c. See Astronomy.

ASTROITES, or Star-Stone, in natural hiſtory. See the articles Asteria and Star-Stone; and Plate LVI.

ASTROLABE, the name of a ſtereographic projection of the ſphere, either upon the plane of the equator, the eye being ſuppoſed to be in the pole of the world; or upon the plane of the meridian, when the eye is ſuppoſed in the point of the interſection of the equinoxial and horizon.

Astrolabe is alſo the name of an inſtrument formerly uſed for taking the altitude of the ſun or ſtars at ſea.

Astrolabe, among the ancients, was the ſame as our armillary ſphere.

ASTROLOGY, a conjectural ſcience, which teaches to judge of the effects and influences of the ſtars, and to foretel future events by the ſituation and different aſpects of the heavenly bodies.

This ſcience has been divided into two branches; *natural* and *judiciary*. To the former belongs the predicting of natural effects; as the changes of weather, winds, ſtorms, hurricanes, thunder, floods, earthquakes, &c. This art properly belongs to natural philoſophy; and is only to be deduced *a poſteriori*, from phenomena and obſervations. Judiciary or judicial aſtrology, is that which pretends to foretel moral events, i. e. ſuch as have a dependence on the free will and agency of man; as if they were directed by the ſtars. This art, which owed its origin to the practices of knavery on credulity, is now univerſally exploded by the intelligent part of mankind.

The profeſſors of this kind of aſtrology maintain, "That the heavens are one great volume or book, wherein God has written the hiſtory of the world; and in which every man may read his own fortune, and the tranſactions of his time. The art, ſay they, had its riſe from the ſame hands as aſtronomy itſelf: while the ancient Aſſyrians, whoſe ſerene unclouded ſky favoured their celeſtial obſervations, were intent on tracing the paths and periods of the heavenly bodies, they diſcovered a conſtant ſettled relation of analogy between them and things below; and hence were led to conclude theſe to be the Parcæ, the Deſtinies, ſo much talked of, which preſide at our births, and diſpoſe of our future fate.

"The laws therefore of this relation being aſcertained by a ſeries of obſervations, and the ſhare each planet has therein; by knowing the preciſe time of any perſon's nativity, they were enabled, from their knowledge in aſtronomy, to erect a ſcheme or horoſcope of the ſituation of the planets at that point of time; and hence, by conſidering their degrees of power and influence, and how each was either ſtrengthened or tempered by ſome other, to compute what muſt be the reſult thereof."

Thus the aſtrologers.—But the chief province now remaining to the modern profeſſors, is the making of kalendars or almanacks.

Judicial aſtrology is commonly ſaid to have been invented in Chaldea, and thence tranſmitted to the Egyptians, Greeks, and Romans; though ſome will have it of Egyptian origin, and aſcribe the invention to Cham. But it is to the Arabs that we owe it. At Rome, the people were ſo infatuated with it, that the aſtrologers, or, as they were then called, the *mathematicians*, maintained their ground in ſpite of all the edicts of the emperors to expel them out of the city. See GENETHLIACI.

Add, that the Bramins, who introduced and practiſed this art among the Indians, have hereby made themſelves the arbiters of good and evil hours, which gives them great authority: they are conſulted as oracles; and they have taken care never to ſell their anſwers but at good rates.

The ſame ſuperſtition has prevailed in more modern ages and nations. The French hiſtorians remark, that in the time of queen Catharine de Medicis, aſtrology was in ſo much vogue, that the moſt inconſiderable thing was not to be done without conſulting the ſtars. And in the reigns of king Henry III. and IV. of France, the predictions of aſtrologers were the common theme of the court converſation. This predominant humour in that court was well rallied by Barclay, in his *Argenis*, lib. ii. on occaſion of an aſtrologer, who had undertaken to inſtruct king Henry in the event of a war then threatened by the faction of the Guiſes.

ASTRONIUM, in botany: A genus of the pentandria order, belonging to the diœcia claſs of plants. The male calyx conſiſts of five leaves, and the corolla is quinquepetalous: Of the female the calyx and corolla are the ſame as in the male; the ſtyli are three, and the ſeed is ſingle. There is but one ſpecies, the graveolens, a native of Jamaica.

ASTRONOMICAL, ſomething relating to ASTRONOMY.

ASTRONOMICAL Calendar, an inſtrument engraved on copper plates, printed on paper, and paſted on a board, with a braſs ſlider carrying a hair: it ſhows by inſpection the ſun's meridian altitude, right aſcenſion, declination, riſing, ſetting, amplitude, &c. to a greater degree of exactneſs than the common globes.

ASTRONOMICAL Sector, a very uſeful mathematical inſtrument, made by the late ingenious Mr Graham; a deſcription of which is given in the courſe of the following article.

ASTRONOMY,

IS a knowledge of the heavenly bodies, with regard to their magnitudes, motions, diſtances, &c. whether real or apparent; and of the natural cauſes on which their phenomena depend.

Hiſtory of Aſtronomy.

The antiquity of this ſcience may be gathered from what was ſpoken by the Deity at the time of creating the celeſtial luminaries, "Let them be for ſigns and ſeaſons," &c. whence it is thought probable that the human race never exiſted without ſome knowledge of aſtronomy among them. Indeed, beſides the motives of mere curioſity, which of themſelves may be ſuppoſed to have excited people to a contemplation of the glorious celeſtial canopy, as far as that was poſſible, it is eaſily to be ſeen that ſome parts of the ſcience anſwer ſuch eſſential purpoſes to mankind, that they could not poſſibly be diſpenſed with.

1 Aſtronomy ſuppoſed to be underſtood by Adam and the Antediluvians.

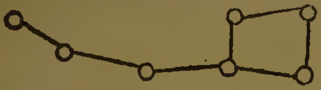
By ſome of the Jewiſh rabbins, Adam, in his ſtate of innocence, is ſuppoſed to have been endowed with a knowledge of the nature, influence and uſes of the heavenly bodies; and Joſephus aſcribes to Seth and his poſterity an extenſive knowledge of aſtronomy. But whatever may be in this, the long lives of the Antediluvians certainly afforded ſuch an excellent opportunity for obſerving the celeſtial bodies, that we cannot but ſuppoſe the ſcience of aſtronomy to have been conſiderably advanced before the flood. Joſephus ſays, that longevity was beſtowed upon them for the very purpoſe of improving the ſciences of geometry and aſtronomy. The latter could not be learned in leſs that 600 years: "for that period (ſays he) is the *grand year*." By which it is ſuppoſed he meant the period wherein the ſun and moon came again into the ſame ſituation as they were in the beginning thereof, with regard to the nodes, apogee of the moon, &c. "This period (ſays Caſſini), whereof we find no intimation in any monument of any other nation, is the fineſt period that ever was invented: for it brings out the ſolar year more exactly than that of Hipparchus and Ptolemy; and the lunar month within about one ſecond of what is determined by modern aſtronomers. If the Antediluvians had ſuch a period of 600 years, they muſt have known the motions of the ſun and moon more exactly than their deſcendants knew them ſome ages after the flood."

2 Aſtronomical knowledge of the Chineſe.

On the building of the tower of Babel, Noah is ſuppoſed to have retired with his children born after the flood, to the north-eaſtern part of Aſia, where his deſcendants peopled the vaſt empire of China. "This (ſays Dr Long) may perhaps account for the Chineſe having ſo early cultivated the ſtudy of aſtronomy; their being ſo well ſettled in an admirable police, and continuing ſo many hundred years as they did in the worſhip of the true God." The vanity of that people indeed has prompted them to pretend a knowledge of aſtronomy almoſt as early as the flood itſelf. Some of the Jeſuit miſſionaries have found traditional accounts among the Chineſe, of their having been taught this ſcience by their firſt emperor Fo-hi, ſuppoſed to be Noah; and Kempfer informs us, that this perſonage diſcovered the motions of the heavens, divided time into years and months, and invented the twelve ſigns into which they divide the zodiac, which they diſtinguiſh by the following

3
Their names for the ſigns of the zodiac.

following names. 1. The mouſe. 2. The ox or cow. 3. The tiger. 4. The hare. 5. The dragon. 6. The ſerpent. 7. The horſe. 8. The ſheep. 9. The monkey. 10. The cock or hen. 11. The dog; and, 12. The boar. They divide the heavens into 28 conſtellations, four of which are aſſigned to each of the ſeven planets; ſo that the year always begins with the ſame planet; and their conſtellations anſwer to the 28 manſions of the moon uſed by the Arabian aſtronomers. Theſe conſtellations in the Chineſe books of aſtronomy, are not marked by the figures of animals, as was in uſe among the Greeks, and from them derived to the other European nations, but by connecting the ſtars by ſtraight lines: and Dr Long informs us, that in a Chineſe book in thin 4to, ſhown him by Lord Pembroke, the ſtars were repreſented by ſmall circles joined by lines; ſo that the great bear would be marked thus,



To the emperor Hong-ti, the grandſon of Noah, they attribute the diſcovery of the pole-ſtar, the invention of the mariner's compaſs, of a period of 60 years, and ſome kind of ſphere. This extraordinary antiquity, however, is with good reaſon ſuſpected, as is likewiſe their knowledge in the calculation of eclipſes; of which Du Halde aſſures us, that 36 are recorded by Confucius himſelf, who lived 551 years before Chriſt; and P. Trigault, who went to China in 1619, and read more than 100 volumes of their annals, ſays, "It is certain that the Chineſe began to make aſtronomical obſervations ſoon after the flood; that they have obſerved a great number of eclipſes, in which they have noted down the hour, day, month, and year, when they happened, but neither the duration nor the quantity; and that theſe eclipſes have been made uſe of for regulating their chronology."

"But out of this abundance (ſays Dr Long), it is much to be regretted, that ſo very few of their obſervations have been particularized; for beſide what has been mentioned above, we meet with no very ancient obſervations of the Chineſe, except a winter ſolſtice in the year 1111, and a ſummer ſolſtice in the year 882, before Chriſt. Martini indeed ſpeaks of a ſummer ſolſtice 2342 years before that period. But M. Caſſini, who calculated it, found that there muſt have been an error in the Chineſe computation of 500 years at leaſt. An error of equal magnitude appears to have been committed in the conjunction of the five planets, which it is pretended they obſerved between the years 2513 and 2435 before Chriſt. In ſhort, ſome have ſuppoſed, that none of theſe are real obſervations, but the reſult of bungling calculations: and it has been hinted, but ſurely on too ſlight a foundation, that even thoſe good fathers themſelves were greatly to be ſuſpected. But let us come to things which are not conteſted.

"P. Gaubil informs us, that at leaſt 120 years before Chriſt, the Chineſe had determined by obſervation the number and extent of their conſtellations as they now ſtand; the ſituation of the fixed ſtars with reſpect to the equinoctial and ſolſtitial points; and the obliquity of the ecliptic. He farther ſays, he cannot tell by what means it is that they foretel eclipſes: but this is certain, that the theory by which they do predict them was ſettled about the ſame time; and that they were acquainted with the true length of the ſolar year, the method of obſerving meridian altitudes of the ſun by the ſhadow of a gnomon, and of learning from thence his declination and the height of the pole, long before. We learn, moreover, from the ſame miſſionary, that there are yet remaining among them ſome treatiſes of aſtronomy, which were written about 200 years before Chriſt; from which it appears, that the Chineſe had known the daily motion of the ſun and moon, and the times of the revolutions of the planets, many years before that period.

"We are informed by Du Halde, that, in the province of Honan, and city Teng-foang, which is nearly in the middle of China, there is a tower, on the top of which it is ſaid that *Toheou-cong*, the moſt ſkilful aſtronomer that ever China produced, made his obſervations. He lived 1200 years before Ptolemy, or more than 1000 years before Chriſt, and paſſed whole nights in obſerving the celeſtial bodies and arranging them into conſtellations. He uſed a very large braſs table placed perfectly horizontal, on which was fixed a long upright plate of the ſame metal, both of which were divided into degrees, &c. By theſe he marked the meridian altitudes; and from thence derived the times of the ſolſtices, which were their principal epocha."

Dr Long repreſents the ſtate of aſtronomy in China as at preſent very low; occaſioned, he ſays, principally by the barbarous decree of one of their emperors*, to have all the books in the empire burnt, excepting ſuch as related to agriculture and medicine. We are informed, however, by the Abbe Groſier, in his deſcription of China, that aſtronomy is cultivated in Peking in the ſame manner as in moſt of the capital cities of Europe. A particular tribunal is eſtabliſhed there, the juriſdiction of which extends to every thing relating to the obſervation of celeſtial phenomena. Its members are, an inſpector; two preſidents, one of them a Tartar and the other a Chineſe; and a certain number of mandarins who perform the duty of aſſeſſors; but for near a century and an half the place of the Chineſe preſident has been filled by an European. Since that time particular attention has been paid to the inſtruction of the aſtronomical pupils; and the preſidents have always conſidered it as their duty to make them acquainted with the ſyſtem and method of calculation made uſe of in Europe. Thus two-thirds of the aſtronomical pupils, maintained at the emperor's expence, in all about 200, have a tolerable notion of the ſtate of the heavens, and underſtand calculation ſo well as to be able to compoſe ephemerides of ſufficient exactneſs. The miſſionaries have never been the authors of any of theſe ephemerides: their employment is to reviſe the labours of the Chineſe mathematicians, verify their calculations, and correct any errors into which they have fallen. The Portugueſe miſſion ſtill continues to furniſh aſtronomers for the academy as it did at the firſt.

* See *China*

The aſtronomical tribunal is ſubordinate to that of ceremonies. When an eclipſe is to be obſerved, information muſt be given to the emperor of the day and hour, the part of the heavens where it will be, &c. and this intelligence muſt be communicated ſome months before it happen; the eclipſe muſt alſo be calculated for the longitude and latitude of the capital city of every province of the empire. Theſe obſervations, as well as the diagram which repreſents the eclipſe, are preſerved by the tribunal of ceremonies, and another called the *calao*, by whom it is tranſmitted to the different provinces and cities of the empire. Some days before the eclipſe, the tribunal of ceremonies cauſes to be fixed up in a public place, in large characters, the hour and minute when the eclipſe will commence; the quarter of the heavens in which it will be viſible, with the other particulars relating to it. The mandarins are ſummoned to appear in ſtate at the tribunal of aſtronomy, and to wait there for the moment in which the phenomenon will take place. Each of them carries in his hand a ſheet of paper, containing a figure of the eclipſe and every circumſtance attending it. As ſoon as the obſervation begins to take place, they throw themſelves on their knees, and knock their heads againſt the earth, and a horrid noiſe of drums and cymbals immediately commences throughout the whole city: a ceremony proceeding from an ancient ſuperſtitious notion, that by ſuch noiſe they prevented the luminary from being devoured by the celeſtial dragon; and tho' this notion is now exploded in China, as well as every where elſe, ſuch is the attachment of the people to ancient cuſtoms, that the ceremonial is ſtill preſerved. While the mandarins thus remain proſtrated in the court, others, ſtationed on the obſervatory, examine, with all the attention poſſible, the beginning, middle, and end of the eclipſe, comparing what they obſerve with the figure and calculations given. They then write down their obſervations, affix their ſeal to them, and tranſmit them to the Emperor; who on his part has been no leſs aſſiduous to obſerve the eclipſe with accuracy. A ceremonial of this kind is obſerved throughout the whole empire.

The Japaneſe, Siameſe, and inhabitants of the Mogul's empire, have alſo, from time immemorial, been acquainted with aſtronomy; and the celebrated obſervatory at BENARES, is a monument both of the ingenuity of the people and of their ſkill in this ſcience.

4
Indian aſtronomy.

Mr. Bailly has been at great pains to inveſtigate the progreſs of the Indians in aſtronomical knowledge, and gives a ſplendid account of their proficiency in the ſcience, as well as of the antiquity of their obſervations. He has examined and compared four different aſtronomical tables of the Indian philoſophers. 1. Of the Siameſe, explained by M. Caſſini in 1689. 2. Thoſe brought from India by M. le Gentil of the Academy of Sciences. 3. and 4. Two other manuſcript tables found among the papers of the late M. de Liſle. All of theſe tables have different epochs, and differ in form, being alſo conſtructed in different ways; yet they all evidently belong to the ſame aſtronomical ſyſtem: the motions attributed to the ſun and the moon are the ſame, and the different epochs are ſo well connected by the mean motions, as to demonſtrate that they had only one, whence the others were derived by calculation. The meridians are all referred to that of Benares above mentioned. The fundamental epoch of the Indian aſtronomy is a conjunction of the ſun and moon, which took place at no leſs a diſtance of time than 3102 years before the Chriſtian æra. Mr Bailly informs us, that, according to our moſt accurate aſtronomical tables, a conjunction of the ſun and moon actually did happen at that time. But though the bramins pretend to have aſcertained the places of the two luminaries at that time, it is impoſſible for us at this time to judge of the truth of their aſſertions, by reaſon of the unequal motion of the moon; which, as ſhall afterwards be more particularly taken notice of, now performs its revolution in a ſhorter time than formerly.

Our author informs us, that the Indians at preſent calculate eclipſes by the mean motions of the ſun and moon obſerved 5000 years ago; and with regard to the ſolar motion, their accuracy far exceeds that of the beſt Grecian aſtronomers. The lunar motions they had alſo ſettled by computing the ſpace through which that luminary had paſſed in 1,600,984 days, or ſomewhat more than 4383 years. They alſo make uſe of the cycle of 19 years attributed by the Greeks to Meton; and their theory of the planets is much better than that of Ptolemy, as they do not ſuppoſe the earth to be the centre of the celeſtial motions, and they believe that Mercury and Venus turn round the ſun. Mr Bailly alſo informs us, that their aſtronomy agrees with the moſt modern diſcoveries of the decreaſe of the obliquity of the ecliptic, the acceleration of the motion of the equinoctial points, with many other particulars too tedious to enumerate in this place.

5
Aſtronomy of the Americans.

It appears alſo, that even the Americans were not unacquainted with aſtronomy, though they made uſe only of the ſolar, and not of the lunar motions, in their diviſion of time. The Mexicans have had a ſtrange predilection for the number 13. Their ſhorteſt periods conſiſted of 13 days; their cycle of 13 months, each containing 20 days; and their century of four periods of 13 years each. This exceſſive veneration for the number 13, according to Siguenza, aroſe from its being ſuppoſed the number of their greater gods. What is very ſurpriſing, though aſſerted as a fact by Abbé Clavigero, is that having diſcovered the exceſs of a few hours in the ſolar above the civil year, they made uſe of intercalary days, to bring them to an equality: but with this difference in regard to the method eſtabliſhed by Julius Cæſar in the Roman kalendar, that they did not interpoſe a day every four years, but 13 days (making uſe here even of this favorite number) every 52 years, which produces the ſame regulation of time.

6
Of the Chaldeans and Egyptians.

Among thoſe nations who firſt began to make any figure in ancient hiſtory, we find the Chaldeans and Egyptians moſt remarkable for their aſtronomical knowledge. Both of them pretended to an extravagant antiquity, and diſputed the honour of having been the firſt cultivators of the ſcience. The Chaldeans boaſted of their temple of Belus; and of Zoroaſter whom they placed 5000 years before the deſtruction of Troy: the Egyptians boaſted of their colleges of Prieſts, where aſtronomy was taught; and of the monument of Oſymandyas, in which we are told was a golden circle 365 cubits in circumference and one cubit thick. The upper face was divided into 365 equal parts, anſwering to the days of the year; and on every diviſion were written the name of the day, and the heliacal riſing of the ſeveral ſtars for that day, with the prognoſtications from their riſing, principally, as Long conjectures, for the weather.

The Chaldeans certainly began to make obſervations very ſoon after the confuſion of languages; for when Alexander the Great took Babylon, Calliſthenes, by

Fig. 2

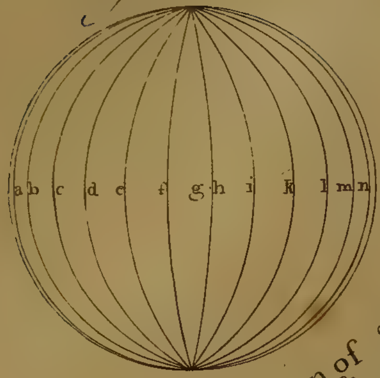


Fig. 3

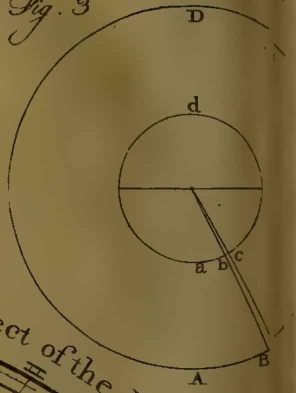


Fig. 1

The motion of Saturn Jupiter and Mars in reſpect of the Earth

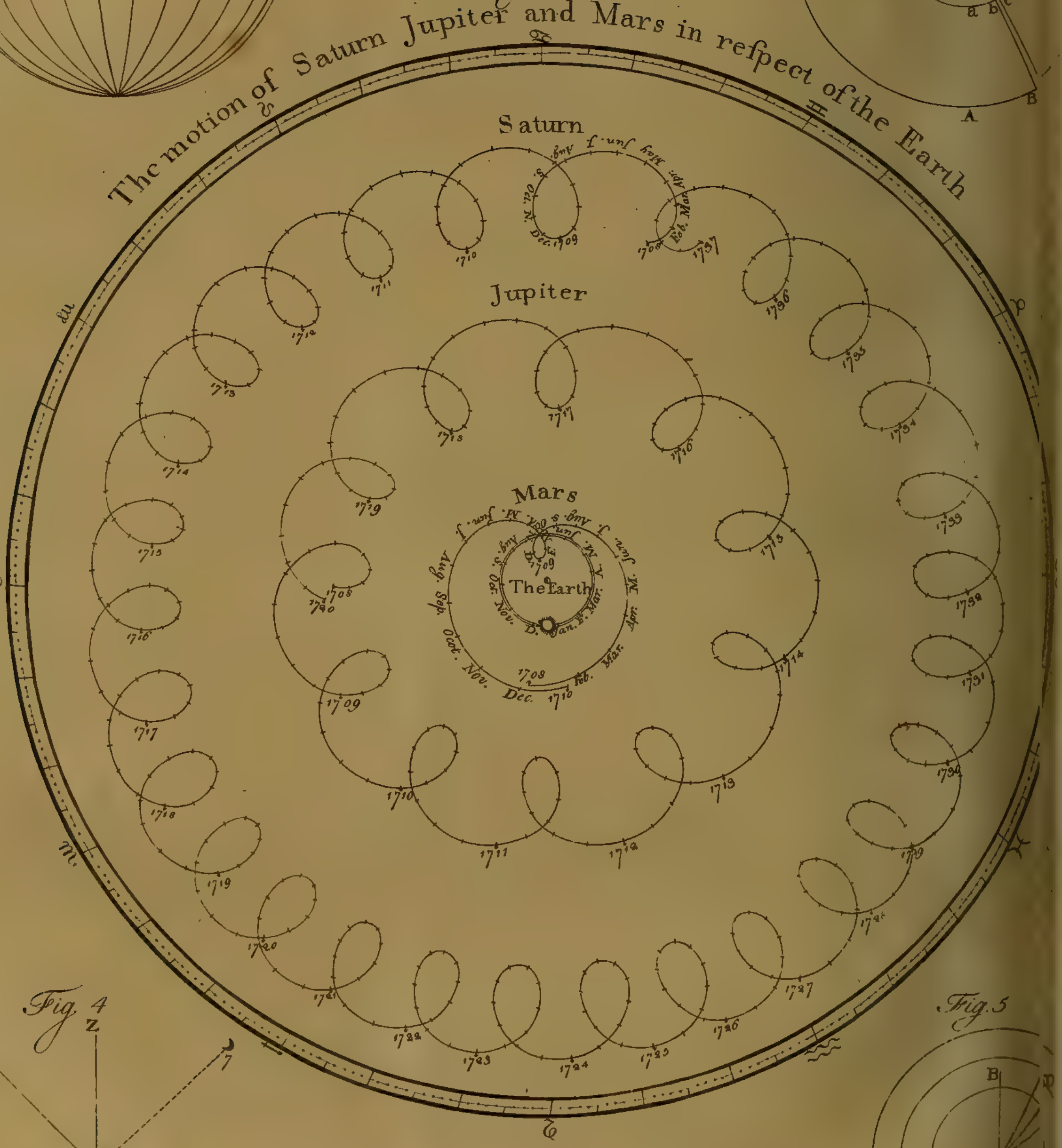


Fig. 4

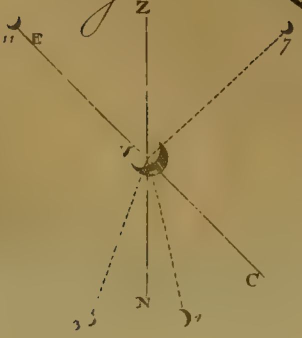
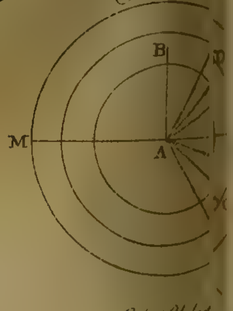


Fig. 5



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by his order, inquired after the aſtronomical obſervations recorded in that city, and obtained them for 1903 years back. Nothing, however, now remains of the Chaldean aſtronomy, excepting ſome periods of years which they had formed for the more ready computation of the heavenly bodies. But though they muſt have laboured under great diſadvantages, for want of proper inſtruments, in thoſe early ages, Geminus, as quoted by Petavius in his Uranologion, informs us, that they had determined, with tolerable exactneſs, the length both of a ſynodical and periodical month. They had alſo diſcovered, that the motion of the moon was not uniform, and even attempted to aſſign thoſe parts of her orbit in which it was quicker or ſlower. Ptolemy alſo aſſures us, that they were not unacquainted with the motion of the moon's nodes, and that of her apogee, ſuppoſing that the former made a complete revolution in $6585\frac{1}{3}$ days, or 18 years 15 days and 8 hours; which period, containing 223 complete lunations, is called the Chaldean *Saros*. The ſame author alſo gives us, from Hipparchus, ſeveral obſervations of lunar eclipſes which had been made at Babylon about 720 years before Chriſt; but though he might very probably meet with many of a more ancient date, it was impoſſible to mention them particularly, on account of the imperfect ſtate of the Chaldean chronology, which commenced only with the æra of Nabonaſſar, 747 years before Chriſt. Ariſtotle likewiſe informs us, that they had many obſervations of the occultations of fixed ſtars and planets by the moon; and from hence, by a very natural and eaſy inference, they were led to conclude that the eclipſes of the ſun were occaſioned alſo by the moon, eſpecially as they conſtantly happened when the latter was in the ſame part of the heavens with the ſun. They had alſo a conſiderable ſhare in arranging the ſtars into conſtellations. Nor had the comets, by which aſtronomers in all ages have been ſo much perplexed, eſcaped their obſervation: for both Diodorus Siculus and Appollinus Myndius, in Seneca, informs us, that many of the Chaldeans held theſe to be laſting bodies, which have ſtated revolutions as well as the planets, but in orbits vaſtly more extenſive; on which account they are only ſeen by us while near the earth, but diſappear again when they go into the higher regions. Others of them were of opinion, that the comets were only meteors raiſed very high in the air, which blaze for a while, and diſappear when the matter of which they conſiſt is conſumed or diſperſed. Dialling was alſo known among them long before the Greeks were acquainted with any ſuch thing.

It is evident, indeed, that the countries both of Chaldea and Egypt were exceedingly proper for aſtronomical obſervations, on account of the general purity and ſerenity of the air. The tower or temple of Belus, which was of an extraordinary height, with ſtairs winding round it up to the top, is ſuppoſed to have been an aſtronomical obſervatory; and the lofty pyramids of Egypt, whatever they were originally deſigned for, might poſſibly anſwer the ſame purpoſe. Indeed theſe very ancient monuments ſhow the ſkill of this people in practical aſtronomy, as they are all ſituated with their four fronts exactly facing the cardinal points. Herodotus aſcribes the Egyptian knowledge in aſtronomy to Seſoſtris, whom Sir Iſaac Newton makes cotemporary with Solomon: but if this was the caſe, he could not be the inſtructor of the Egyptians in aſtronomical matters, ſince we find that Moſes, who lived 500 years before Solomon, was ſkilled in all the wiſdom of the Egyptians, in which we are undoubtedly to include aſtronomy.

From the teſtimony of ſome ancient authors, we learn that they believed the earth to be ſpherical, that they knew the moon was eclipſed by falling into its ſhadow, and that they made their obſervations with the greateſt exactneſs. They even pretended to foretel the appearance of comets, as well as earthquakes and inundations; which extraordinary knowledge is likewiſe aſcribed to the Chaldeans. They attempted to meaſure the magnitude of the earth and ſun; but the methods they took to find out the latter were very erroneous. It does not indeed appear with certainty that they had any knowledge of the true ſyſtem of the univerſe; and by the time of the Emperor Auguſtus, their aſtronomical knowledge was entirely loſt.

7
Of the Phenicians.

From Chaldea the ſcience of aſtronomy moſt probably paſſed into Phenicia; though ſame are of opinion that the Phenicians derived their knowledge of this ſcience from the Egyptians. They ſeem, however, to have been the firſt who applied aſtronomy to the purpoſes of navigation; by which they became maſters of the ſea, and of almoſt all the commerce in the world. They became adventurous in their voyages, ſteering their ſhips by one of the ſtars of the Little Bear; which being near the immoveable point of the heavens called the *Pole* is the moſt proper guide in navigation. Other nations made their obſervations by the Great Bear; which being too diſtant from the pole could not guide them in long voyages; and for this reaſon they never durſt venture far from the coaſts.

8
Aſtronomy of the Greeks.

The firſt origin of aſtronomical knowledge among the Greeks is unknown. Sir Iſaac Newton ſuppoſes that moſt of the conſtellations were invented about the time of the Argonautic expedition: but Dr Long is of opinion that many of them muſt have been of a much older date; and that the ſhepherds, who were certainly the firſt obſervers, gave names to them according to their fancy; from whence the poets invented many of their fables. Several of the conſtellations are mentioned by Heſiod and Homer, the two moſt ancient writers among the Greeks, who lived about 870 years before Chriſt; Heſiod deſiring the farmer to regulate the time of ſowing and harveſt by the riſing and ſetting of the Pleiades; and Homer informing us, that obſervations from the Pleiades, Orion, and Arcturus, were uſed in navigation. Their aſtronomical knowledge, however, was greatly improved by Thales the Mileſian, who travelled into Egypt, and brought from thence the firſt principles of the ſcience. He is ſaid to have determined the height of the pyramids by meaſuring their ſhadows at the time the ſun was 45 degrees high, and when of conſequence the lengths of the ſhadows of objects are equal to their perpendicular heights. But his reputation was raiſed to the higheſt pitch among his countrymen, by the prediction of an eclipſe, which happened juſt at the time that the armies of Alyattes king of Lydia, and Cyaxares the Mede, were about to engage; and being regarded as an evil omen by both parties, inclined them

9
Improved by Thales.

to peace. To him Callimachus attributes the forming of the conſtellation of the little bear; the knowledge of which he certainly introduced into Greece. He alſo taught the true length of the year; determined the coſmical ſetting of the Pleiades in his time to have been 25 days after the autumnal equinox; divided the earth into five zones by means of the polar circles and tropics; taught the obliquity of the ecliptic; and ſhowed that the equinoctial is cut by the meridians at right angles, all of which interſect each other at the poles. He is alſo ſaid to have obſerved the exact time of the ſolſtices, and from thence to have deduced the true length of the ſolar year; to have obſerved eclipſes of the ſun and moon; and to have taught that the moon had no light but what ſhe borrowed from the ſun. According to Stanley, he alſo determined the diameter of the ſun to be one-720th part of his annual orbit. "But (ſays Dr Long) theſe things ſhould be received with caution. There are ſome reaſons which might be aſſigned for ſuppoſing that the knowledge of Thales in theſe matters was much more circumſcribed: and indeed it is not unreaſonable to ſuppoſe, that that veneration for the ancients which leads authors to write profeſſedly on the hiſtory of ancient times, may have induced them to aſcribe full as much knowledge to thoſe who lived in them as was really their due."

10
By Anaximander, &c.

The ſucceſſors of Thales, Anaximander, Anaximanes, and Anaxagoras, contributed conſiderably to the advancement of aſtronomy. The firſt is ſaid to have invented or introduced the gnomon into Greece; to have obſerved the obliquity of the ecliptic; and taught that the earth was ſpherical, and the centre of the univerſe, and that the ſun was not leſs than it. He is alſo ſaid to have made the firſt globe, and to have ſet up a ſun-dial at Lacedemon, which is the firſt we hear of among the Greeks; though ſome are of opinion that theſe pieces of knowledge were brought from Babylon by Pherycides, a cotemporary of Anaximander. Anaxagoras alſo predicted an eclipſe which happened in the fifth year of the Peloponneſian war; and, taught that the moon was habitable, conſiſting of hills, valleys, and waters, like the earth.

11
Doctrines of Pythagoras.

His cotemporary Pythagoras, however, greatly improved not only aſtronomy and mathematics, but every other branch of philoſophy. He taught that the univerſe was compoſed of four elements, and that it had the ſun in the centre; that the earth was round, and had antipodes; and that the moon reflected the rays of the ſun; that the ſtars were worlds, containing earth, air, and ether; that the moon was inhabited like the earth; and that the comets were a kind of wandering ſtars, diſappearing in the ſuperior parts of their orbits, and becoming viſible only in the lower part of them. The white colour of the milky-way he aſcribed to the brightneſs of a great number of ſmall ſtars; and he ſuppoſed the diſtances of the moon and planets from the earth to be in certain harmonic proportions to one another. He is ſaid alſo to have exhibited the oblique courſe of the ſun in the ecliptic and the tropical circles, by means of an artificial ſphere; and he firſt taught that the planet Venus is both the evening and morning ſtar. This philoſopher is ſaid to have been taken priſoner by Cambyſes, and thus to have become acquainted with all the myſteries of the Perſian magi; after which he ſettled at Crotona in Italy, and founded the Italian ſect.

About 440 years before the Chriſtian æra, Philolaus, a celebrated Pythagorean, aſſerted the annual motion of the earth round the ſun; and ſoon after Hicetas, a Syracuſan, taught its diurnal motion on its own axis. About this time alſo flouriſhed Meton and Euctemon at Athens, who took an exact obſervation of the ſummer ſolſtice 432 years before Chriſt; which is the oldeſt obſervation of the kind we have, excepting what is delivered by the Chineſe. Meton is ſaid to have compoſed a cycle of 19 years, which ſtill bears his name; and he marked the riſings and ſettings of the ſtars, and what ſeaſons they pointed out: in all which he was aſſiſted by his companion Euctemon. The ſcience, however, was obſcured by Plato and Ariſtotle, who embraced the ſyſtem afterwards called the *Ptolemaic*, which places the earth in the centre of the univerſe.

Eudoxus the Cnidian was a cotemporary with Ariſtotle, though conſiderably older, and is greatly celebrated on account of his ſkill in aſtronomy. He was the firſt who introdced geometry into the ſcience, and he is ſuppoſed to be the inventor of many propoſitions attributed to Euclid. Having travelled into Egypt in the earlier part of his life, and obtained a recommendation from Ageſilaus to Nectanebus king of Egypt, he, by his means, got acceſs to the prieſts, who had the knowledge of aſtronomy entirely among them, after which he taught in Aſia and Italy. Seneca tells us that he brought the knowledge of the planetary motions from Egypt into Greece; and Archimedes, that he believed the diameter of the ſun to be nine times that of the moon. He was alſo well acquainted with the method of drawing a ſun-dial upon a plane; from whence it may be inferred that he underſtood the doctrine of the projection of the ſphere: yet, notwithſtanding what has been ſaid concerning the obſervations of Eudoxus, it is not certain that his ſphere was not taken from one much more ancient, aſcribed to Chiron the Centaur. The reaſon given for this ſuppoſition is, that had the places of the ſtars been taken from his own obſervations, the conſtellations muſt have been half a ſign farther advanced than they are ſaid to be in his writings.

Soon after Eudoxus, Calippus flouriſhed, whoſe ſyſtem of the celeſtial ſphere is mentioned by Ariſtotle; but he is better known from a period of 76 years, containing four corrected metonic periods, and which had its beginning at the ſummer ſolſtice in the year 330, before Chriſt. But about this time, or rather earlier, the Greeks having begun to plant colonies in Italy, Gaul, and Egypt, theſe became acquainted with the Pythagorean ſyſtem, and the notions of the ancient Druids concerning aſtronomy. Julius Cæſar informs us, that the latter were ſkilled in this ſcience; and that the Gauls in general were able ſailors, which at that time they could not be without a competent knowledge of aſtronomy: and it is related of Pythoas, who lived at Marſeilles in the time of Alexander the Great, that he obſerved the altitude of the ſun at the ſummer ſolſtice by means of a gnomon. He is alſo ſaid to have travelled as far as Thule to ſettle the climates.

12
State of aſtronomy in Egypt after the death of Alexander.

After the death of Alexander the Great, ſciences flouriſhed in Egypt more than in any other part of the world; and a famous ſchool was ſet up at Alexandria under the auſpices of Ptolemy Philadelphus, a prince inſtructed in all kinds of learning, and the patron of all thoſe who cultivated them; and this ſchool continued to be the ſeminary of all kinds of literature, till the invaſion of the Saracens in 650. Timocharis and Aryſtillus, who firſt cultivated the aſtronomical ſcience in this ſchool, began to put it on a new footing; being much more careful in their obſervations, and exact in noting down the times when they were made, than their predeceſſors. Ptolemy aſſures us, that Hipparchus made uſe of their obſervations, by means of which he diſcovered that the ſtars had a motion in longitude of about one degree in an hundred years; and he cites many of their obſervations, the oldeſt of which is before the erection of this ſchool, in the year 295, when the moon juſt touched the northern ſtar in the forehead of the ſcorpion; and the laſt of them was in the 13th year of Philadelphus, when Venus hid the former ſtar of the four in the left wing of Virgo.

From this time the ſcience of aſtronomy continued greatly to advance. Ariſtarchus, who lived about 270 years before Chriſt, ſtrenuouſly aſſerted the Pythagorean ſyſtem, and gave a method of determining the diſtance of the ſun by the moon's dichotomy. Eratoſthenes, born at Cyrene in 271 B. C. determined the meaſure of a great circle of the earth by means of a gnomon. His reputation was ſo great, that he was invited from Athens to Alexandria by Ptolemy Euergetes, and made by him keeper of the royal library at that place. At his inſtigation the ſame prince ſet up thoſe armillas or ſpheres, which Hipparchus and Ptolemy the aſtronomer afterwards employed ſo ſucceſsfully in obſerving the heavens. He alſo found the diſtance between the tropics to be eleven ſuch parts as the whole meridian contains eighty-three. About the ſame time Beroſus, a native of Chaldea, flouriſhed at Athens. He is by ſome ſaid to have brought many obſervations from Babylon, which are aſcribed to the Greeks; while others contend, that the latter owe little or nothing of their aſtronomical knowledge to the Babylonians. The celebrated Archimedes, who next to Sir Iſaac Newton holds the firſt place among mathematicians, was nothing inferior as an aſtronomer to what he was as a geometrician. He determined the diſtance of the moon from the earth, of Mercury from the moon, of Venus from Mercury, of the ſun from Venus, of Mars from the ſun, of Jupiter from Mars, and of Saturn from Jupiter; as likewiſe the diſtance of the fixed ſtars from the orbit of Saturn. That he made aſtronomical obſervations, is not to be doubted; and it appears from an epigram of the poet Claudian, that he invented a kind of planetarium, or orrery, to repreſent the phenomena and motions of the heavenly bodies.

13
Diſcoveries of Archimedes.

14
Of Hipparchus.

Hipparchus was the firſt who applied himſelf to the ſtudy of every part of aſtronomy, his predeceſſors having chiefly conſidered the motions and magnitudes of the ſun and moon. Ptolemy alſo informs us, that he firſt diſcovered the orbits of the planets to be eccentric, and on this hypotheſis wrote a book againſt Eudoxus and Calippus. He gives many of his obſervations; and ſays, that by comparing one of his with another made by Ariſtarchus 145 years before, he was enabled to determine the length of the year with great preciſion. Hipparchus alſo firſt found out the anticipation of the moon's nodes, the eccentricity of her orbit, and that ſhe moved ſlower in her apogee than in her perigee. He collected the accounts of ſuch ancient eclipſes as had been obſerved by the Chaldeans and Egyptians. He formed hypotheſes concerning the celeſtial motions, and conſtructed tables of thoſe of the ſun and moon, and would have done the ſame with thoſe of the other planets if he could have found ancient obſervations ſufficient for the purpoſe; but, theſe being wanting, he was obliged to content himſelf with collecting fit obſervations for that purpoſe, and endeavouring to form theories of the five planets. By comparing his own obſervations on the ſpica virginis with thoſe of Timochares at Alexandria made 100 years before, he diſcovered that the fixed ſtars changed their places, and had a ſlow motion of their own from weſt to eaſt. He corrected the Calippic period, and pointed out ſome errors in the method laid down by Eratoſthenes for meaſuring the circumference of the earth. By means of geometry, which was now greatly improved, he was enabled to attempt the calculation of the ſun's diſtance in a more correct manner than any of his predeceſſors; but unhappily it required ſo much accuracy in obſervation as was found impracticable. His greateſt work, however, was his catalogue of the fixed ſtars, which he was induced to attempt by the appearance of a new ſtar. The catalogue is preſerved by Ptolemy, and contains the longitudes and latitudes of 1022 ſtars, with their apparent magnitudes. He wrote alſo concerning the intervals between eclipſes both ſolar and lunar, and is ſaid to have calculated all that were to happen for no leſs than 600 years from his time.

15
Makes the firſt catalogue of fixed ſtars.

16
Syſtem of Ptolemy.

Little progreſs was made in aſtronomy from the time of Hipparchus to that of Ptolemy, who flouriſhed in the firſt century. The principles on which his ſyſtem is built are indeed erroneous; but his work will always be valuable on account of the number of ancient obſervations it contains. It was firſt tranſlated out of the Greek into Arabic in the year 827, and into Latin from the Arabic in 1230. The Greek original was unknown in Europe till the beginning of the 15th century, when it was brought from Conſtantinople, then taken by the Turks, by George a monk of Trapezond, who tranſlated it into Latin. Various editions were afterwards publiſhed; but little or no improvement was made by the Greeks in this ſcience.

17
Aſtronomy of the Arabians.

During the long period from the year 800 to the beginning of the 14th century, the weſtern parts of Europe were immerſed in deep ignorance and barbarity. However, ſeveral learned men aroſe among the Arabians. The caliph Al Manſur was the firſt who introduced a taſte for the ſciences in his empire. His grandſon Al Mamun, who aſcended the throne in 814, was a great encourager of the ſciences, and devoted much of his own time to the ſtudy of them. He made many aſtronomical obſervations himſelf, and determined the obliquity of the ecliptic to be 23° 35′. He employed many able mechanics in conſtructing proper inſtruments, which he made uſe of for his obſervations; and under his auſpices a degree of the earth was meaſured a ſecond time in the plain of Singar, on the border of the Red Sea. From this time aſtronomy was ſtudiouſly cultivated by the Arabians; and Elements of Aſtronomy were written by Alferganus, who was partly cotemporary with the caliph Al Mamun. But the moſt celebrated of all their aſtronomers is Albategnius, who lived about the year of Chriſt 880. He greatly reformed aſtronomy, by comparing his own obſervations with thoſe of Ptolemy. Thus he calculated the motion of the ſun's apogee from Ptolemy's time to his own; determined the preceſſion of the equinoxes to be one degree in 70 years; and fixed the ſun's greateſt declination at 23.35′. Finding that the tables of Ptolemy required much correction, he compoſed new ones of his own fitted to the meridian of Aracta, which were long held in eſtimation by the Arabians. After his time, though ſeveral eminent aſtronomers appeared among the Saracens, none made any very valuable obſervations for ſeveral centuries, excepting Ebn Younis aſtronomer to the caliph of Egypt: who obſerved three eclipſes with ſuch care, that by means of them we are enabled to determine the quantity of the moon's acceleration ſince that time.

Other eminent Saracen aſtronomers were, Arzachel a Moor of Spain, who obſerved the obliquity of the ecliptic, and conſtructed tables of ſines, or half chords of double arcs, dividing the diameter into 300 parts; and Alhazen, his cotemporary, who firſt ſhowed the importance of the theory of refractions in aſtronomy; writing alſo upon the twilight, the height of the clouds, and the phenomenon of the horizontal moon.

Ulug Beg, a grandſon of the famous Tartar prince Timur Beg, or Tamerlane, was a great proficient in practical aſtronomy. He is ſaid to have had very large inſtruments for making his obſervations; particularly a quadrant as high as the church of Sancta Sophia at Conſtantinople, which is 180 Roman feet. He compoſed aſtronomical tables from his own obſervations for the meridian of Samarcand his capital, ſo exact as to differ very little from thoſe afterwards conſtructed by Tycho Brache; but his principal work is his catalogue of the fixed ſtars, made from his own obſervations in the year of Chriſt 1437. The accuracy of his obſervations may be gathered from his determining the height of the pole at Samarcand to be 39° 37′ 23″.

Beſides theſe improvements, we are indebted to the Arabians for the preſent form of trigonometry. Manelaus, indeed, an eminent Greek aſtronomer who flouriſhed about the year 90, had publiſhed three books of Spherics, in which he treated of the geometry neceſſary to aſtronomy, and which ſhow great ſkill in the ſciences; but his methods were very laborious, even after they had been improved and rendered more ſimple by Ptolemy: but Geber the Arabian, inſtead of the ancient method, propoſed three or four theorems, which are the foundation of our modern trigonometry. The Arabians alſo made the practice ſtill more ſimple, by uſing ſines inſtead of the chords of double arcs. The arithmetical characters they had from the Indians.

18 Revival of aſtronomy in Europe.

During the greateſt part of this time, almoſt all Europe continued ignorant not only of aſtronomy but of every other ſcience. The emperor Frederick II. firſt began to encourage learning in 1230; reſtoring ſome univerſities, and founding a new one in Vienna. He alſo cauſed the works of Ariſtotle, and the Almageſt or Aſtronomical Treatiſe of Ptolemy, to be tranſlated into Latin; and from the tranſlation of this book we may date the revival of aſtronomy in Europe. Two years after this publication, John de Sacro Boſco, or of Halifax, an Engliſhman, wrote his four books *De Sphæra*, which he compiled from Ptolemy Albategnius, Alferganus, and other Arabian aſtronomers: this work was ſo much celebrated, that for 300 years it was preferred in the ſchools to every other; and has been thought worthy of ſeveral commentaries, particularly by Clavius in 1531. In 1240, Alphonſo king of Caſtile cauſed the tables of Ptolemy to be corrected: for which purpoſe he aſſembled many perſons ſkilled in aſtronomy, Chriſtians, Jews, and Moors; by whom the tables called *Alphonſine* were compoſed, at the expence of 40,000, or according to others 400,000 ducats. About the ſame time Roger Bacon, an Engliſh monk, publiſhed many things relative to aſtronomy; particularly of the places of the fixed ſtars, ſolar rays, and lunar aſpects. Vitellio, a Polander, wrote a treatiſe on Optics about 1270, in which he ſhowed the uſe of refractions in aſtronomy.

19 Improvements of Purbach.

From this time to that of Purbach; who was born in 1423, few or no improvements were made in aſtronomy. He wrote a commentary on Ptolemy's Almageſt, ſome treatiſes on Arithmetic and Dialling, with tables for various climates. He not only uſed ſpheres and globes, but conſtructed them himſelf; and formed new tables of the fixed ſtars, reduced to the middle of that age. He compoſed alſo new tables of ſines for every ten minutes, which Regiomontanus afterwards extended to every ſingle minute, making the whole ſine 60, with 6 ciphers annexed. He likewiſe corrected the tables of the planets, making new equations to them, becauſe the Alphonſine tables were very faulty in this reſpect. In his ſolar tables he placed the ſun's apogee in the beginning of Cancer; but retained the obliquity of the ecliptic 23° 33½′, to which it had been reduced by the lateſt obſervations. He made new tables for computing eclipſes, of which he obſerved ſome, and had juſt publiſhed a theory of the planets, when he died in 1461.

20 Of Regiomontanus.

John Muller of Monteregio (Coningſberg), a town of Franconia, from whence he was called *Regiomontanus*, was the ſcholar and ſucceſſor of Purbach. He completed the epitome of Ptolemy's Almageſt which Purbach had begun; and after the death of the latter, went to Rome, where he made many aſtronomical obſervations. Having returned to Nuremberg in 1471, he was entertained by a wealthy citizen named *Bernard Walther*, who having a great love for aſtronomy, cauſed ſeveral inſtruments to be made under the direction of Regiomontanus, for obſerving the altitude of the ſun and ſtars, and other celeſtial phenomena. Among theſe was an armillary aſtrolabe, like that which had been uſed by Hipparchus and Ptolemy at Alexandria, and with which many obſervations were made. He alſo made ephemerides for 30 years to come, ſhowing the lunations, eclipſes, &c. He wrote the Theory of the Planets and Comets, and a Treatiſe of Triangles yet in repute for ſeveral extraordinary caſes. He is ſaid to have been the firſt who introduced the uſe of tangents into trigonometry; and to have publiſhed in print (the art of printing having been lately invented) the works of many of the moſt celebrated ancient aſtronomers. After his death, which happened at Rome, Walther made a diligent ſearch for all his inſtruments and papers which could be found; and continued his obſervations with the inſtruments he had till his death. The obſervations of both were collected by order of the ſenate of Nuremberg, and publiſhed there

ASTRONOMY

Plate LXI

Fig. 14

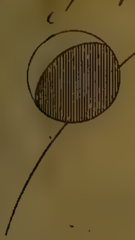
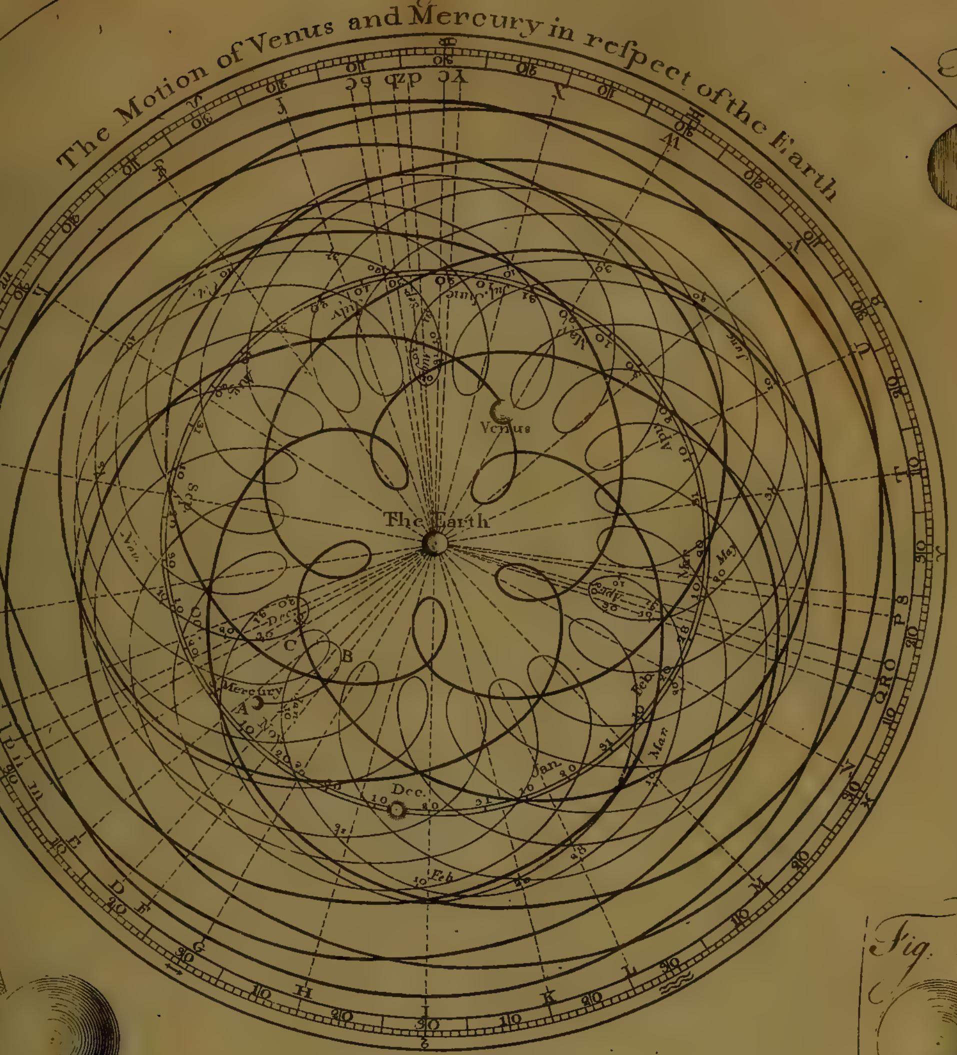


Fig. 6



The Motion of Venus and Mercury in respect of the Earth

Fig. 13

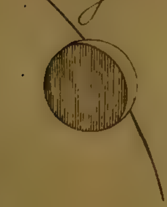


Fig. 7

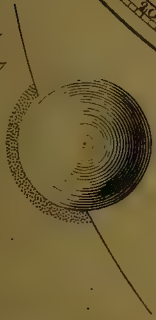


Fig. 11

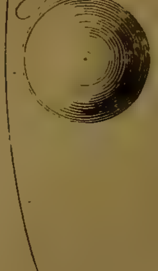


Fig. 8

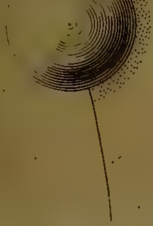


Fig. 9

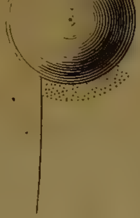


Fig. 10

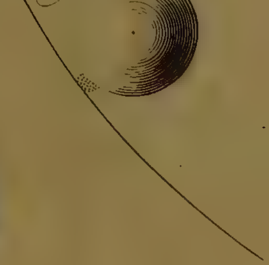
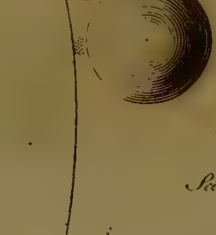


Fig. 12



Scot Philad^a

there by John Schoner in 1544; afterwards by Snellius at the end of the obſervations made by the Landgrave of Heſſe in 1618; and laſtly, in 1666, with thoſe of Tycho Brache. Walther, however, as we are told by Snellius, found fault with his armilla, not being able to give any obſervation with certainty to leſs than ten minutes. He made uſe of a good clock, which alſo was a late invention in thoſe days.

21 Of Werner John Werner, a clergyman, ſucceeded Walther as aſtronomer at Nuremberg; having applied himſelf with great aſſiduity to the ſtudy of that ſcience from his infancy. He obſerved the motion of the comet in 1500; and publiſhed ſeveral tracts, in which he handled many capital points of geometry, aſtronomy, and geography, in a maſterly manner. He publiſhed a tranſlation of Ptolemy's Geography, with a commentary, which is ſtill extant. In this he firſt propoſed the method of finding the longitude at ſea by obſerving the moon's diſtance from the fixed ſtars; which is now ſo ſucceſsfully put in practice. He alſo publiſhed many other treatiſes on mathematics and geography; but the moſt remarkable of all his treatiſes, are thoſe concerning the motion of the eighth ſphere or of the fixed ſtars, and a ſhort theory of the ſame. In this he ſhewed by comparing his own obſervations of the ſtars regulus, ſpica virginis, and the bright ſtar in the ſouthern ſcale of the balance, made in 1514, with the places aſſigned to the ſame ſtars by Ptolemy, Alphonſus, and others, that the motion of the fixed ſtars, now called *the preceſſion of the equinoctial points*, is one degree ten minutes in 100 years, and not one degree only, as former aſtronomers had made it. He made the obliquity of the ecliptic 23° 28′, and the firſt ſtar of Aries 26° diſtant from the equinoctial point. He alſo conſtructed a planetarium repreſenting the celeſtial motions according to the Ptolemaic hypotheſis, and made a great number of meteorological obſervations with a view towards the prediction of the weather. The obliquity of the ecliptic was ſettled by Dominic Maria, the friend of Copernicus, at 23° 29′, which is ſtill held to be juſt.

22 Pythagorean ſyſtem reſtored by Copernicus The celebrated Nicholaus Copernicus next makes his apearance, and is undoubtedly the great reformer of the aſtronomical ſcience. He was originally bred to the practice of medicine, and had obtained the degree of Doctor in that faculty: but having conceived a great regard for the mathematical ſciences, eſpecially aſtronomy, he travelled into Italy, where he for ſome time was taught by Dominic Maria, or rather aſſiſted him in his aſtronomical operations. On his return to his own country, being made one of the canons of the church, he applied himſelf with the utmoſt aſſiduity to the contemplation of the heavens, and to the ſtudy of the celeſtial motions. He ſoon perceived the deficiency of all the hypotheſes by which it had been attempted to account for theſe motions; and for this reaſon he ſet himſelf to ſtudy the works of the ancients, with all of whom he alſo was diſſatisfied excepting Pythagoras; who, as has been already related, placed the ſun in the centre, and ſuppoſed all the planets, with the earth itſelf, to revolve round him. He informs us, that he began to entertain theſe notions about the year 1507; but not being ſatisfied with ſtating the general nature of his hypotheſis, he became deſirous of determining the ſeveral periodical revolutions of the planets, and thence of conſtructing tables of their motions which might be more agreeable to truth than thoſe of Ptolemy and Alphonſus. The obſervations he was enabled to make, however, muſt have been extremely inaccurate; as he tells us, that if with the inſtruments he made uſe of he ſhould be able to come within ten minutes of the truth, he would rejoice no leſs than Pythagoras did when he diſcovered the proportion of the hypothenuſe to the other two ſides of a right-angled triangle. His work was completed in the year 1530; but he could not be prevailed upon to publiſh it till towards the end of his life, partly through diffidence, and partly through fear of the offence which might be taken at the ſingularity of the doctrines ſet forth in it. At laſt, overcome by the importunities of his friends, he ſuffered it to be publiſhed at their expence, and under the inſpection of Schoner and Oſiander, with a dedication to Pope Paul III. and a preface, in which it was attempted to palliate as much as poſſible the extraordinary innovations it contained. During the time of its publication, the author himſelf was attacked by a bloody flux, ſucceeded by a palſy; ſo that he received a copy only a few hours before his death, which happened on the 23d of May 1543.

After the death of Copernicus, the aſtronomical ſcience was greatly improved by Schoner, Nonius, Appian, and Gemma Friſius. Schoner ſurvived Copernicus only four years; however, he greatly improved the methods of making celeſtial obſervations, reformed and explained the kalendar, and publiſhed a treatiſe of coſmography. Nonius had applied himſelf very early to the ſtudy of aſtronomy and navigation; but finding the inſtruments at that time in uſe exceſſively inaccurate, he applied himſelf to the invention of others which ſhould be leſs liable to inconvenience. Thus he invented the aſtronomical quadrant, in which he divided the degrees into minutes by a number of concentric circles. The firſt of theſe was divided into 90 equal parts, the ſecond into 89, the third into 88, and ſo on, as low as 46; and thus, as the index of the quadrant would always fall upon one or other of the diviſions, or very near it, the minutes might be known by computation. He publiſhed many treatiſes on mathematical ſubjects, particularly one which detected the errors of Orontius, who had imagined that he could ſquare the circle, double the cube, &c. by finding two mean proportionals betwixt two right lines. Appian's chief work was intitled *The Cæſarian Aſtronomy*; and was publiſhed at Ingoldſtadt in 1540, dedicated to the emperor Charles V. and his brother Ferdinand. In this he ſhowed how to reſolve aſtronomical problems by means of inſtruments, without either calculations or tables; to obſerve the places of the ſtars and planets by the aſtrolabe; and to foretel eclipſes and deſcribe the figures of them; the whole illuſtrated with proper diagrams. In his ſecond book he deſcribes the method of dividing an aſtronomical quadrant, and of uſing it properly. His treatiſe concludes with the obſervation of five comets. Gemma Friſius wrote a commentary on a work of Appian, intitled his *Coſmography*, with many obſervations of eclipſes. He invented alſo the aſtronomical ring, and ſeveral other inſtruments, which, though they could not boaſt of much exactneſs ſuperior to others, were yet of conſiderable utility in taking obſervations at ſea; and he is alſo memorable for being the firſt who propoſed a time-keeper for determining the longitude at ſea.—George Joachim Rheticus was a ſcholar of Copernicus, to attend whoſe lectures he gave up his profeſſorſhip of mathematics at Wittemberg. For the improvement of aſtronomical calculations, he began to conſtruct a table of ſines, tangents, and ſecants, for every minute and ten ſeconds of the quadrant. In this work he firſt ſhowed the uſe of ſecants in trigonometry, and greatly enlarged the uſe of tangents, firſt invented by Regiomontanus; but he aſſigned for the radius a much larger number of places than had been done before, for the greater exactneſs of calculation. This great work he did not live to accompliſh; but it was completed by his diſciple Valentine Otho, and publiſhed at Heidelberg in 1594.

23 Several illuſtrious perſons apply to the ſtudy of aſtronomy.

During this century, the liſt of aſtronomers was dignified by ſome very illuſtrious names. About the year 1561, William IV. Landgrave of Heſſe Caſſel, applied himſelf to the ſtudy of aſtronomy. With the aſſiſtance of Rothman and Burgius, the former an aſtronomer, the latter an excellent mathematical inſtrument maker, he erected an obſervatory on the top of his palace at Caſſel, and furniſhed it with ſuch inſtruments as were then in uſe, made in the beſt manner the artiſts of that age could execute. With theſe he made a great number of obſervations, which were by Hevelius preferred to thoſe of Tycho-Brache, and which were publiſhed by Snellius in 1618. From theſe obſervations he determined the longitudes and latitudes of 400 ſtars, which he inſerted in a catalogue where their places are rectified to the beginning of the year 1593.

24 Obſervations of Tycho-Brache.

Tycho-Brache began his obſervations about the ſame time with the Landgrave of Heſſe, already mentioned. He obſerved the great conjunction of Saturn and Jupiter in 1563; and finding the inſtruments he could procure very inaccurate, he made a quadrant capable of ſhewing ſingle minutes, and likewiſe a ſextant four cubits radius. In 1571, he diſcovered a new ſtar in the chair of Caſſiopeia; which induced him, like Hipparchus, to make a catalogue of the ſtars. This contained the places of 777 ſtars, rectified to the year 1600; but inſtead of the moon, which was uſed by the ancients to connect the places of the ſun and ſtars, Tycho ſubſtituted Venus as having little or no parallax, and yet being like the moon viſible both day and night. By the recommendation of the Landgrave of Heſſe, he obtained from the king of Denmark the iſland of Huenna, oppoſite to Copenhagen, where an obſervatory was built. The firſt ſtone of this building, afterwards called *Uraniburg*, was laid in the year 1576. It was of a ſquare form, one ſide of it being about 60 feet in length; and on the eaſt and weſt ſides were two round towers of 32 feet diameter each. The inſtruments were more large and ſolid than had ever been ſeen before by any aſtronomer. They conſiſted of quadrants, ſextants, circles, ſemicircles, armillæ both equatorial and zodiacal, parallactic rulers, rings, aſtrolabes, globes, clocks, and ſun-dials. Theſe inſtruments were ſo divided as to ſhow ſingle minutes; and in ſome the arch might be read off to 10 ſeconds. Moſt of the diviſions were diagonal: but he had one quadrant divided according to the method invented by Nonius; that is, by 47 concentric circles. The whole expence is ſaid to have amounted to 200,000 crowns. The method of dividing by diagonals, which Tycho greatly admired, was the invention of Mr Richard Chanceller, an Engliſhman: Tycho, however, ſhows, that it is not accurately true when ſtraight lines are employed, and the circles at equal diſtances from each other; but that it may be corrected by making circular diagonals, which if continued would paſs through the centre.

25 Account of Uraniburg, his obſervatory.

Tycho employed his time at Uraniburg to the beſt advantage; but falling into diſcredit on the death of the king, he was obliged to remove to Holſtein, and at laſt found means to get himſelf introduced to the emperor, with whom he continued to his death. He is well known to have been the inventor of a ſyſtem of aſtronomy, which bears his name; and which he vainly endeavoured to eſtabliſh on the ruins of that of Copernicus; but the ſimplicity and evident conſonancy to the phenomena of nature, diſplayed in all parts of the Copernican ſyſtem, ſoon got the better of the unnatural and complicated ſyſtem of Tycho. His works, however, which are very numerous, diſcover him to have been a man of vaſt abilities. After his death the caſtle of Uraniburg quickly fell to decay, and indeed ſeems to have been purpoſely pulled down; for, in 1652, when Mr Huet went to Sweden, it was almoſt level with the ground, and few traces of the walls could be diſcerned. None of the neighbouring inhabitants had ever heard of the name of Tycho or Uraniburg, excepting one old man, whom Mr Huet found out with great difficulty, and who had been a ſervant in the family! All the diſcoveries of Purback, Regiomontanus, and Tycho, were collected and publiſhed in the year 1621, by Longomontanus, who had been Tycho's favourite ſcholar.

26 Diſcoveries of Kepler.

While Tycho reſided at Prague with the emperor, he invited thither John Kepler, afterwards ſo famous for his diſcoveries. Under the tuition of ſo great an aſtronomer, the latter quickly made an amazing progreſs. He found that his predeceſſors had erred in ſuppoſing the orbits of the planets to be circular, and their motions uniform: on the contrary, he perceived from his own obſervations, that they were elliptical, and their motions unequal, having the ſun in one of the foci of their orbits; but that, however, they varied in abſolute velocity, a line drawn from the centre of the ſun to the planet, and revolving with it, would always deſcribe equal areas in equal times. He diſcovered, in the year 1618, that the ſquares of the periodical times are as the cubes of the diſtances of the planets; two laws which have been of the greateſt importance to the advancement of aſtronomy. He ſeems to have had ſome notion of the extenſive power of the principle of gravity: for he tells us, that gravity is a mutual power betwixt two bodies; that the moon and earth tend towards each other, and would meet in a point nearer the earth than the moon in the proportion of the ſuperior magnitude of the former, were they not hindered by their projectile motions. He adds alſo, that the tides ariſe from the gravitation of the waters towards the moon: however, he did not adhere ſteadily to theſe principles, but afterwards ſubſtituted others as the cauſes of the planetary motions.

Cotemporary with Kepler were Mr Edward Wright, and Napier baron of Merchiſton. To the former we owe ſeveral very good meridional obſervations of the ſun's altitude, made with a quadrant of ſix feet radius, in the years 1594, 1595, and 1596; from which he greatly improved the theory of the ſun's motion, and computed more exact tables of his declination than had been done by any perſon before. He publiſhed alſo in 1599, an excellent Treatiſe, entitled, "Certain Errors in Navigation diſcovered and detected." To the latter we are indebted for the knowledge of logarithms; a diſcovery, as was juſtly obſerved by Dr Halley, one of the moſt uſeful ever made in the art of numbering. John Bayer, a German, who lived about the ſame time, will ever be memorable for his work, entitled, *Uranometria*, which is a very complete celeſtial atlas, or a collection of all the conſtellations viſible in Europe. To this he added a nomenclature, in which the ſtars in each conſtellation are marked with the letters of the Greek alphabet; and thus every ſtar in the heavens may be referred to with the utmoſt preciſion and exactneſs. About the ſame time alſo, aſtronomy was cultivated by many other perſons; abroad, by Maginus, Mercator, Maurolycus, Homelius, Schultet, Stevin, &c.; and by Thomas and Leonard Digges, John Dee, and Robert Flood, in England; but none of them made any conſiderable improvement.

27
Invention of teleſcopes and conſequent diſcoveries.

The beginning of the 17th century was diſtinguiſhed not only by the diſcovery of logarithms, but by that of teleſcopes, a ſort of inſtruments by which aſtronomy was brought to a degree of perfection utterly inconceivable by thoſe who knew nothing of them. The queſtion concerning the inventor is diſcuſſed under the article Optics; but whoever was entitled to this merit, it is certain that Galileo was the firſt who brought them to ſuch perfection as to make any conſiderable diſcoveries in the celeſtial regions. With inſtruments of his own making, Galileo diſcovered the inequalities in the moon's ſurface, the ſatellites of Jupiter, and the ring of Saturn; though this laſt was unknown to him after he had ſeen it, and the view he got made him conclude that the planet had a threefold body, or that it was of an oblong ſhape like an olive. He diſcovered ſpots on the ſun, by means of which he found out the revolution of that luminary on his axis; and he diſcovered alſo that the milky way and nebulæ were full of ſmall ſtars. It was not, however, till ſome time after theſe diſcoveries were made that Galileo and others thought of applying the obſervations on Jupiter's ſatellites to the purpoſe of finding the longitude of places on the ſurface of the earth; and even after this was thought of, aſtronomers found it ſo difficult to conſtruct tables of their motions, that it was not till after many obſervations had been made in diſtant places of the world, that Caſſini was able to determine what poſitions of the ſatellites were moſt proper for finding out the longitude. At laſt he perceived that the entrance of the firſt ſatellite into the ſhadow of Jupiter, and the exit of it from the ſame, were the moſt proper for this purpoſe: that next to theſe the conjunctions of the ſatellites with Jupiter, or with one another, may be made uſe of; eſpecially when any two of them, moving in contrary directions, meet with each other: and laſtly, that obſervations on the ſhadows of the ſatellites, which may be ſeen on the diſk of Jupiter, are uſeful, as alſo the ſpots which are ſeen upon his face, and are carried along it with greater velocity than has hitherto been diſcovered in any of the other heavenly bodies.

28
Logarithmic tables compoſed.

While aſtronomers were thus buſy in making new diſcoveries, the mathematicians in different countries were no leſs earneſtly employed in conſtructing logarithmic tables to facilitate their calculations. Benjamin Urſinus, an excellent mathematician of Brandenburg, calculated much larger tables of logarithms than had been done by their noble inventor, and publiſhed them in 1625. They were improved by Henry Briggs, Savilian profeſſor of Oxford; who by making unity the logarithm of ten, thus rendered them much more convenient for the purpoſes of calculation. Logarithmic tables of ſines and tangents were alſo compoſed by Mr Briggs and Adrian Vlacq at Goude, ſo that the buſineſs of calculation was now rendered nearly as eaſy as poſſible.

29
Tranſit of Venus firſt diſcovered by Mr Horrox.

In 1633, Mr Horrox, a young aſtronomer of very extraordinary talents, diſcovered that Venus would paſs over the diſk of the ſun on the 24th of November 1639. This event he announced only to one friend, a Mr Crabtree; and theſe two were the only perſons in the world who obſerved this tranſit the firſt time it had ever been viewed by human eyes. Mr Horrox made many uſeful obſervations at the time; and had even formed a new theory of the moon, ſo ingenious as to attract the notice of Sir Iſaac Newton; but the hopes of aſtronomers from the abilities of this excellent young man were blaſted by his death in the beginning of January 1640.

30
Foundation of the academy of ſciences at Paris and Royal Society at London.

About the year 1638 many learned men began to aſſemble at Paris in order to hold conferences on different ſcientific ſubjects, which was the firſt foundation of the Royal Academy of Sciences in that capital. This practice was introduced in France by Merſennus, and ſoon after at London by Oldenburg; which laid the foundation of the Royal Society there. About this time alſo the celebrated aſtronomer Hevelius flouriſhed at Dantzic, building an obſervatory in his own houſe, and furniſhing it with excellent inſtruments of his own conſtruction; particularly octants and ſexants of braſs of three and four feet radius, as well as teleſcopes, with which he conſtantly obſerved the ſpots and phaſes of the moon, and from which obſervations he afterwards compiled his excellent and beautiful work intitled *Selenographia*. This noble building, together with all the books and inſtruments it contained, was conſumed by fire on the 26th of September 1679; but the memory, as well as the form and conſtruction of the inſtruments, is preſerved in a curious work of the ingenious inventor, intitled *Machina Cæleſtis*; though almoſt the whole impreſſion of this book was involved in the ſame fate with the inſtruments it deſcribes. The damage ſuſtained on this occaſion was eſtimated at 30,000 crowns.

The celebrated Engliſh mechanic Dr Hooke, who was cotemporary with Hevelius, had in the mean time invented inſtruments with teleſcopic ſights, which he preferred to thoſe uſed by Hevelius ſo much, that a diſpute commenced, which procured Hevelius a viſit from Dr Halley. The latter had at that time taken a voyage to St Helena at the deſire of the Royal Society, in order to obſerve and form a catalogue of the ſtars in the ſouthern hemiſphere. The reſult of his obſervations with Hevelius's inſtruments was, that three ſeveral obſervations on the Spica Virginis and Regulus differed only a few ſeconds from each other. They were the invention of Tyco-Brache, and are deſcribed under the article Optics. At this viſit Halley and Hevelius obſerved on occultation of Jupiter by the moon, and determined the diameter of the latter to be 30'. 33''.

In 1671 the Royal Obſervatory in Paris was finiſhed, and the uſe of it aſſigned to Mr Caſſini, after it had been furniſhed with inſtruments at a very great expence: and the obſervatory at Greenwich being likewiſe built five years after, Mr Flamſtead was appointed aſtronomer-royal. The obſervations in both theſe places, however, have been ſo numerous, that it is in vain to attempt any account of them.

31 Improvements in teleſcopes.

Before the middle of the 17th century the conſtruction of teleſcopes had been greatly improved, particularly by Fontana and Huygens. The latter conſtructed one of 123 feet, which is ſtill preſerved in the muſeum of the Royal Society at London. With this he obſerved the moon and planets for a long time, and diſcovered that Saturn was encompaſſed with a ring. The French, however, ſtill outdid the Engliſh artiſts; and by means of teleſcopes of 200 and 300 feet focus, M. Caſſini was enabled to ſee all the five ſatellites of Saturn, his belts, and the ſhadows of Jupiter's ſatellites paſſing over his body. In 1666 M. Azout applied a micrometer to teleſcopes for the purpoſe of meaſuring the diameters of the planets, and ſmall diſtances in the heavens; however an inſtrument of this kind had been before invented by Mr Gaſcoine, though it was but little known abroad.

Notwithſtanding all theſe diſcoveries by means of teleſcopes, it was evident that they ſtill continued in a very imperfect ſtate, and their imperfections at the time appeared to be without remedy. One defect was the enormous length requiſite to admit of any very conſiderable magnifying power; and another was the incorrectneſs of the image ariſing from the aberration of the rays, as was then ſuppoſed, by the ſpherical figure of the glaſs. To obviate theſe inconveniences, Merſennus is ſaid to have firſt propoſed, in a letter to Deſcartes, the uſe of reflectors inſtead of lenſes in the conſtruction of teleſcopes; but this he did in ſuch an obſcure manner, that the latter laboured to perſuade him of the falſehood of the principle on which his ſcheme was founded. In 1663, however, James Gregory of Aberdeen ſhowed how ſuch a teleſcope might be conſtructed. He ſhowed alſo, that in order to form a perfect image of an object in this manner, the figure of the ſpeculum ought to be parabolic; but Sir Iſaac Newton, who applied himſelf to the framing of teleſcopes of the reflecting kind, found it impracticable to grind them of the deſired figure. Laying aſide the idea of reflecting teleſcopes, therefore, he applied himſelf to the execution of a ſcheme formed by Deſcartes, viz. that of grinding lenſes of the figure of one of the conic ſections. In proſecuting this plan, he diſcovered, that the greateſt errors to which teleſcopes were ſubject aroſe from the different refrangibility of the rays of light, for which he could not then find any remedy. He therefore returned to the ſcheme he had juſt abandoned; and, in the year 1672, preſented to the Royal Society two reflectors which were conſtructed with ſpherical ſpeculums, as he could not procure any other. The inconveniences ariſing from the different refrangibility of the rays of light, have ſince been in the fulleſt manner corrected by Mr Dolland, the excellency of whoſe achromatic teleſcopes are too well known to need any encomium.

About the beginning of the preſent century, the practical part of aſtronomy ſeemed to languiſh for want of proper inſtruments. Roemer, indeed, had invented ſome new ones, and Dr Hooke had turned his attention towards this ſubject in a very particular manner; but either through want of ſkill in the artiſts, or ſome other unfortunate circumſtance, it happened that nothing effectual was done. But at the very time when this was the caſe with practical aſtronomy, the ſpeculative part was carried in a manner to its utmoſt pitch by the labours of the immortal Newton, whoſe Principia gave an entire new face to the ſcience. It was not, however, for many years reliſhed by the foreign philoſophers, though almoſt immediately adopted at home, and has continued ever ſince to ſpread its reputation farther and farther, ſo that now it is in a manner eſtabliſhed all over the world. "But (ſays Dr. Long) that, after Newton's ſyſtem had for ſo long a time been neglected, it ſhould all at once be univerſally received and approved of, is not to be attributed to chance, or the caprice of faſhion, as ſome who are ignorant of it are apt to think; and from thence to expect that ſome other ſyſtem will hereafter take its place and bury it in oblivion. The ſyſtem of Newton, like that of Copernicus, is ſo agreeable to the phenomena of nature, and ſo well put together, that it *muſt* laſt as long as truth and reaſon endure, although time may perhaps bring the word attraction into diſuſe; and though it may no longer be thought inherent in matter, yet the laws of gravitation, as they are now called, and on which this ſyſtem is founded, will never be forgotten."

32 Aſtronomical inſtruments firſt improved in England

It was alſo in Britain that the firſt improvements in aſtronomical inſtruments took place. The celebrated mechanic and watchmaker Graham, carried the accuracy of his inſtruments to a degree which ſurpriſed every one. He alſo greatly improved the principles of watchwork, and made clocks to go with much greater regularity than before. The old eight feet mural arch at Greenwich was alſo conſtructed by him; as was a ſmall equatorial ſector for making obſervations out of the meridian: but he is chiefly remarkable for contriving the zenith ſector of 24 feet radius, and afterwards one of 12½ feet, by which Dr Bradley diſcovered the aberration of the fixed ſtars. The reflecting teleſcope which had been invented by Gregory, and executed by Newton, was greatly improved by Mr Hadley, and a very complete and powerful inſtrument of that kind was preſented to the Royal Society in 1719. The ſame gentleman has alſo immortalized his memory by the invention of the reflecting quadrant, which he preſented to the Society in 1731, which is now in univerſal uſe at ſea; and without which all improvements of the lunar theory would have been uſeleſs for determining the longitude, through the want of an inſtrument proper to make the obſervations with. It however appears, that an inſtrument, exactly ſimilar to this in its principles, had been invented by Sir Iſaac Newton; and a deſcription of it, together with a drawing, given by the inventor to Dr Halley, when he was preparing for his voyage to diſcover the variation of the needle in 1701. About the middle of this century, the conſtructing and dividing of large aſtronomical inſtruments was carried to a great degree of perfection by Mr John Bird: reflecting teleſcopes were equally improved by Mr Short, who firſt executed the divided object-glaſs micrometer. This had indeed been thought of by M. Louville, and ſeveral other perſons long before; and a deſcription of one nearly agreeing with that of Mr Short had been publiſhed in the Philoſophical Tranſactions for 1753: but had it not been for the great ſkill of Mr Short in figuring and centering glaſſes of this kind, it is very probable the ſcheme might never have been executed. About this time alſo Mr Dollond brought refracting teleſcopes to ſuch perfection, that they became ſuperior to reflectors of equal length; though all of them are now excelled by thoſe of Mr Herſchel, whoſe Teleſcopic diſcoveries have been far more numerous and ſurpriſing than thoſe of any other aſtronomer.

33 Improvements within this laſt century

We ſhall cloſe this hiſtory with a ſhort account of the labours of the principal aſtronomers ſince the building the Royal Obſervatories at Paris, Greenwich, and the appointment of Mr Flamſtead to the office of aſtronomer royal. This gentleman not only made obſervations on the ſun, moon, planets, and comets which appeared in his time, but on the fixed ſtars alſo, of which he gave a catalogue of 3000: many of them ſo ſmall that they cannot be diſcerned without the help of a teleſcope: he alſo publiſhed new ſolar tables, and a theory of the moon according to Horrox. He publiſhed a very curious tract on the doctrine of the ſphere, in which he ſhowed how to conſtruct eclipſes of the ſun and moon, as well as occultations of the fixed ſtars by the moon geometrically; and it was upon his obſervations that Halley's tables and Newton's theory of the moon were conſtructed. Mr Caſſini alſo diſtinguiſhed himſelf very conſiderably. He erected the gnomon, and drew the famous meridian line in the church of Petronia at Borunia. He enjoyed his office more than 40 years, making many obſervations on the ſun, moon, planets, and comets, and greatly amended the elements of their motions. The office was continued in his family, and his grandſon ſtill enjoys it. Rœmer, a celebrated Daniſh aſtronomer, firſt diſcovered the progreſſive motion of light by obſerving the eclipſes of Jupiter, and read a diſſertation upon it before the Royal Academy of Sciences at Paris in the year 1675. He was alſo the firſt who made uſe of a meridional teleſcope.

Mr Flamſtead was ſucceeded in 1719 by Dr Halley, "the greateſt aſtronomer (ſays M. de la Lande) without contradiction in England;" and, adds Dr Long, "I believe he might have ſaid in the whole world." He had been ſent, at the age of 21, by King Charles II. to the iſland of St Helena, in order to make a catalogue of the ſouthern ſtars, which was publiſhed in 1679. In 1705, he publiſhed his *Synopſis Aſtronomiæ Cometicæ*, in which, after immenſe calculation, he ventured to predict the return of one in 1758 or 1759. He alſo publiſhed many learned diſſertations in the Philoſophical Tranſactions concerning the uſe that might be made of the next tranſit of Venus in determining the diſtance of the ſun from the earth. He was the firſt who diſcovered the acceleration of the moon, and gave a very ingenious method of finding her parallax by three obſerved phaſes of a ſolar eclipſe. He compoſed tables of the ſun, moon, and all the planets; and, in the nine years in which he was at Greenwich, made near 1500 obſervations of the moon; all which he compared with the tables, and noted the differences; and theſe, he thought, would return in about 18 years. He recommended the method of determining the longitude by means of the moon's diſtance from the ſun and certain fixed ſtars. He was convinced of its ſuperior excellence; and it has ſince been adopted by all the moſt eminent aſtronomers in Europe. It is at preſent the only ſure guide to the mariner; and the great perfection to which it is now brought is much owing to the induſtry and exertions of Dr Maſkelyne, the preſent aſtronomer-royal, to whom we are indebted for the publication of the Nautical Almanac, the Requiſite Tables, and other works of the utmoſt ſervice to practical aſtronomy.

34 True figure of the earth diſcovered.

In the mean time an attempt was made in France to meaſure a degree of the earth, which occaſioned a very warm diſpute concerning the figure of it. Caſſini, from Picart's meaſure, concluded that the earth was an oblong ſpheroid; but Newton, from a conſideration of the laws of gravity and the diurnal motion of the earth, had determined the figure of it to be an oblate ſpheroid, and flatted at the poles. To determine this point, Lewis XV. reſolved to have two degrees of the meridian meaſured; one under, or very near the equator; and the other as near the pole as poſſible. For this purpoſe the Royal Academy of Sciences ſent M. Maupertuis, Clairault, Camus, and Le Monier, to Lapland. They were accompanied by the Abbé Outhier, a correſpondent of the ſame academy. They were joined by M. Celſius profeſſor of anatomy at Upſal; and having ſet out from France in the ſpring of the year 1736, returned to it in 1737, after having fully accompliſhed their errand. On the ſouthern expedition were diſpatched M. Godin, Condamine, and Bouguer, to whom the king of Spain joined Don George Juan and Don Anthony de Ulloa, two very ingenious gentlemen and officers of the marine. They left Europe in 1735; and after enduring innumerable hardſhips and difficulties in the execution of their commiſſion, returned to Europe at different times, and by different ways, in the years 1744, 1745, and 1746. The reſult of this arduous taſk was a confirmation of Newton's inveſtigation. Picart's meaſure was reviſed by Caſſini and De la Caille; and, after his errors were corrected, it was found to agree very well with the other two. On this occaſion too it was diſcovered, that the attraction of the great mountains of Peru had an effect on the plumb-line of one of their largeſt inſtruments, drawing it ſeven or eight ſeconds from the true perpendicular.

Dr Halley, dying in 1742, was ſucceeded by Dr Bradley, who, though inferior as a mathematician, greatly exceeded him as a practical aſtronomer. He was the firſt who made obſervations with an accuracy ſufficient to detect the leſſer inequalities in the motions of the planets and fixed ſtars. Thus he diſcovered the aberration of light, the nutation of the earth's axis, and was able to make the lunar tables much more perfect than they had ever been. He alſo obſerved the places, and computed the elements of the comets which appeared in the years 1723, 1736, 1743, and 1757. He made new and moſt accurate tables of the motions of Jupiter's ſatellites, from his own obſervations and thoſe of Dr Pound; and from a multitude of obſervations of the ſun, moon, and ſtars, was enabled to give the moſt accurate table of mean refractions yet extant, as well as the beſt methods of computing the variations of thoſe refractions ariſing from the different ſtates of the air as indicated by the thermometer and barometer. In 1750, having procured a very large tranſit inſtrument made by Mr Bird, and a new mural quadrant of braſs eight feet radius, he began to make obſervations with redoubled induſtry; ſo that betwixt this time and his death, which happened in 1762, he made obſervations for ſettling the places of all the ſtars in the Britiſh catalogue, together with near 1500 places of the moon, much the greater part of which he compared with the tables of Mr Mayer.

35 Improvements by the French aſtronomers.

In the mean time the French aſtronomers were aſſiduous in their endeavours to promote the ſcience of aſtronomy. The theory of the moon, which had been given in a general way by Sir Iſaac Newton, began to be particularly conſidered by Meſſrs Clairault, D'Alembert, Euler, Mayer, Simpſon, and Walmſly; tho' Clairault, Euler, and Mayer, diſtinguiſhed themſelves beyond any of the reſt, and Mr Euler has been particularly happy in the arrangement of his tables for the eaſe and expedition of computation. He was excelled in exactneſs, however, by Mayer, who publiſhed his tables in the Gottingen Acts for 1753. In theſe the errors in longitude never exceeded two minutes; and having yet farther improved them, he ſent a copy to the lords of the Britiſh admiralty in 1755; and it was this copy which Dr Bradley compared with his obſervations, as already mentioned. His laſt corrections of them were afterwards ſent over by his widow; for which ſhe and her children received a reward of L.3000. Accurate tables for Jupiter's ſatellites were alſo compoſed by Mr Wargentin a moſt excellent Swediſh aſtronomer, and publiſhed in the Upſal Acts in 1741; which have ſince been corrected by the author in ſuch a manner as to render them greatly ſuperior to any ever publiſhed before.

36 Of M. de la Caille.

Amongſt the many French aſtronomers who contributed to the advancement of the ſcience, we are particularly indebted to M. de la Caille, for a moſt excellent ſet of ſolar tables, in which he has made allowances for the attractions of Jupiter, Venus, and the moon. In 1750 he went to the Cape of Good Hope, in order to make obſervations in concert with the moſt celebrated aſtronomers in Europe, for determining the parallax of the moon, as well as of the planet Mars, and from thence that of the ſun; from whence it appeared that the parallax of the ſun could not greatly exceed 10 ſeconds. Here he re-examined and adjuſted the places of the ſouthern ſtars with great accuracy, and meaſured a degree of the meridian at that place. In Italy the ſcience was cultivated with the greateſt aſſiduity by Signior Bianchini, father Boſcovich, Friſi, Manfredi, Zanotti, and many others; in Sweden by Wargentin already mentioned, Blingenſtern, Mallet, and Planman; and in Germany, by Euler elder and younger, Mayer, Lambert, Griſchow, &c. In the year 1760 all the learned ſocieties in Europe began to prepare for obſerving the tranſit of Venus over the ſun, foretold by Dr Halley upwards of 80 years before it happened, ſhowing at the ſame time the important uſe which might be made of it. Unfortunately, however, for the cauſe of ſcience, many of the aſtronomers ſent out to obſerve this phenomenon were prevented by unavoidable accidents from reaching the places of their deſtination, and others were diſappointed by the badneſs of the weather. It happened alſo, that the circumſtances of the phenomenon were much leſs favourable for the purpoſe of determining the ſun's parallax than had been expected by Dr Halley, owing to the faults of the tables he made uſe of: ſo that, notwithſtanding all the labours of aſtronomers at that time, they were not able to determine the matter; and even after their obſervations in 1769, when the circumſtances of the tranſit were more favourable, the parallax of the ſun remained ſtill uncertain.

Dr Bradley was ſucceeded in his office of aſtronomer-royal by Mr Bliſs Savilian profeſſor of aſtronomy at Oxford; who being in a very declining ſtate of health at the time of his acceſſion to the office, did not enjoy it long. He was ſucceeded by the learned Nevil Maſkelyne, D. D. the preſent aſtronomer-royal, whoſe name will be rendered immortal by his aſſiduity and ſucceſs in bringing the lunar method of determining the longitude at ſea into general practice.

Such was the general ſtate of aſtronomy, when Mr Herſchel's great diſcovery of augmenting the power of teleſcopes, beyond the moſt ſanguine hopes of aſtronomers, opened at once a ſcene altogether unlooked for. By this indefatigable obſerver we are made acquainted with a new primary planet attended by two ſecondaries belonging to our ſolar ſyſtem; ſo that the latter now appears to have double the bounds formerly aſſigned to it; this new planet being at leaſt twice the diſtance of Saturn from the ſun. In the ſtill farther diſtant celeſtial regions, among the fixed ſtars, his obſervations are equally ſurpriſing; of which we ſhall only ſay with Dr Prieſtley *, "Mr Herſchel's late diſcoveries in and beyond the bounds of the ſolar ſyſtem, the great views that he has given of the arrangement of the ſtars, their revolutions, and thoſe of the immenſe ſyſtems into which they are formed, are peculiarly calculated to inſpire an ardent deſire of ſeeing ſo great a ſcene a little more unfolded. Such diſcoveries as theſe give us a higher idea of the value of our being, by raiſing our ideas of the ſyſtem of which we are a part; and with this an earneſt wiſh for the continuance of it."

SECT. I. *Of the apparent Motions, Magnitudes, and Changes, in the celeſtial Bodies, as ſeen by the naked eye.*

As the true motions of bodies at a great diſtance are to be gathered only from a careful obſervation of their apparent ones, it is abſolutely neceſſary for thoſe who want to become acquainted with the true motions of the heavenly bodies, to know perfectly the different changes which take place in the heavens as ſeen from this earth, the only place from which any obſervation can be made. By carefully attending to theſe, a little knowledge of optics will enable us to underſtand with great certainty not only the true ſyſtem of nature, but alſo what appearance the heavens would make to a ſpectator placed in any part of the viſible creation.

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* *Exper. and Obſerv.* vol. vi. Pref.

37 Apparent motion of the ſun.

The firſt and moſt obvious phenomenon is the daily riſing of the ſun in the eaſt, and his ſetting in the weſt; after which the moon and ſtars appear, ſtill keeping the ſame weſterly courſe, till we loſe ſight of them altogether. This cannot be long taken notice of before we muſt likewiſe perceive that neither the ſun nor moon always riſe exactly in the ſame point of the heavens. If we begin to obſerve the ſun, for inſtance, in the beginning of March, we will find that he ſeems to riſe almoſt every day ſenſibly more to the northward than he did the day before, to continue longer above the horizon, and to be more vertical at mid-day. This continues till towards the end of June, when he is obſerved to move backward in the ſame manner; and this retrograde motion continues to the end of December, or near it, when he begins again to move forwards, and ſo on.

38 Of the moon.

The motion of the moon through the heavens, as well as her appearance at different times, is ſtill more remarkable than thoſe of the ſun. When ſhe firſt becomes viſible at the time ſhe is called the *new moon*, ſhe appears in the weſtern part of the heavens, and ſeems to be at no great diſtance from the ſun himſelf. Every night ſhe not only increaſes in ſize, but removes to a greater diſtance from the ſun; till at laſt ſhe appears in the eaſtern part of the horizon, juſt at the time the ſun diſappears in the weſtern. After this ſhe gradually moves farther and farther eaſtward, and therefore riſes every night later and later, till at laſt ſhe ſeems to approach the ſun as nearly in the eaſt as ſhe did in the weſt, and riſes only a little before him in the morning, as in the firſt part of her courſe ſhe ſet in the weſt not long after him. All theſe different appearances are completed in the ſpace of a month; after which they begin in the ſame order as before. They are not, however, at all times regular; for at ſome ſeaſons of the year, particularly in harveſt, the moon for ſeveral days riſes nearly at the ſame hour every night.

39 Of the ſtars.

In contemplating the ſtars, it is obſerved that ſome of them have the ſingular property of neither riſing in the eaſt nor ſetting in the weſt; but ſeem to turn round one immoveable point, near which is placed a ſingle ſtar called the *pole*, or *pole-ſtar*. This point is more or leſs elevated according to the different parts of the earth from which we take our view. The inhabitants of Lapland, for inſtance, ſee it much more elevated above the horizon, or more vertical, than we do; we ſee it more vertical than it appears to the inhabitants of France and Spain; and they, again, ſee it more elevated than the inhabitants of Barbary. By continually travelling ſouth, this ſtar would at length ſeem depreſſed in the horizon, and another point would appear directly oppoſite to it, round which the ſtars in the ſouthern part of the horizon would ſeem to turn. In this part of the heavens, however, there is no ſtar ſo near the pole as there is in the northern part; neither is the number of ſtars in the ſouthern part of the heavens ſo great as in the northern. Suppoſing us ſtill to travel ſouthward, the north-pole would then entirely diſappear, and the whole hemiſphere would appear to turn round a ſingle point in the ſouth, as the northern hemiſphere appears to us to turn round the pole-ſtar.—The general appearance of the heavens, therefore, is that of a vaſt concave ſphere, turning round two points fixed in the north and ſouth parts of it, once in 24 hours.

40 Fixed ſtars and planets

When we further conſider the ſtars, we will find the greateſt part of them to keep their places with reſpect to one another; that is, if we obſerve two ſtars having a certain apparent diſtance from each other this night, they will ſeem to have the ſame to-morrow, and every other ſucceeding night; but we will by no means obſerve them to have the ſame places either with reſpect to the ſun or moon, as muſt be eaſily underſtood from what we have already ſaid. Neither do all the ſtars in the heavens appear to be of this fixed kind. Some of them, on the contrary, change their places very remarkably with regard to the fixed ſtars, and with regard to one another. Of theſe, five were only obſerved formerly; but Mr Herſchel has now diſcovered a ſixth. They are diſtinguiſhed by the appellation of *planets*, (from πλανω, to *err* or *wander*); and called by the names of *Mercury*, *Venus*, *Mars*, *Jupiter*, *Saturn*, and the *Georgium Sidus*. The fixed ſtars are likewiſe diſtinguiſhed from the planets by their continually exhibiting that appearance which is called the *ſcintillation* or *twinkling of the ſtars*. This is ſaid to ariſe from the exceeding minuteneſs of their apparent diameter; ſo that the interpoſition of any little ſubſtance, of which there are many floating in the atmoſphere, continually deprives us of the ſight of them; but the interpoſing body ſoon changing its place, we again ſee the ſtar, and thus the twinkling is produced.

Mercury is a ſmall ſtar, but emits a very bright white light; though by reaſon of his always keeping near the ſun, he is ſeldom to be ſeen; and when he does makes his appearance, his motion towards the ſun is ſo ſwift, that he can only be diſcerned for a ſhort time. He appears a little after ſunſet, and again a little before ſunriſe.

Venus, the moſt beautiful ſtar in the heavens, known by the names of the *morning* and *evening ſtar*, likewiſe keeps near the ſun, though ſhe recedes from him almoſt double the diſtance of mercury. She is never ſeen in the eaſtern quarter of the heavens when the ſun is in the weſtern; but always ſeems to attend him in the evening, or to give notice of his approach in the morning.

Mars is of a red fiery colour, and always gives a much duller light than Venus, though ſometimes he equals her in ſize. He is not ſubject to the ſame limitation in his motions as Mercury or Venus; but appears ſometimes very near the ſun, and ſometimes at a great diſtance from him; ſometimes riſing when the ſun ſets, or ſetting when he riſes. Of this planet it is remarkable, that when he approaches any of the fixed ſtars, which all the planets frequently do, theſe ſtars change their colour, grow dim, and often become totally inviſible, though at ſome little diſtance from the body of the planet: but Mr Herſchel thinks this has been exaggerated by former aſtronomers.

Jupiter and Saturn likewiſe often appear at great diſtances from the ſun. The former ſhines with a bright white light, and the latter with a pale faint one: and the motion of Saturn among the fixed ſtars is ſo ſlow, that, unleſs carefully obſerved, he will not be thought to move at all.

41
Apparent magnitudes of the planets different at different times.

Beſides the motions which we obſerve in all theſe planets, their apparent magnitudes are very different at different times. Every perſon muſt have obſerved that Venus, though ſhe conſtantly appears with great ſplendor is not always equally big; and this apparent difference of magnitude is ſo remarkable, that ſhe appears no leſs than 32 times larger at ſome ſeaſons than at others. This increaſe of magnitude is likewiſe very remarkable in Mars and Jupiter, but leſs ſo in Saturn and Mercury.

42
Their irregular motion.

Though we have thus deſcribed the motions of the planets with reſpect to their apparent diſtances from the ſun, they by no means appear to us to move regularly in the heavens; but, on the contrary, in the moſt complex and confuſed manner that can be imagined, ſometimes going forward, ſometimes backward, and ſometimes ſeeming to be ſtationary. They all ſeem to deſcribe looped curves; but it is not known when any of theſe curves would return into themſelves, except that of Venus, which returns nearly into itſelf every eighth year. On each ſide of the loops they appear ſtationary; in that part of each loop near the earth, retrograde; and in every other part of their path direct.

43
Comets.

Theſe, however, are not the only moving bodies which are to be obſerved in the celeſtial regions. The ſix abovementioned are indeed the only ones which appear almoſt conſtantly, or diſappear only at certain intervals, and then as certainly return. But there are others which appear at uncertain intervals, and with a very different aſpect from the planets. Theſe are very numerous, and no fewer than 450 are ſuppoſed to belong to our ſolar ſyſtem. They are called *Comets*, from their having a long tail, ſomewhat reſembling the appearance of hair. This, however, is not always the caſe; for ſome comets have appeared which were as well defined and as round as planets: but in general they have a luminous matter diffuſed around them, or projecting out from them, which to appearance very much reſembles the Aurora Borealis. When theſe appear, they come in a direct line towards the ſun, as if they were going to fall into his body; and after having diſappeared for ſome time in conſequence of their proximity to that luminary, they fly off again on the other ſide as faſt as they came, projecting a tail much greater and brighter in their receſs from him than when they advanced towards him; but, getting daily at a farther diſtance from us in the heavens, they continually loſe of their ſplendor, and at laſt totally diſappear. Their apparent magnitude is very different: ſometimes they appear only of the bigneſs of the fixed ſtars; at other times they will equal the diameter of Venus, and ſometimes even of the ſun or moon. So, in 1652, Hevelius obſerved a comet which ſeemed not inferior to the moon in ſize, though it had not ſo bright a ſplendor, but appeared with a pale and dim light, and had a diſmal aſpect. Theſe bodies will alſo ſometimes loſe their ſplendor ſuddenly, while their apparent bulk remains unaltered. With reſpect to their apparent motions, they have all the inequalities of the planets; ſometimes ſeeming to go forwards, ſometimes backwards, and ſometimes to be ſtationary.

44
Fixed ſtars ſeemingly deſtructible and generable.

Though the fixed ſtars are the only marks by which aſtronomers are enabled to judge of the courſes of the moveable ones, and though they have never been obſerved to change their places; yet they ſeem not to be endued with the permanency even of the earth and planets, but to be periſhable or deſtructible by accident, and likewiſe generable by ſome natural cauſe. Several ſtars obſerved by the ancients are now no more to be ſeen, but are deſtroyed; and new ones have appeared, which were unknown to the ancients. Some of them have alſo diſappeared for ſome time, and again become viſible.

We are alſo aſſured from the obſervations of aſtronomers, that ſome ſtars have been obſerved which never were ſeen before, and for a certain time they have diſtinguiſhed themſelves by their ſuperlative luſtre; but afterwards decreaſing, they vaniſhed by degrees, and were no more to be ſeen. One of theſe ſtars being firſt ſeen and obſerved by Hipparchus, the chief of the ancient aſtronomers, ſet him upon compoſing a catalogue of the fixed ſtars, that by it poſterity might learn whether any of the ſtars periſh, and others are produced afreſh.

45
Dr Halley's hiſtory of new ſtars.

After ſeveral ages another new ſtar appeared to Tycho Brache and the aſtronomers who were cotemporary with him; which put him on the ſame deſign with Hipparchus, namely, the making a catalogue of the fixed ſtars. Of this, and other ſtars which have appeared ſince that time, we have the following hiſtory by Dr Halley: "The firſt new ſtar in the chair of Caſſiopeia, was not ſeen by Cornelius Gemma on the 8th of November 1572, who ſays, he that night conſidered that part of the heaven in a very ſerene ſky, and ſaw it not: but that the next night, November 9, it appeared with a ſplendor ſurpaſſing all the fixed ſtars, and ſcarce leſs bright than Venus. This was not ſeen by Tycho Brache before the 11th of the ſame month: but from thence he aſſures us that it gradually decreaſed and died away, ſo as in March 1574, after ſixteen months, to be no longer viſible; and at this day no ſigns of it remain. The place thereof in the ſphere of fixed ſtars, by the accurate obſervations of the ſame Tycho, was $0^{s}\ 9^{\circ}\ 17'$ *a* $1^{ma}\ \ast\ \Upsilon^{is}$, with $53^{\circ}\ 45'$ north latitude.

"Such another ſtar was ſeen and obſerved by the ſcholars of Kepler, to begin to appear on Sept. 30. *ſt. vet.* anno 1604, which was not to be ſeen the day before: but it broke out at once with a luſtre ſurpaſſing that of Jupiter; and like the former, it died away gradually, and in much about the ſame time diſappeared totally, there remaining no footſteps thereof in January 1605—6. This was near the ecliptic, following the right leg of Serpentarius; and by the obſervations of Kepler and others, was in $7^{s}\ 20^{\circ}\ 00'$ *a* $1^{ma}\ \ast\ \Upsilon$, with north latitude $1^{\circ}\ 56'$. Theſe two ſeem to be of a diſtinct ſpecies from the reſt, and nothing like them has appeared ſince.

"But between them, viz. in the year 1596, we have the firſt account of the wonderful ſtar in Collo Ceti, ſeen by David Fabricius on the third of Auguſt, *ſt. vet.* as bright as a ſtar of the third magnitude which has been ſince found to appear and diſappear periodically,

Fig. 15

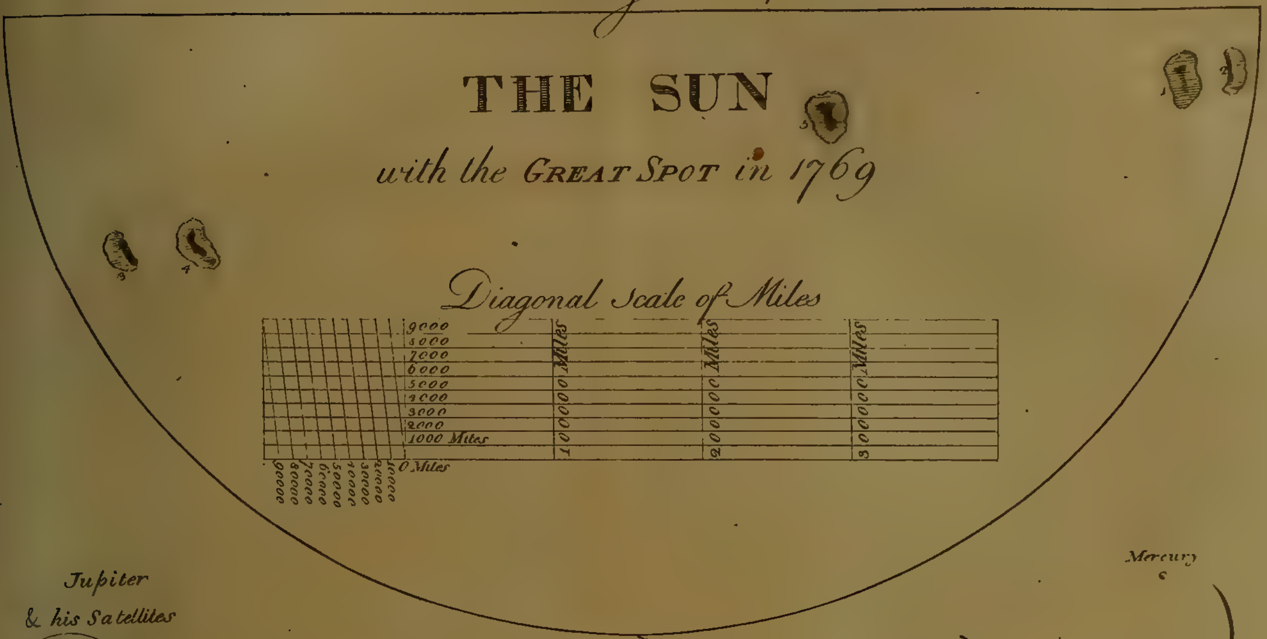


Fig. 18

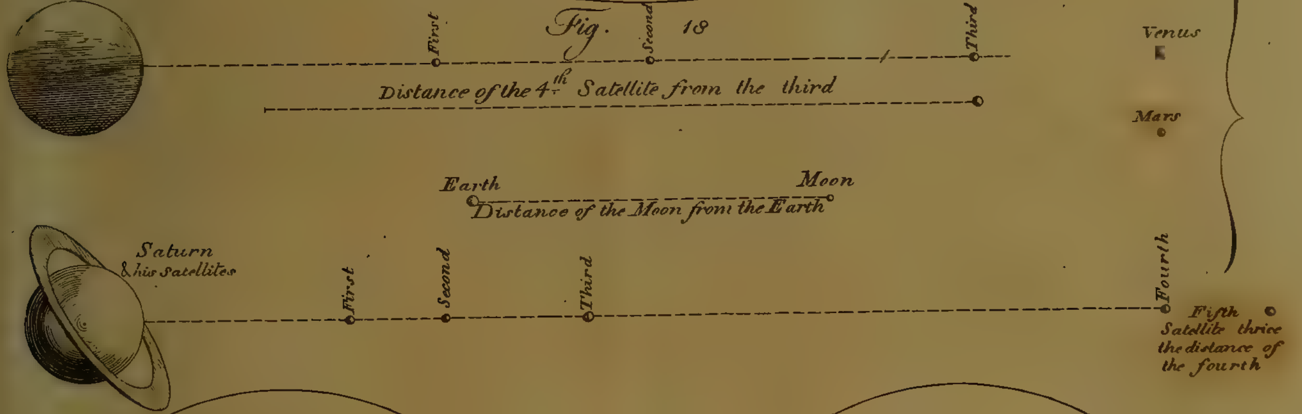

Jupiter
& his Satellites
First
Second
Third
Distance of the 4th Satellite from the third
Earth
Moon
Distance of the Moon from the Earth
Saturn
& his Satellites
First
Second
Third
Fourth
Fifth Satellite thrice the distance of the fourth
Mercury
Venus
Mars

Fig. 16

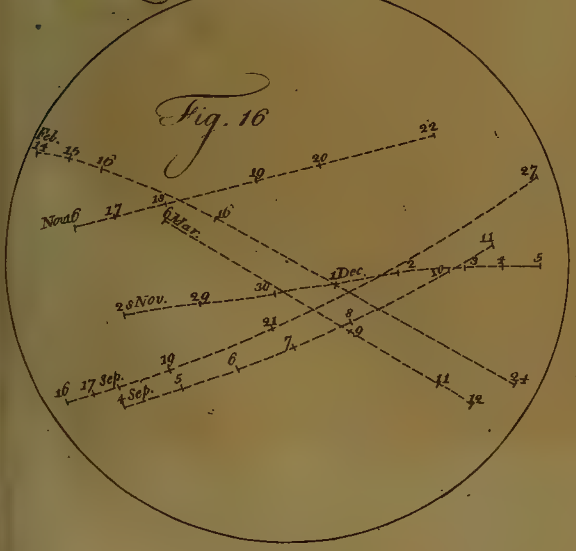
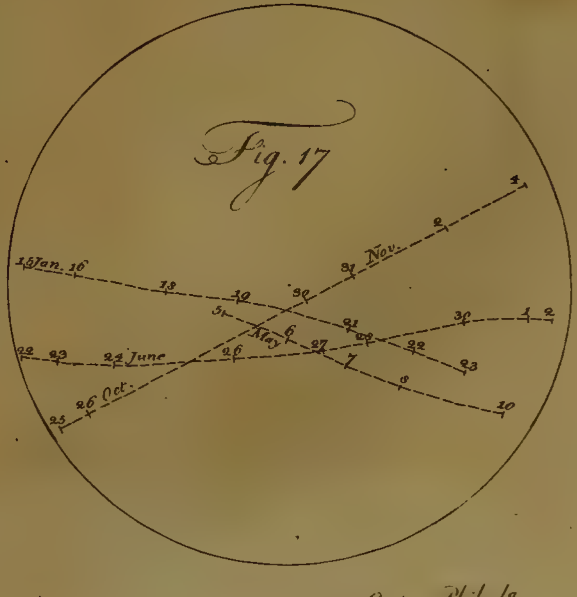


Fig. 17



Scot Philada.

Apparent Motion, &c.

its period being preciſely enough ſeven revolutions in ſix years, though it returns not always with the ſame luſtre. Nor is it ever totally extinguiſhed, but may at all times be ſeen with a ſix-feet tube. This was ſingular in its kind, till that in Collo Cygni was diſcovered. It precedes the firſt ſtar in Aries 1° 40′, with 15° 57′ ſouth latitude.

"Another new ſtar was firſt diſcovered by William Janſonius in the year 1600, *in pectore*, or rather *in eductione*, Colli Cygni, which exceeded not the third magnitude. This having continued ſome years, became at length ſo ſmall, as to be thought by ſome to have diſappeared entirely: but in the years 1657, 1658, and 1659, it again aroſe to the third magnitude; tho' ſoon after it decayed by degrees to the fifth or ſixth magnitude, and to this day is to be ſeen as ſuch in $9^s\ 18^\circ\ 38'$ *a* 1^{ma} * ♈, with 55° 29′ north latitude.

"A fifth new ſtar was firſt ſeen by Hevelius in the year 1670, on July 15. *ſt. vet.* as a ſtar of the third magnitude, but by the beginning of October was ſcarce to be perceived by the naked eye. In April following it was again as bright as before, or rather greater than of the third magnitude, yet wholly diſappeared about the middle of Auguſt. The next year, in March 1672, it was ſeen again, but not exceeding the 6th magnitude: ſince when, it has been no further viſible, though we have frequently ſought for its return; its place is $9^s\ 3^\circ\ 17'$ *a* 1^{ma} * ♈, and has lat. north 47° 28′.

"The ſixth and laſt is that diſcovered by Mr G. Kirch in the year 1686, and its period determined to be of $404\frac{1}{2}$ days; and though it rarely exceeds the fifth magnitude, yet it is very regular in its returns, as we found in the year 1714. Since then we have watched, as the abſence of the moon and clearneſs of the weather would permit, to catch the firſt beginning of its appearance in a ſix-feet tube, that, bearing a very great aperture, diſcovers moſt minute ſtars. And on June 15, laſt, it was firſt perceived like one of the very leaſt teleſcopical ſtars: but in the reſt of that month and July, it gradually increaſed, ſo as to become in Auguſt viſible to the naked eye; and ſo continued all the month of September. After that, it again died away by degrees; and on the eighth of December, at night, was ſcarce diſcernible by the tube; and, as near as could be gueſſed, equal to what it was at its firſt appearance on June 25th: ſo that this year it has been ſeen in all near ſix months, which is but little leſs than half its period; and the middle, and conſequently the greateſt brightneſs, falls about the 10th of September."

46
Mr Montanere's account of changes among the fixed ſtars.

Concerning the changes which happen among the fixed ſtars, Mr Montanere, profeſſor of mathematics at Bononia, gave the following account, in a letter to the Royal Society, dated April 30th, 1670. "There are now wanting in the heavens two ſtars of the ſecond magnitude in the ſtern of the ſhip Argo, and its yard; Bayerus marked them with the letters β and γ. I and others obſerved them in the year 1664, upon the occaſion of the comet that appeared that year: when they diſappeared firſt, I know not: only I am ſure that in the year 1668, upon the 10th of April, there was not the leaſt glimpſe of them to be ſeen; and yet the reſt about them, even of the third and fourth magnitudes, remained the ſame. I have obſerved many more changes among the fixed ſtars, even to the number of an hundred, though none of them are ſo great as thoſe I have ſhowed."

Apparent Motion, &c.

47
Mr Pigot's remarks on the accounts of variable ſtars.

The late improvements in aſtronomy, and particularly thoſe in the conſtruction of teleſcopes, have now given aſtronomers an opportunity of obſerving the changes which take place among the ſtars with much greater accuracy than could be formerly done. In a paper in the 76th volume of the Philoſophical Tranſactions, Mr Edward Pigot gives a diſſertation on the ſtars ſuſpected by the aſtronomers of laſt century to be changeable. For the greater accuracy in the inveſtigation of his ſubject, he divides them into two claſſes; one containing thoſe which are undoubtedly changeable, and the other thoſe which are only ſuſpected to be ſo. The former contains a liſt of 12 ſtars, from the firſt to the fourth magnitudes; including the new one which appeared in Caſſiopeia in 1572, and that in Serpentarius in 1604: the other contains the names of 38 ſtars of all magnitudes, from the firſt to the ſeventh. He is of opinion, that the celebrated new ſtar in Caſſiopeia is a periodical one, and that it returns once in 150 years. Mr Keill is of the ſame opinion; and Mr Pigot thinks, that its not being obſerved at the expiration of each period is no argument againſt the truth of that opinion; "ſince (ſays he), perhaps, as with moſt of the variable, it may at different periods have different degrees of luſtre, ſo as ſometimes only to increaſe to to the ninth magnitude; and if this ſhould be the caſe, its period is probably much ſhorter." For this reaſon, in September 1782, he took a plan of the ſmall ſtars near the place where it formerly appeared, but in four years had obſerved no alteration.

48
Star in Collo Celi.

The ſtar in the neck of the Whale had alſo been examined by Mr Pigot from the end of 1782 to 1786, but he never found it exceed the ſixth magnitude; though Mr Goodricke had obſerved it on the 9th of Auguſt to be of the ſecond magnitude, and on the 3d of September the ſame year it was of the third magnitude. Mr Pigot deduced its period from its apparent equality with a ſmall ſtar in the neighbourhood, and thence found it to be 320, 328, and 337 days.

49
Algol.

The moſt remarkable of theſe changeable ſtars is that called *Algol*, in the head of Meduſa. It had long been known to be variable; but its period was firſt aſcertained by Mr Goodricke of York, who began to obſerve it in the beginning of 1783. It changes continually from the firſt to the fourth magnitude; and the time taken up from its greateſt diminution to its leaſt is found, at a mean, to be 2 days 20 hours 49 minutes and 3 ſeconds. During four hours it gradually diminiſhes in luſtre, which it recovers during the ſucceeding four hours; and in the remaining part of the period it invariably preſerves its greateſt luſtre, and after the expiration of the term its diminution again commences. According to Mr Pigot, the degree of brightneſs of this ſtar when at its *minimum* is variable in different periods, and he is of the ſame opinion with regard to its brightneſs when at its full; but whether theſe differences return regularly or not, has not been determined.

The 420th of Mayer's catalogue in Leo, has lately been ſhewn to be variable by Mr. Koch. Some years before 1782, that gentleman perceived it undoubtedly ſmaller than the 419th of the ſame catalogue. In February that year, it was of the ſame brightneſs with the 419th, that is, of the ſeventh magnitude. In April 1783, it was of the ninth magnitude; and in the ſame month 1784, it was of the tenth. Mr Pigot could never obſerve this ſtar, though he frequently looked for it with a night-glaſs, and on the fifth of April 1785 with a three-feet achromatic tranſit inſtrument.

50 Variable ſtar in Hydra.

In 1704, Maraldi obſerved a variable ſtar in Hydra, whoſe period he ſettled at about two years, though with conſiderable variations: but from the obſervations even of Maraldi, Mr Pigot concludes, that its period was then only 494 days; and from ſome others made by himſelf, he thinks that now it is only 487 days; ſo that ſince the time of Maraldi it has ſhortened ſeven days. The particulars relating to this ſtar are as follow. 1. When at its full brightneſs it is of the fourth magnitude, and does not perceptibly change for a fortnight. 2. It is about ſix months in increaſing from the tenth magnitude and returning to the ſame; ſo that it may be conſidered as inviſible during that time. 3. It is conſiderably more quick, perhaps one half more ſo, in its increaſe than in its decreaſe. 4. Though when at its full it may always be ſtyled a ſtar of the fourth magnitude, it does not conſtantly attain the ſame degree of brightneſs, but the differences are very ſmall. This ſtar is the 30th of Hydra in Hevelius's catalogue, and is marked by him of the ſixth magnitude.

51 Swan's head.

The new ſtar in Serpentarius, obſerved by Kepler, ſeems to have been of the ſame nature with that of Caſſiopeia; and Mr. Pigot therefore looks upon it alſo to be a periodical one, though, after taking a plan of the neareſt ſtars in that part of the heavens, in the year 1782, he could, in four years time, perceive no alteration.

The variation of the ſtar β Lyræ was diſcovered by Mr Goodricke abovementioned, who ſuſpects its period to be ſix days nine hours; which coincides with the opinion of Mr Pigot.

The new ſtar near the Swan's Head, obſerved by Don Anthelme in December 1669, ſoon became of the third magnitude, and diſappeared in 1672. Mr Pigot has conſtantly looked for it ſince November 1781, but without ſucceſs. He is of opinion, that had it only increaſed to the 10th or 11th magnitude, he would have ſeen it, having taken a plan of all the neighbouring ſmall ſtars.

The next variable ſtar in Mr Pigot's catalogue is the η Antinoi, whoſe variation and period he diſcovered in 1785. From his corrected obſervations, he concludes that it continues at its greateſt brightneſs 40 hours without decreaſing; it is 66 hours after it begins to decreaſe before it comes to its full diminution; after which it continues ſtationary for 30 hours more, and then increaſes for 36 hours. In every period it ſeems to acquire its full brightneſs, and to be equally decreaſed.

52 Swan's neck.

The variable ſtar in the Swan's Neck was obſerved for three years. The period of this ſtar had been ſettled by Maraldi and Caſſini at 405, and by M. Le Gentil at 405.3 days; but from a mean of the obſervations of Mr Pigot, it appears to be only 329. "Perhaps (ſays he) its period is irregular; to determine which ſeveral intervals of 15 years ought to be taken; and I am much inclined to believe that it will be found only 396 days 21 hours." The particulars relating to this ſtar are: 1. When at its full brightneſs it undergoes no perceptible change for a fortnight. 2. It is about three months and an half in increaſing from the 11th magnitude to its full brightneſs, and the ſame in decreaſing; for which reaſon it may be conſidered as inviſible during ſix months. 3. It does not always attain the ſame degree of luſtre, being ſometimes of the fifth and ſometimes of the ſeventh magnitude.

53 Swan's breaſt.

In 1600, G. Janſonius diſcovered a variable ſtar in the breaſt of the Swan, which was afterwards obſerved by different aſtronomers, and ſuppoſed to have a period of about ten years. The reſults of Mr Pigot's calculations from the obſervations of former aſtronomers are, 1. That it continues in full luſtre for five years. 2. It decreaſes rapidly for two years. 3. It is inviſible to the naked eye for four years. 4. It increaſes ſlowly during ſeven years. 5. All theſe changes are completed in 18 years. 6. It was at its *minimum* at the end of the year 1663. 7. It does not always increaſe to the ſame degree of brightneſs, being ſometimes of the third, and at others only of the ſixth magnitude. "I am entirely ignorant (ſays Mr. Pigot) whether it is ſubject to the ſame changes in this century, having not met with any ſeries of obſervations on it; but if the above conjectures are right, it will be at its minimum in a very few years. Since November 1781 I have conſtantly ſeen it of the ſixth magnitude. Sometimes I have ſuſpected that it has decreaſed within theſe two laſt years, though in a very ſmall degree."

The laſt ſtar in Mr. Pigot's firſt claſs is the δ Cephei, whoſe variation was diſcovered by Mr. Goodricke. Its changes are very difficult to be ſeen, unleſs it is obſerved at the times of its greateſt and leaſt brightneſs. The reſult of the obſervations hitherto made upon it are, that its period conſiſts of 5 days 8 hours 37′ on a mean. The following obſervations relate to ſome ſtars of the ſecond claſs.

54 Stars, the variation of which is leſs certain.

1. Hevelius's 6th Caſſiopeæ was miſſing in 1782, nor could Mr Pigot find it in 1783 and 1784.

2. ξ or 46th Andromedæ, ſaid to be variable, but the evidence is not convincing to Mr Pigot.

3. Flamſtead's 50, 52, Andromedæ, and Hevelius's 41 Andromedæ. The poſition and characters of theſe ſtars differ conſiderably in different catalogues, and ſome of them are ſaid by Caſſini to have diſappeared and reappeared. Mr Pigot therefore gives their comparative brightneſs as obſerved in the years 1783, 1784, and 1785, during which time he does not mention any particular change.

4. Tycho's 20th Cœti. "This (ſays Mr Pigot) muſt be the ſtar which Hevelius ſaid had diſappeared, being Tycho's ſecond in the Whale's Belly. There can hardly be any doubt that it is the χ, miſplaced by Tycho. This χ is of the fourth or fifth magnitude."

5. σ, or the 17th Eridani of Ptolemy and Ulug Beigh. Flamſtead ſays he could not ſee this ſtar in 1691 and 1692; but in 1782, 1783, and 1784, Mr Pigot obſerved in that place one of the ſeventh magnitude, which appeared always of the ſame luſtre.

6. Flamſtead's 41 Tauri was ſuppoſed by Caſſini to be either a new or variable ſtar; but Mr Pigot thinks there is no reaſon to be of that opinion. "That it is

not new (ſays he) is evident, ſince it is Ulug Beigh's 26th and Tycho's 43d.

7. A ſtar about 2¼ north of 53 Eridani, and 47 Eridani. Caſſini ſuppoſed the firſt of theſe ſtars to be a new one, and that it was not viſible in 1664. He mentions another ſtar thereabouts, which he alſo eſteemed a new one.

8. γ Canis Majoris. Maraldi could not ſee this ſtar in 1670; but in 1692 and 1693 it appeared of the fourth magnitude. Mr Pigot made frequent obſervations upon it from 1782 to 1786, but could perceive no variation.

9. α, β Geminorum. "If either of theſe ſtars (ſays our author) have changed in brightneſs, it is probable the β. In 1783, 1784, and 1785, the β was undoubtedly brighter than α."

10. ξ Leonis. According to Montanari, this ſtar was hardly viſible in 1693. In 1783, 1784, and 1785, it was of the fifth magnitude. By Tycho, Flamſtead, Mayer, Bradley, &c. it is marked of the fourth.

11. ψ Leonis. This ſtar is ſaid to have diſappeared before the year 1667, but according to Mr Pigot's obſervations, was conſtantly of the fifth or ſixth magnitude ſince 1783.

12. 25th Leonis. In 1783 our author firſt perceived that this ſtar was miſſing, and could not perceive it in 1784 and 1785, even with a tranſit inſtrument.

13. Bayer's ι Leonis, or Tycho's 16 Leonis, was not viſible in 1709, nor could it be ſeen in 1785. It is a different ſtar from the ι Leonis of the other catalogues, though Tycho's deſcription of its place is the ſame.

14. δ Urſæ Majoris. This ſtar is ſuſpected to change in brightneſs, on account of its being marked by Tycho, the prince of Heſſe, &c. of the ſecond magnitude, while Hevelius, Bradley and others have marked it of the third. In 1786, and for three years before it appeared as a bright ſtar of the fourth magnitude.

15. η Virginis. This is ſuppoſed to be variable, becauſe Flamſtead, on the 27th of January 1680, could not ſee it; but he obſerved it in 1677, and ſome years afterwards. Mr Pigot obſerved it frequently in 1784 and 1785, and found it a ſtar of the ſixth magnitude without any perceptible change.

16. Bayer's ſtar of the ſixth magnitude 1° ſouth of g Virginis. "This ſtar (ſays Mr Pigot) is not in any of the nine catalogues that I have. Maraldi looked for it in vain; and in May 1785 I could not ſee the leaſt appearance of it. It certainly was not of the eighth magnitude.

17. A ſtar in the northern thigh of Virgo, marked by Ricciolus of the ſixth magnitude, could not be ſeen by Maraldi in 1709: nor was it of the ninth magnitude, if at all viſible in 1785.

18. The 91 and 92 Virginis. In 1785, one of theſe ſtars, probably the 91, was miſſing; the remaining one is of the ſixth or ſeventh magnitude.

19. α Draconis. Mr Pigot coincides in opinion with Mr Herſchel, that this ſtar is variable. Bradley, Flamſtead, &c. mark it of the ſecond magnitude, but in 1786 it was only a bright fourth. It was frequently examined by Mr Pigot from the 4th of October 1782, but without any alteration being perceived.

20. Bayer's ſtar in the weſt ſcale of Libra. Maraldi could not ſee this ſtar, and it was likewiſe inviſible to Mr Pigot in 1784 and 1785.

21. Nº 6 of Ptolemy and Ulug Beigh's unformed in Libra. This ſtar is not mentioned in any other catalogues than the above. Mr Pigot frequently obſerved a little ſtar of the ſeventh magnitude very near its place.

22. κ Libræ. This ſtar is thought to be variable; but Mr Pigot is not of that opinion, though "certainly (ſays he) it is rather ſingular, that Hevelius, whoſe attention was directed to that part of the heavens to find Tycho's 11th, did not find the κ; and the more ſo, as he has noticed two much ſmaller ſtars not far from it. During theſe three years I have found the κ conſtantly of the fifth magnitude."

23. Tycho's 11th Libræ. Mr Pigot is of opinion that no ſuch ſtar as this ever exiſted; and that it is no other than the κ with an error of 2 degrees of longitude.

24. 33 Serpentis. This ſtar was miſſing in 1784; nor could it be perceived with a night-glaſs in 1785.

25. A ſtar marked by Bayer near ε urſæ majoris. This ſtar could not be ſeen by Caſſini; nor was Mr Pigot able to diſcover it with a night-glaſs in 1782.

26. The ρ, or Ptolemy and Ulug Beigh's 14th Ophiuchi, or Flamſtead's 36th. Mr Pigot has no doubt that this is the ſtar which is ſaid to have diſappeared before the year 1695; and it is evident that it was not ſeen by Hevelius. In 1784 and 1785 Mr Pigot found it of the fourth or fifth magnitude: but he is far from being certain of its having undergone any change, eſpecially as it has a ſouthern declination of 26 degrees; for which reaſon great attention muſt be paid to the ſtate of the atmoſphere.

27. Ptolemy's 13th and 18th Ophiuchi, fourth magnitude. Mr Pigot is of opinion that theſe ſtars are miſplaced in the catalogues. The 18th of Ptolemy he thinks ought to be marked with a north latitude inſtead of a ſouth, which would make it agree nearly with Flamſtead's 58th; and he is alſo of opinion that the 13th of Ptolemy is the 40th of Flamſtead.

28. σ Sagittarii. Mr Herſchel, as well as Mr Pigot, is of opinion, that this ſtar has probably changed its magnitude, though the reaſon ſeems only to be the great diſagreement concerning it among the different catalogues of ſtars.

29. θ Serpentis. This ſtar, according to Mr Montanari, is of variable magnitude; but Mr Pigot never could perceive any alteration.

30. Tycho's 27th Capricorni was miſſing in Hevelius's time, and Mr Pigot could not find it with a tranſit inſtrument.

31. Tycho's 22d Andromedæ, and ο Andromedæ. Mr Caſſini informs us, that in his time the former had grown ſo ſmall that it could ſcarcely be ſeen; and Mr Pigot, that no ſtar was to be ſeen its place in 1784 and 1785: but he is of opinion that Caſſini may have miſtaken the ο Andromedæ for the 22d; for which reaſon he obſerved this ſtar three years, but without any alteration in its brightneſs.

32. Tycho's 19th Aquarii. Hevelius ſays that this ſtar was miſſing, and that Flamſtead could not ſee it with his naked eye in 1679. Mr Pigot could not ſee it in 1782; but is perſuaded that it is the ſame with

Flamſtead's 56th marked *f* by Bayer, from which it is only a degree and an half diſtant. The 53d of Flamſtead, marked *f* in Ptolemy's catalogue, is a different ſtar.

38. La Caille's 483 Aquarii was firſt diſcovered to be miſſing in 1778, and was not viſible in 1783 and 1784.

Beſides theſe there are ſeveral others certainly variable, but which cannot be ſeen in this country. There are ſome alſo ſuſpected to be variable, but for which Mr Pigot thinks there is no reaſon. Mr Herſchel alſo gives ſtrong reaſons for not laying great ſtreſs on all the obſervations by which new ſtars have been ſaid to be diſcovered. Mr Pigot aſſures us from repeated experience, that even more than a ſingle obſervation, if not particulariſed and compared with neighbouring ſtars, is very little to be depended upon; different ſtreaks of the clouds, the ſtate of the weather, &c. having often cauſed him to err a whole magnitude in the brightneſs of the ſtar.

55 Wollaſton's method of diſcovering variations among the fixed ſtars.

As theſe changes to which the fixed ſtars are liable do not ſeem to be ſubject to any certain rule, Mr Wollaſton has given an eaſy method of obſerving whether they do take place in any part of the heavens or not, and that without much expence of inſtruments or waſte of time, which are great objections to aſtronomical obſervations in general. His firſt idea was, that the work ſhould be undertaken by aſtronomers in general; each taking a particular diſtrict of the heavens, and from time to time obſerving the right aſcenſion and declination of every ſtar in that ſpace allotted to him, framing an exact map of it, and communicating their obſervations to one common place of information. This method, however, being too laborious, he next propoſes the noting down at the time, or making a drawing of what one ſees while they are obſerving. A drawing of this kind once made, would remain, and could be conſulted on any future occaſion; and if done at firſt with care, a tranſient review would diſcover whether any ſenſible change had taken place ſince it was laſt examined, which could not ſo well be done by catalogues or verbal deſcription. For this purpoſe he recommends the following method: "To a night-glaſs, but of Dollond's conſtruction, which magnifies about ſix times, and takes in about as many degrees of a great circle, I have added croſs wires interſecting one another at an angle of 45 degrees. More wires may be croſſed in other directions; but I apprehend theſe will be ſufficient. This teleſcope I mount on a polar axis. One coarſely made, and without any diviſions on its circle of declination, will anſwer the purpoſe, as there is no great occaſion for accuracy in that reſpect; but as the heavenly bodies are more readily followed by an equatorial motion of the teleſcope, ſo their relative poſitions are much more eaſily diſcerned when they are looked at conſtantly as in the ſame direction. An horizontal motion, except in the meridian, would be apt to miſlead the judgment. It is ſcarcely neceſſary to add, that the wires muſt ſtand ſo as for one to deſcribe a parrallel of the equator nearly; another will then be a horary circle, and the whole area will be divided into eight equal ſectors.

"Thus prepared, the teleſcope is to be pointed to a known ſtar, which is to be brought into the centre or common interſection of all the wires. The relative poſitions of ſuch other ſtars as appear within the field are to be judged of by the eye; whether at $\frac{1}{2}$, $\frac{1}{3}$, or $\frac{1}{4}$ from the centre towards the circumference, or *vice verſa*; and ſo with regard to the neareſt wire reſpectively. Theſe, as one ſees them, are to be noted down with a black-lead pencil upon a large meſſage-card held in the hand, upon which a circle ſimilarly divided is ready drawn. One of three inches diameter ſeems moſt convenient. The motion of the heavenly bodies in ſuch a teleſcope is ſo ſlow, and the noting down of the ſtars ſo quickly done, that there is commonly full time for it without moving the teleſcope. When that is wanted, the principal ſtar is eaſily brought back again into the centre of the field at pleaſure, and the work reſumed. After a little practice, it is aſtoniſhing how near one can come to the truth in this way: and tho' neither the right aſcenſions nor the declinations are laid down by it, nor the diſtances between the ſtars meaſured; yet their apparent ſituations being preſerved in black and white, with the day and year, and hour, if thought neceſſary, written underneath, each card then becomes a regiſter of the then appearance of the heavens; which is eaſily re-examined at any time with little more than a tranſient view; and which will yet ſhow, on the firſt glance, if there ſhould have happened in it any alteration of conſequence."

Fig. 35. ſhows part of the corona borealis delineated in this manner, and which was afterwards fully taken down by making the ſtars α, β, γ, δ, ϵ, ζ, ϑ, ι, κ, π, ρ, σ, and τ ſucceſſively central; and theſe were joined with ſome of the ſtars of Bootes, for the ſake of connecting the whole, and united into one map, as repreſented fig. 37.

Plate LXVI.

In obſerving in this way, it is evident, that the places of ſuch ſtars as happen to be under or very near any of the wires are more to be depended upon than thoſe which are in the intermediate ſpaces, eſpecially if towards the edges of the fields; ſo alſo thoſe which are neareſt to the centre, becauſe better defined, and more within the reach of one wire or another. For this reaſon, different ſtars of the ſame ſet muſt ſucceſſively be made central, or brought towards one of the wires, where any ſuſpicion ariſes of a miſtake, in order to approach nearer to a certainty; but if the ſtand of the teleſcope be tolerably well adjuſted and fixed, this is ſoon done.

In ſuch a glaſs it is ſeldom that light ſufficient for diſcerning the wires is wanting. When an illuminator is required, a piece of card or white paſteboard projecting on one ſide beyond the tube, and which may be brought forward occaſionally, is better than any other. By cutting acroſs a ſmall ſegment of the object-glaſs, it throws a ſufficient light down the tube though the candle be at a great diſtance, and one may loſe ſight of the falſe glare by drawing back the head, and moving the eye a little to one ſide, when the ſmall ſtars will be ſeen as if no illuminator was there. See a delineation of the principal fixed ſtars, with the apparent path of the ſun among them, on plate LXIV. and LXV.

56 Galaxy, or milky-way.

A very remarkable appearance in the heavens is that called the *galaxy*, or *milky-way*. This is a broad circle, in ſome places double, but for the moſt part ſingle, ſurrounding the whole celeſtial concave. It is of a whitiſh colour, ſomewhat reſembling a faint aurora borealis; but Mr Brydone, in his journey to the top of mount Ætna, found that phenomenon to make a glorious ap-

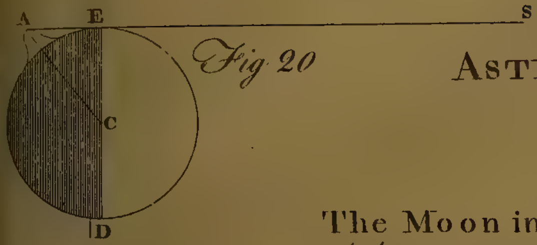


Fig 20

Fig 21
1773h.8.55
2 ♃. at
h11..8

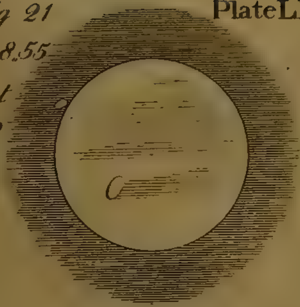


Fig 19

The Moon in her mean libration
with the Spots according to Riccioli Cassini &c

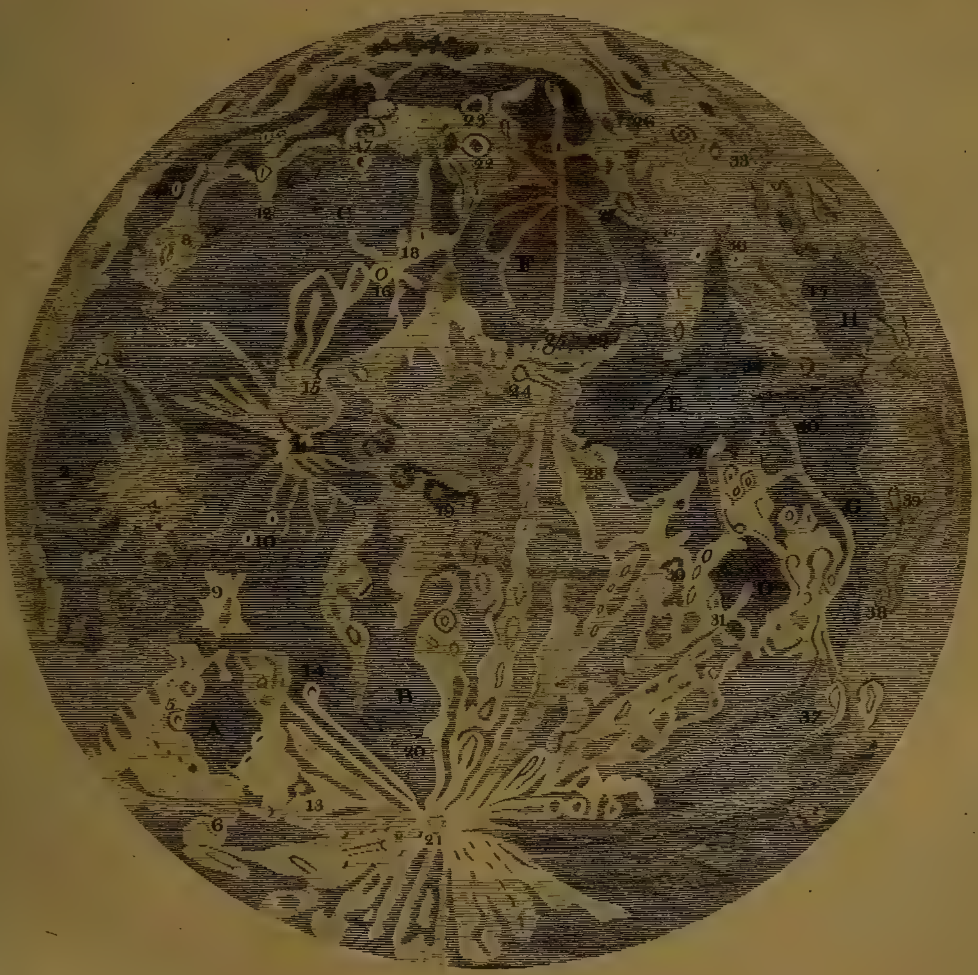
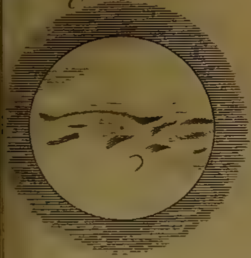
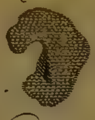


Fig 22



Sept.r 15
H9 0

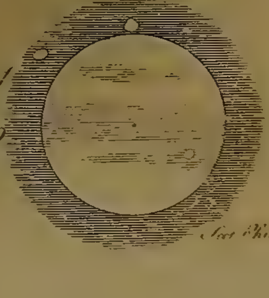
Fig 23



Nov.r 13 1773

Fig 22

Sept.r 11
H9 0



Scot Philad.a

pearance, being, as he expreſſes it, like a pure flame that ſhot acroſs the heavens.

57 Eclipſes.

The only appearance, beſides thoſe already mentioned, which are very obſervable by the unaſſiſted eye, are thoſe unexpected obſcurations of the ſun and moon, commonly called *eclipſes*. Theſe are too well known, and attract the attention too much, to need any particular deſcription. We have, however, accounts very well authenticated, of obſcurations of the ſun continuing for a much longer time than a common eclipſe poſſibly can do, and likewiſe of the darkneſs being much greater than it uſually is on ſuch occaſions: and that theſe accounts are probably true, we ſhall afterwards have occaſion to obſerve.

SECT. II. *Of the Appearances of the Celeſtial Bodies as ſeen through Teleſcopes.*

58 Solar ſpots when firſt diſcovered.

1. THE ſun, tho' to human eyes ſo extremely bright and ſplendid, is yet frequently obſerved, even through a teleſcope of but very ſmall powers, to have dark ſpots on his ſurface. Theſe were entirely unknown before the invention of teleſcopes, though they are ſometimes of ſufficient magnitude to be diſcerned by the naked eye, only looking through a ſmoked glaſs to prevent the brightneſs of the luminary from deſtroying the ſight. The ſpots are ſaid to have been firſt diſcovered in the year 1611; and the honour of the diſcovery is diſputed betwixt Galileo and Scheiner, a German Jeſuit at Ingoldſtadt. But whatever merit Scheiner might have in the priority of the diſcovery, it is certain that Galileo far exceeded him in accuracy, though the work of Scheiner has conſiderable merit, as containing obſervations ſelected from above 3000, made by himſelf. Since his time the ſubject has been carefully ſtudied by all the aſtronomers in Europe; the reſult of whoſe obſervations, as given by Dr Long, is to the following purpoſe.

59 Dr Long's account of them.

There is great variety in the magnitudes of the ſolar ſpots; the difference is chiefly in ſuperficial extent of length and breadth; their depth or thickneſs is very ſmall: ſome have been ſo large, as by computation to be capable of covering the continents of Aſia and Africa; nay, the whole ſurface of the earth, or even five times its ſurface. The diameter of a ſpot, when near the middle of the diſk, is meaſured by comparing the time it takes in paſſing over a croſs hair in a teleſcope, with the time wherein the whole diſk of the ſun paſſes over the ſame hair; it may alſo be meaſured by the micrometer; and by either of theſe methods we may judge how many times the diameter of the ſpot is contained in the diameter of the ſun. Spots are ſubject to increaſe and diminution of magnitude, and ſeldom continue long in the ſame ſtate. They are of various ſhapes; moſt of them having a deep black nucleus ſurrounded by a duſky cloud, whereof the inner parts near the black are a little brighter than the outſkirts. They change their ſhapes, ſomething in the manner that our clouds do; though not often ſo ſuddenly: thus, what is of a certain figure to-day, ſhall, to-morrow, or perhaps in a few hours, be of a different one; what is now but one ſpot, ſhall in a little time be broken into two or three; and ſometimes two or three ſpots ſhall coaleſce, and be united into one. Dr Long, many years ſince, while he was viewing the image of the ſun through a teleſcope caſt upon white paper, ſaw one roundiſh ſpot, by eſtimation not much leſs than the diameter of our earth, break into two, which receded from one another with prodigious velocity. This obſervation was ſingular at the time; for though ſeveral writers had taken notice of this after it was done, none of them had been making any obſervation at the time it was actually doing.

The number of ſpots on the ſun is very uncertain; ſometimes there are a great many, ſometimes very few; and ſometimes none at all. Scheiner made obſervations on the ſun from 1611 to 1629; and ſays he never found his diſk quite free of ſpots, excepting a few days in December 1624. At other times he frequently ſaw 20, 30, and in the year 1625 he was able to count 50 ſpots on the ſun at a time. In an interval afterwards of 20 years, from 1650 to 1670, ſcarce any ſpots were to be ſeen, and ſince that time ſome years have furniſhed a great number of ſpots, and others none at all; but ſince the beginning of the laſt century, not a year paſſed wherein ſome were not ſeen; and at preſent, ſays Mr Caſſini, in his *Elemens d'Aſtronomie* publiſhed in 1740, they are ſo frequent, that the ſun is ſeldom without ſpots, and often ſhows a good number of them at a time.

From theſe phenomena, it is evident, that the ſpots are not endowed with any permanency, nor are they at all regular in their ſhape, magnitude, number, or in the time of their appearance or continuance. Hevelius obſerved one that aroſe and vaniſhed in 16 or 17 hours; nor has any been obſerved to continue longer than 70 days, which was the duration of one in the year 1676: thoſe ſpots that are formed gradually, are gradually diſſolved; while thoſe that ariſe ſuddenly, are for the moſt part ſuddenly diſſolved. When a ſpot diſappears, that part where it was generally becomes brighter than the reſt of the ſun, and continues ſo for ſeveral days; on the other hand, thoſe bright parts (called *faculæ*, as the others are called *maculæ*) ſometimes turn to ſpots.

60 The ſolar ſpots move from weſt to eaſt.

The ſolar ſpots appear to have a motion which carries them acroſs the ſun's diſk. Every ſpot, if it continues long enough without being diſſolved, appears to enter the ſun's diſk on the eaſt ſide, to go from thence with a velocity continually increaſing till it has gone half its way; and then to move ſlower and ſlower, till it goes off at the weſt ſide, after which it diſappears for about the ſame ſpace of time that it ſpent in croſſing the diſk, and then enters upon the eaſt ſide again, nearly in the ſame place, and croſſes it in the ſame tract, and with the ſame unequal motion as before. This apparent inequality in the motion of the ſpots is purely optical, and is in ſuch proportion as demonſtrates them to be carried round equably or in a circle, the plane of which continued paſſes through or near the eye of a ſpectator upon the earth.

Beſides the real changes of the ſpots already mentioned, there is another which is purely optical, and is owing to their being ſeen on a globe differently turned towards us. If we imagine the globe of the ſun to have a number of circles drawn upon its ſurface, all paſſing through the poles, and cutting his equator at equal diſtances, theſe circles which we may call meridians, if they were viſible, would appear to us at unequal diſtances, as in fig. 2. Now, ſuppoſe a ſpot were round, and ſo large as to reach from one meridian to another, it would appear round only at *g*, when it was in the middle of that half of the globe which is to-

Plate LX.

wards our earth; for then we view the full extent of it in length and breadth: in every other place it turns away from us, and appears narrower, though of the ſame length, the farther it is from the middle; and on its coming on at *a*, and going off at *n*, it appears as ſmall as a thread, the thin edge being then all that we ſee.

The motion of the ſpots is in the order of the ſigns (the ſame way that all motions in the ſolar ſyſtem, thoſe of the comets alone excepted, are performed); and therefore, as the earth revolves round the ſun the ſame way with the ſolar ſpots, one of theſe will appear to remain longer on the diſk than it would otherwiſe do if the earth remained at reſt. Thus, in fig. 3. let A B C D be the orbit of the earth, *a b c d* the equator of the ſun; let *a* be a ſpot ſeen in the middle of the diſk by a ſpectator upon the earth at A. The ſpot being carried round through *b c d*, according to the order of the letters, will in about 25 days bring it again to *a*: but during that interval, the earth will be got to B, and the middle of the diſk at *b*; ſo that about two days more will intervene before a ſpectator upon the earth at C will view it in the middle of the then apparent diſk at *c*. There are, however, but few inſtances of ſuch returning ſpots; ſo that Scheiner, out of his multitude of obſervations, found only three or four of this kind.

Plate LX.

As fig. 2. is an orthographic projection of meridians on the ſun's diſk, it may be thought that they would ſhow the apparent diurnal motion of the ſpots; ſo that, for example, a ſpot which to-day at noon is in the meridian marked *a*, would to-morrow at noon be in that marked *b*, the next day in that marked *c*, and ſo on: but Scheiner ſays, that, caſting the ſun's picture on paper through a teleſcope, the diſtance between the place of a ſpot at noon any given day and the place at noon the day immediately preceding, or the day immediately following, will be greater when the ſpot is near the circumference of the diſk than according to the orthographic projection it ought to be. This deviation of ſpots he thought owing to the refraction of the glaſſes in the teleſcope being greater near the circumference than in the middle; and he was confirmed in this opinion, by finding, that if ſpots were obſerved by letting the ſun ſhine through a ſmall hole without a glaſs, upon white paper held at a good diſtance from the hole in a dark room, their places would then be every day according to the orthographic projection. But he found this method of obſerving the ſolar ſpots attended with great difficulties. Another proof that this deviation of the ſolar ſpots is occaſioned by the different refraction of the glaſſes of the teleſcope, is deduced from the following experiment. Our author pierced with a needle 12 ſmall holes at equal diſtances in a thin plate of braſs; and placing the plate before the glaſſes of a ſhort teleſcope, let the ſun ſhine through, receiving 12 bright ſpots upon a white paper placed in ſuch a manner that the light might fall perpendicularly upon it. Here alſo he found the diſtances between the ſpots near the outſide greater than between thoſe in the middle; whereas, when he received them upon paper without any glaſſes, the ſituation of the bright ſpots exactly correſponded to that of the ſmall holes in the plate.

The face of the ſun, when clear of ſpots, ſeen by the naked eye through a ſmoked or coloured glaſs, or through a thin cloud, or the vapours near the horizon, appears all over equally luminous: but when viewed thro' the teleſcope, the glaſſes being ſmoked or coloured, beſides the difference between the faculæ and the other parts, the middle of the diſk appears brighter than the outſkirts; becauſe the light is darted more directly towards us from the middle than from any other part, and the faculæ appear more diſtinctly near the ſides, as being on a darker ground than in the middle.

61 Account of their phenomena by different obſervers.

The phenomena of the ſolar ſpots, as delivered by Scheiner and Hevelius, may be ſummed up in the following particulars. 1. Every ſpot which hath a nucleus, or conſiderably dark part, hath alſo an umbra, or fainter ſhade, ſurrounding it. 2. The boundary betwixt the nucleus and umbra is always diſtinct and well defined. 3. The increaſe of a ſpot is gradual, the breadth of the nucleus and umbra dilating at the ſame time. 4. In like manner, the decreaſe of a ſpot is gradual, the breadth of the nucleus and umbra contracting at the ſame time. 5. The exterior boundary of the umbra never conſiſts of ſharp angles; but is always curvilinear, how irregular ſoever the outline of the nucleus may be. 6. The nucleus of a ſpot, whilſt on the decreaſe, often changes its figure by the umbræ encroaching irregularly upon it, inſomuch that in a ſmall ſpace of time new encroachments are diſcernible, whereby the boundary betwixt the nucleus and umbra is perpetually varying. 7. It often happens, by theſe encroachments, that the nucleus of a ſpot is divided into two or more nuclei. 8. The nuclei of the ſpots vaniſh ſooner than the umbra. 9. Small umbræ are often ſeen without nuclei. 10. An umbra of any conſiderable ſize is ſeldom ſeen without a nucleus in the middle of it. 11. When a ſpot which conſiſted of a nucleus and umbra is about to diſappear, if it is not ſucceeded by a *facula*, or ſpot brighter than the reſt of the diſk, the place where it was is ſoon after not diſtinguiſhed from the reſt.

In the Philoſophical Tranſactions, Vol. LXIV. Dr Wilſon, profeſſor of aſtronomy at Glaſgow, hath given a diſſertation on the nature of the ſolar ſpots, and mentions the following appearances. 1. When the ſpot is about to diſappear on the weſtern edge of the ſun's limb, the eaſtern part of the umbra firſt contracts, then vaniſhes, the nucleus and weſtern part of the umbra remaining; then the nucleus gradually contracts and vaniſhes, while the weſtern part of the umbra remains. At laſt this diſappears alſo; and if the ſpot remains long enough to become again viſible, the eaſtern part of the umbra firſt becomes viſible, then the nucleus; and when the ſpot approaches the middle of the diſk, the nucleus appears environed by the umbra on all ſides, as already mentioned. 2. When two ſpots lie very near to one another, the umbra is deficient on that ſide which lies next the other ſpot: and this will be the caſe, though a large ſpot ſhould be contiguous to one much ſmaller; the umbra of the large ſpot will be totally wanting on that ſide next the ſmall one. If there are little ſpots on each ſide of the large one, the umbra does not totally vaniſh; but appears flattened, or preſſed in towards the nucleus on each ſide. When the little ſpots diſappear, the umbra of the large one extends itſelf as uſual. This circumſtance, he obſerves, may ſometimes prevent the diſappearance of the umbra in the manner abovementioned; ſo that the weſtern umbra may diſappear before the nucleus, if a ſmall ſpot happens to break out on that ſide.

62 Mr Dunn's account.

In the ſame volume, p. 337. Mr Wollaſton obſerves, that the appearances mentioned by Dr Wilſon are not conſtant. He poſitively affirms, that the faculæ or bright ſpots on the ſun are often converted into dark ones. "I have many times (ſays he) obſerved, near the eaſtern limb, a bright facula juſt come on, which has the next day ſhown itſelf as a ſpot, though I do not recollect to have ſeen ſuch a facula near the weſtern one after a ſpot's diſappearance. Yet, I believe, both theſe circumſtances have been obſerved by others; and perhaps not only near the limbs. The circumſtance of the faculæ being converted into ſpots I think I may be ſure of. That there is generally (perhaps always) a mottled appearance over the face of the ſun, when carefully attended to, I think I may be as certain. It is moſt viſible towards the limbs, but I have undoubtedly ſeen it in the centre; yet I do not recollect to have obſerved this appearance, or indeed any ſpots towards his poles. Once I ſaw with a twelve-inch reflector, a ſpot burſt to pieces while I was looking at it. I could not expect ſuch an event, and therefore cannot be certain of the exact particulars; but the appearance, as it ſtruck me at the time, was like that of a piece of ice when daſhed on a frozen pond, which breaks to pieces and ſlides in various directions." He alſo acquaints us, that the nuclei of the ſpots are not always in the middle of the umbræ; and gives the figure of one ſeen November 13th 1773, which is a remarkable inſtance to the contrary. Mr Dunn, however, in his new Atlas of the Mundane Syſtem, gives ſome particulars very different from the above. "The face of the ſun (ſays he) has frequently many large black ſpots, of various forms and dimenſions, which move from eaſt to weſt, and round the ſun, according to ſome obſervations in 25 days, according to others in 26, and according to ſome in 27 days. The black or central part of each ſpot is in the middle of a great number of very ſmall ones, which permit the light to paſs between them. The ſmall ſpots are ſcarce ever in contact with the central ones: but what is moſt remarkable when the whole ſpot is near the limb of the ſun, the ſurrounding ſmall ones form nearly a ſtraight line, and the central part projects a little over it, like Saturn in his ring."

The ſpots are by no means confined to one part of the ſun's diſk; though we have not heard of any being obſerved about his polar regions; and though their direction is from eaſt to weſt, yet the paths they deſcribe in their courſe over the diſk are exceedingly different; ſometimes being ſtraight lines, ſometimes curves, ſometimes deſcending from the northern to the ſouthern part of the diſk, ſometimes aſcending from the ſouthern to the northern, &c. This was obſerved by Mr Derham (Philoſ. Tranſ. N° 330), who hath given figures of the apparent paths of many different ſpots, wherein the months in which they appeared, and their particular progreſs each day, are marked.

63 Mercury and Venus ſometimes appear as ſpots.

Beſides theſe ſpots, there are others which ſometimes appear very round and black, travelling over the diſk of the ſun in a few hours. They are totally unlike the others, and will be ſhown to proceed from an interpoſition of the planets Mercury and Venus between the earth and the ſun. Excepting the two kinds of ſpots abovementioned, however, no kind of object is diſcovered on the ſurface of the ſun, but he appears like an immenſe ocean of elementary fire or light.

63 Teleſcopic view of the moon.

2. With the moon the caſe is very different. Many darkiſh ſpots appear in her to the naked eye; and, through a teleſcope, their number is prodigiouſly increaſed: ſhe alſo appears very plainly to be more protuberant in the middle than at the edges, or to have the figure of a globe, and not a flat circle. When the moon is horned or gibbous, the one ſide appears very ragged and uneven, but the other always exactly defined and circular. The ſpots in the moon always keep their places exactly; never vaniſhing, or going from one ſide to the other, as thoſe of the ſun do. We ſometimes ſee more or leſs of the northern and ſouthern, and eaſtern and weſtern part of the diſk or face; but this is owing to what is called her libration, and will hereafter be explained.

The aſtronomers Florentius, Langrenus, John Hevelius of Dantzick, Grimaldus, Ricciolus, Caſſini, and M. de la Hire, have drawn the face of the moon as ſhe is ſeen through teleſcopes magnifying between 200 and 300 times. Particular care has been taken to note all the ſhining parts in her ſurface; and, for the better diſtinguiſhing them, each has been marked with a proper name. Langrenus and Ricciolus have divided the lunar regions among the philoſophers, aſtronomers, and other eminent men; but Hevelius and others, fearing leſt the philoſophers ſhould quarrel about the diviſion of their lands, have endeavoured to ſpoil them of their property, by giving the names belonging to different countries, iſlands, and ſeas on earth, to different parts of the moon's ſurface, without regard to ſituation or figure. The names adopted by Riccioli, however, are thoſe which are generally followed, as the names of *Hipparchus Tycho*, *Copernicus*, &c. are more pleaſing to aſtronomers than thoſe of Africa, the Mediterranean Sea, Sicily, and Mount Ætna. On Plate LXIII. is a tolerably exact repreſentation of the full moon in her mean libration, with the numbers to the principal ſpots according to Riccioli, Caſſini, Mayer, &c. The aſteriſk refers to one of the volcanoes diſcovered by Dr Herſchel, to be afterwards more particularly noticed. The names are as follow:

* Herſchel's Volcano.
1 Grimaldus.
2 Galileus.
3 Ariſtarchus.
4 Keplerus.
5 Gaſſendus
6 Shikardus.
7 Harpalus.
8 Heraclides.
9 Lanſbergius.
10 Reinoldus.
11 Copernicus
12 Helicon.
13 Capuanus.
14 Bullialdus.
15 Eratoſthenes.
16 Timocharis.
17 Plato.
18 Archimedes.
19 Inſula Sinus Medii.
20 Pitatus.
21 Tycho.
22 Eudoxus.
23 Ariſtoteles.
24 Manilius.
25 Menelaus.
26 Hermes.
27 Poſſidonius.
28 Dionyſius.
29 Plinius.
30 Calharina Cyrillus.
  Theophilus.
31 Fracaſtorius.
32 Promontorium acutum
  Cenſorinus.
33 Meſſala.
34 Promontorium ſomnii.
35 Proclus.
36 Cleomedes.
37 Snellius et Furnerius.
38 Petavius.

Appearances of Celeſtial Bodies thro' Telescopes.

38 Petavius.
39 Langrenus
40 Taruntius.
A Mare Humorum.
B Mare Nubium.
C Mare Imbrium.
D Mare Nectaris.
E Mare Tranquilitatis.
F Mare Serenitatis.
G Mare Fœcunditatis.
H Mare Criſium.

We have already obſerved, that when the planet Mars approaches any of the fixed ſtars, they loſe their light, and ſometimes totally diſappear before he ſeems to touch them: but it is not ſo with the moon; for though ſhe very often comes in betwixt us and the ſtars, they preſerve their luſtre till immediately in ſeeming contact with her, when they ſuddenly diſappear, and as ſuddenly re-appear on the oppoſite ſide. When Saturn, however, was hid by the moon in June 1762, Mr. Dunn, who watched his appearance at the emerſion, obſerved a kind of faint ſhadow to follow him for a little from the edge of the moon's diſk. This appearance is repreſented fig. 88.

Plate LXIX.

64
Mercury appears always equally luminous.

3. Mercury, when looked at through teleſcopes magnifying about 200 or 300 times, appears equally luminous throughout his whole ſurface, without the leaſt dark ſpot. He appears indeed to have the ſame difference of phaſes with the moon, being ſometimes horned, ſometimes gibbous, and ſometimes ſhining almoſt with a round face, though not entirely full, becauſe his enlightened ſide is never turned directly towards us, unleſs when ſo near the ſun as to be inviſible; but at all times perfectly well defined without any ragged edge, and perfectly bright.

65
Spots, when firſt diſcovered on the diſk of Venus.

66
Caſſini's obſervations.

4. Dr Long informs us, that the earlieſt account he had met with of any ſpots ſeen by means of the teleſcope on the diſk of Venus was in a collection of letters printed at Paris in 1665, in one of which M. Auzout relates his having received advice from Poland that Mr Burratini had, by means of large teleſcopes, ſeen ſpots upon the planet Venus ſimilar to thoſe upon the moon. In 1667, Caſſini, in a letter to Mr Pettit, mentions his having for a long time carefully obſerved Venus through an excellent teleſcope made by Campani, in order to know whether that planet revolved on its axis or not, as he had before found Jupiter and Mars to do. But though he then obſerved ſome ſpots upon her, he ſays, that even when the air was quiet and clear, they appeared faint, irregular, and not well defined: ſo that it was difficult to have ſuch a diſtinct view of any of them as to be certain that it was the ſame ſpot which was ſeen again in any ſubſequent obſervation; and this difficulty was increaſed, in the firſt place, when Venus was in her inferior ſemicircle; becauſe at that time ſhe muſt be viewed through the thick vapours near the horizon; though otherwiſe it was moſt proper, on account of her being then neareſt to us. In the ſecond place, if we would obſerve her at ſome height above thoſe vapours, it could only be for a ſhort time; and, thirdly, when ſhe is low in her inferior circle, and at that time neareſt the earth, the enlightened part of her is too ſmall to diſcover any motion in it. He was therefore of opinion, that he ſhould ſucceed better in his obſervations when the planet was about its mean diſtance from us, ſhowing about one-half of her enlightened hemiſphere; at which time alſo he could obſerve her for a much longer time above the groſs atmoſpherical vapours. His firſt appearance of ſucceſs was October 14. 1666 at three-quarters paſt five in the evening; when he ſaw a bright ſpot (fig. 37.), but could not then view that ſpot long enough to draw any inference concerning the planet's motion. He had no farther ſucceſs till the 20th of April, the following year; when, about a quarter of an hour before ſunriſe, he began again to perceive on the diſk of Venus, now about half enlightened, a bright part near the ſection, diſtant from the ſouthern horn a little more than a fourth-part of the diameter of the diſk, and near the eaſtern edge. He took notice alſo of a darkiſh oblong ſpot nearer to the northern than the ſouthern horn: at ſunriſe the bright part was advanced further from the ſouthern horn than when he firſt obſerved it; but though he was pleaſed to find that he had now a convincing proof of the planet's motion, he was ſurpriſed that the ſpots moved from ſouth to north in the lower part of the diſk, and from north to ſouth in the upper part; a kind of motion of which we have no example, except in the librations of the moon. This, however, was occaſioned by the ſituation of the planet's axis. Caſſini expected to have found the rotation of Venus ſimilar to that of Jupiter and Mars, both of which have their axes perpendicular to their reſpective orbits, and turn round according to the order of the ſigns; ſo that, in each of them, the motion of the inferior half of their reſpective globe, or that part next the ſun, is from eaſt to weſt; in the ſuperior half from weſt to eaſt; but in Venus, whoſe axis is inclined 75 degrees towards her orbit, the coincidence is ſo near, that one-half of her diſk appears to move from ſouth to north, the other from north to ſouth.

Appearances of Celeſtial Bodies thro' Teleſcopes.

Plate LXVI.

67
Why the ſpots ſeem to move ſouth to north, &c.

68
Particular account of the appearances of the ſpots at different times.

On the 21ſt of April, at ſunriſe, the bright part was a good way off the ſection, and about a fourth-part of the diameter diſtant from the ſouthern horn. When the ſun was eight degrees ſix minutes high, it ſeemed to be got beyond the center, and was cut through by the ſection. At the time the ſun was ſeven degrees high the ſection cut it in the middle, which ſhowed its motion to have ſome inclination towards the centre.

May 9. a little before ſunriſe, the bright ſpot was ſeen near the centre, a little to the northward, with two obſcure ones ſituated between the ſection and the circumference, at a diſtance from each other, equal to that of each of them from the neareſt angular point or horn of the planet. The weather being at that time clear, he obſerved for an hour and half a quarter the motion of the bright ſpot, which ſeemed to be exactly from ſouth to north, without any ſenſible declination to eaſt or weſt. A variation was at the ſame time perceived in the darkiſh ſpot too great to be aſcribed to any optical cauſe. The bright ſpot was alſo ſeen on the 10th and 13th days of May before ſunriſe between the northern horn and the centre, and the ſame irregular change of darkiſh ſpots was taken notice of; but as the planet removed to a greater diſtance from the earth, it became more difficult to obſerve theſe appearances. The above phenomena are repreſented as they occurred in figs. 37—43.

69
Caſſini's concluſions concerning the revolution of Venus on her axis.

But though, from the appearances juſt now related, M. Caſſini was of opinion that Venus revolved on her axis, he was by no means ſo poſitive in this matter as with regard to Mars and Jupiter. "The ſpots on theſe (ſays he) I could attentively obſerve for a whole night, when the planets were in oppoſition to the ſun:

I

70 **Difficulties attending theſe obſervations.**

I could ſee them return to the ſame ſituation, and conſider their motion during ſome hours, and judge whether they were the ſame ſpots or not, and what time they took in turning round: but it was not the ſame with the ſpots of Venus; for they can be obſerved only for ſo ſhort a time, that it is much more difficult to ſhow with certainty when they return into the ſame ſituation. I can, however, ſuppoſing that the bright ſpot which I obſerved on Venus, and particularly this year, was the ſame, ſay that ſhe finiſhes her motion, whether of rotation or libration, in leſs than a day; ſo that, in 23 days nearly, the ſpot comes into the ſame ſituation on nearly the ſame hour of the day, though not without ſome irregularity. Now ſuppoſing the bright ſpot obſerved to be always the ſame) whether this motion is an entire turning round or only a libration, is what I dare not poſitively affirm."

71 **Bianchini's obſervations.**

72 **Doubts concerning the time ſhe takes up in revolving round her axis.**

Plate LXVI.

In 1669 M. Caſſini again obſerved Venus through a teleſcope, but could not then perceive any ſpots upon her ſurface; the reaſon of which Du Hamel conjectures to have been the fluctuation of the vapours near the horizon, which prevented them from being viſible. However, we hear nothing more of any ſpots being ſeen on her diſk till the year 1726; when, on the 9th of February, Bianchini, with ſome of Campani's teleſcopes of 90 and 100 Roman palms, began to obſerve the planet at the altitude of 40° above the horizon, and continued his obſervations till, by the motion of ſeveral ſpots, he determined the poſition of her axis to be inclined as above mentioned, that the north pole pointed at a circle of latitude drawn through the 20th degree of Aquarius, elevated 15 or 20° above the orbit of Venus. He delineated alſo the figures of ſeveral ſpots which he ſuppoſed to be ſeas, and complimented the king of Portugal and ſome other great men by calling them by their names. Though none of Bianchini's obſervations were continued long enough to know whether the ſpots, at the end of the period aſſigned for the rotation of the planet, would have been in a different ſituation from what they were at the beginning of it; yet, from obſervations of two and of four days, he concluded the motion of the ſpots to be at the rate of 15° per day; at which advance the planet muſt turn round either once in 24 days or in 23 hours; but without farther obſervation it could not be determined which of the two was the period of revolution; for if an obſerver ſhould at a particular hour, ſuppoſe ſeven in the evening, mark exactly the place of a ſpot, and at the ſame hour next evening find the ſpot advanced 15°, he would not be able to determine whether the ſpot had advanced only 15°, or had gone once quite round with the addition of 15° more in part of another rotation. Mr Bianchini, however, ſuppoſes Venus to revolve in 24 days eight hours; the principal proof adduced for which is an obſervation of three ſpots, A B C, being ſituated as in fig. 44. when they were viewed by himſelf and ſeveral perſons of diſtinction for about an hour, during which they could not perceive any change of place. The planet being then hid behind Barbarine palace, they could not have another view of her till three hours after, when the ſpots ſtill appeared unmoved. "Now (ſays M. Bianchini) if her rotation were ſo ſwift as to go round in 23 hours, in this ſecond view, three hours after the former, the ſpots muſt have advanced near 50 degrees; ſo that the ſpot C would have been gone off at R, the ſpot B would have ſucceeded into the place of C, the ſpot A into the place of B, and there would have been no more but two ſpots, A and B, to have been ſeen."

73 **Diſpute between Caſſini and Bianchini.**

Caſſini, the ſon, in a memoir for 1732, denies the concluſion of Bianchini to be certain. He ſays, that, during the three hours interval, the ſpot C might be gone off the diſk, and the ſpot B got into the place thereof, where, being near the edge, it would appear leſs than in the middle. That A, ſucceeding into the place of B, would appear larger than it had done near the edge, and that another ſpot might come into the place of A; and there were other ſpots beſides theſe three on the globe of the planet, as appears by the figures of Bianchini himſelf, particularly one which would naturally come into the place of A. That if the rotation of Venus be ſuppoſed to be in 23 hours, it will agree with Bianchini's, obſervations, as well as with thoſe of his father; but that, on the other ſuppoſition, the latter muſt be entirely rejected as erroneous: and he concludes with telling us, that Venus had frequently been obſerved in the moſt favourable times by M. Maraldi and himſelf with excellent teleſcopes of 80 and 100 feet focus, without their being able to ſee any diſtinct ſpot upon her diſk. "Perhaps, (ſays Dr Long), thoſe ſeen by Bianchini had diſappeared, or the air in France was not clear enough; which laſt might be the reaſon why his father could never ſee thoſe ſpots in France which he had obſerved in Italy, even when he made uſe of the longeſt teleſcopes. Neither of theſe aſtronomers take notice of any indentings in the curve which divides the illuminated part from the dark in the diſk of Venus, though in ſome views of that planet by Fontana and Ricciolus, the curve is indented; and it has from thence been concluded, thatthe ſurface of the planet is mountainous like that of the moon. This had alſo been ſuppoſed by Burratini, already mentioned; and a late writer has obſerved, that 'When the air is in a good ſtate for obſervation, mountains like thoſe of the moon may be obſerved with a very powerful teleſcope.'

74 **Caſſini diſcovers her ſatellite.**

Caſſini, beſides the diſcovery of the ſpots on the diſk of Venus by which he was enabled to aſcertain her revolution on an axis, had alſo a view of her ſatellite or moon, of which he gives the following account.—"A. D. 1686, Aug. 28th, at 15 minutes after four in the morning, looking at Venus with a teleſcope of 34 feet, I ſaw, at the diſtance of one-third of her diameter, eaſtward, a luminous appearance, of a ſhape not well defined, that ſeemed to have the ſame phaſe with Venus, which was then gibbous on the weſtern ſide. The diameter of this phenomenon was nearly equal to a fourth part of the diameter of Venus. I obſerved it attentively for a quarter of an hour, and having left off looking at it for four or five minutes, I ſaw it no more; but day-light was then advanced. I had ſeen a like phenomenon which reſembled the phaſe of Venus, Jan. 25th, A.D. 1672, from 52 minutes after ſix in the morning to two minutes after ſeven, when the brightneſs of the twilight made it diſappear. Venus was then horned, and this phenomenon, the diameter whereof was nearly a fourth-part of the diameter of Venus, was of the ſame ſhape. It was diſtant from the ſouthern horn of Venus, a diameter of the planet, on the weſtern ſide. In theſe two obſervations, I was in doubt whether it was not a ſatellite of Venus of ſuch a conſiſtence as not to be very well fitted to reflect the light of the ſun; and which, in magnitude bore nearly the ſame proportion to Venus as the moon does to the earth, being at the ſame diſtance from the ſun and the earth as Venus was, the phaſes whereof it reſembled. Notwithſtanding all the pains I took in looking for it after theſe two obſervations, and at divers other times, in order to complete ſo conſiderable a diſcovery, I was never able to ſee it. I therefore ſuſpend my judgment of this phenomenon. If it ſhould return often, there will be theſe two epochas, which, compared with other obſervations, may be of uſe to find out the periodical time of its return, if it can be reduced to any rule."

75
Diſcovered alſo by Mr Short.

A ſimilar obſervation was made by Mr Short on the 23d of October 1740, about ſunriſe. He uſed at this time a reflecting teleſcope of about 16.5 inches, which magnified between 50 and 60 times, with which he perceived a ſmall ſtar at about 10′ diſtance from Venus, as meaſured by the micrometer; and putting on a magnifying power of 240 times, he found the ſtar put on the ſame appearance with the planet herſelf. Its diameter was ſomewhat leſs than a third of that of the primary, but its light was leſs vivid, though exceedingly ſharp and well defined. The ſame appearance continued with a magnifying power of 140 times. A line, paſſing through the centre of Venus and it, made an angle of 18 or 20 degrees with the equator: he ſaw it ſeveral times that morning for about the ſpace of an hour, after which he loſt ſight of it, and could never find it again.

From this time the ſatellite of Venus, though very frequently looked for by Aſtronomers, could never be perceived, which made it generally believed that Caſſini and Mr Short had been miſtaken; but as the tranſits of the planet over the ſun in 1761 and 1769 ſeemed to promiſe a greater certainty of finding it, the ſatellite was very carefully looked for by almoſt every one who had an opportunity of ſeeing the tranſit, but generally without ſucceſs. M. Baudouin at Paris had provided a teleſcope of 25 feet, in order to obſerve the paſſage of the planet over the ſun, and to look for its ſatellite; but he did not ſucceed either at that time or in the months of April and May following. M. Montaigne, however, one of the members of the Society of Limoges, had better ſucceſs. On the 3d of May 1761, he perceived, about half an hour after nine at night, at the diſtance of 20′ from Venus, a ſmall creſcent, with the horns pointing the ſame way as thoſe of the planet; the diameter of the former being about one-fourth of that of the latter; and a line drawn from Venus to the ſatellite making an angle with the vertical of about 20° towards the ſouth. But though he repeated this obſervation ſeveral times, ſome doubt remained whether it was not a ſmall ſtar. Next day he ſaw the ſame ſtar at the ſame hour, diſtant from Venus about half a minute, or a minute more than before, and making with the vertical an angle of 10° below on the north ſide; ſo that the ſatellite ſeemed to have deſcribed an arc of about 30°, whereof Venus was the centre, and the radius 20′. The two following nights were hazy, ſo that Venus could only be ſeen; but on the 7th of May, at the ſame hour as before, he ſaw the ſatellite again above Venus, and on the north ſide, at the diſtance of 25 or 26′ upon a line which made an angle of about 45°, with the vertical towards the right hand. The light of the ſatellite was always very weak, but it had the ſame phaſis with its primary, whether viewed together with it in the field of his teleſcope or by itſelf. The teleſcope was nine feet long, and magnified an object between 40 and 50 times, but had no micrometer; ſo that the diſtance abovementioned are only from eſtimation.

76
Seen by M. Montaigne at the tranſit in 1761.

Plate LX.

Fig. 4. Repreſents the three obſervations of M. Montaigne. V is the planet Venus; ZN the vertical. EC, a parallel to the ecliptic, making then an angle with the vertical of 45°; the numbers 3, 4, 7, mark the ſituations of the ſatellite on the reſpective days. From the figure it appears that the points 3 and 7 would have been diametrically oppoſite, had the ſatellite gone 15° more round the point V at the laſt obſervation; ſo that in four days it went through 155°. Then, as 155° is to four days or 96 hours, ſo is 360 to a fourth number, which gives 9 days 7 hours for the whole length of the ſynodical revolution. Hence M. Baudouin concluded, that the diſtance of this ſatellite was about 60 of the ſemidiameters of Venus from its ſurface; that its orbit cut the ecliptic nearly at right angles; had its aſcending node in 22° of Virgo; and was in its greateſt northern digreſſion on the 7th at nine at night; and he ſuppoſed, that at the tranſit of the primary the ſatellite would be ſeen accompanying it. By a ſubſequent obſervation, however, on the 11th of May, he corrected his calculation of the periodical time of the ſatellite, which he now enlarged to 12 days; in conſequence of which he found that it would not paſs over the diſk of the ſun along with its primary, but go at the diſtance of above 20′ from his ſouthern limb; though if the time of its revolution ſhould be 15 hours longer than 12 days, it might then paſs over the ſun after Venus was gone off. He imagined the reaſon why this ſatellite was ſo difficult to be obſerved, might be, that one part of its globe was cruſted over with ſpots, or otherwiſe unfit to reflect the light of the ſun. By comparing the periodical time of this ſatellite with that of our moon, he computed the quantity of matter in Venus to be nearly equal to that in our earth; in which caſe it muſt have conſiderable influence in changing the obliquity of the ecliptic, the latitudes and longitudes of ſtars, &c.

77
Why this ſatellite is ſo difficult to be ſeen.

This is all the evidence which has yet been publiſhed concerning the exiſtence of the ſatellite of Venus; as it does not appear that, during the tranſit of 1769, any of the obſervers had the good fortune to perceive it. In the Philoſophical Tranſactions for 1761, Mr Hirſt gives an account of his having obſerved an atmoſphere round the planet Venus. The obſervations were made at Fort St George; and looking attentively at that part of the ſun's diſk where he expected the planet would enter, he plainly perceived a faint ſhade or penumbra; on which he called out to his two aſſiſtants, “ 'Tis a coming!' and two or three ſeconds after, the firſt external contact took place in the moment whereof all the three agreed; but he could not ſee the penumbra after the egreſs: and of the other two gentlemen, one had gone home, and the other loſt the planet out of the field of his teleſcope. Mr Dunn at Chelſea ſaw a penumbra, or ſmall diminution of light,

78
Obſervations concerning the atmoſphere of Venus.

light, that grew darker and darker for about five ſeconds before the internal contact preceding the egreſs; from whence he determines that Venus is ſurrounded with an atmoſphere of about 50 geographical miles high. His obſervations, he tells us, were made with an excellent ſix-feet Newtonian reflector, with a magnifying power of 110, and of 220 times: he had a clear dark glaſs next his eye; and the ſun's limb appeared well defined; but a very narrow wateriſh penumbra appeared round Venus. The darkeſt part of the planet's phaſis was at the diſtance of about a ſixth-part of her diameter from its edge; from which an imperfect light encreaſed to the centre, and illuminated round about.

In the northern parts of Europe this penumbra could not be ſeen. Mr Wargentin, who communicated ſeveral obſervations of the firſt external contact, ſays, that he could not mark the time exactly, becauſe of the undulation of the limb of the ſun; but thought it very remarkable that, at the egreſs, the limb of Venus that was gone off the ſun ſhowed itſelf with a faint light during almoſt the whole time of emerſion. Mr. Bergman, who was then at the obſervatory at Upſal, begins his account at the time when three-fourths of the diſk of the planet was entered upon that of the ſun; and he ſays, that the part which was not come upon the ſun was viſible, though dark, and ſurrounded by a creſcent of faint light, as in fig. 7.: but this appearance was much more remarkable at the egreſs; for as ſoon as any part of the planet was got off the ſun, that part was viſible with a like creſcent, but brighter, fig. 8. As more of the planetary diſk went off that of the ſun, however, that part of the creſcent which was fartheſt from the ſun grew fainter, and vaniſhed, until at laſt only the horns could be ſeen, as in fig. 9. The total ingreſs was not inſtantaneous: but, as two drops of water, when about to part, form a ligament between them; ſo there was a dark ſwelling ſtretched out between Venus and the ſun, as in fig. 10.; and when this ligament broke, the planet appeared to have got about an eighth-part of her diameter from the neareſt limb of the ſun; fig. 11. he ſaw the like appearance at going off, but not ſo diſtinct, fig. 12. Mr Chappe likewiſe took notice, that the part of Venus which was not upon the ſun was viſible during part of the time of ingreſs and egreſs; that it was farther ſurrounded by a ſmall luminous ring of a deep yellow near the place that appeared in the form of the creſcent, which was much brighter at the going off than coming upon the ſun; and that, during the whole time the diſk of Venus was upon the ſun, he ſaw nothing of it. The time of the total ingreſs was inſtantaneous like a flaſh of lightening; but at the egreſs the limb of the ſun began to be obſcured three ſeconds before the interior contact. Some of the French aſtronomers attributed this luminous ring round Venus to the inflection of the ſun's rays, as they alſo do the light ſeen round the moon in ſolar eclipſes; but Mr Chappe ſuppoſes it to have been owing to the ſun enlightening more than one half of the planetary globe, though he owns this cauſe not to be altogether ſufficient. Mr Fouchy, who obſerved the tranſit at La Muette in France, perceived, during the whole time, a kind of ring round Venus, brighter than the reſt of the ſun, which became fainter the farther it went from the planet, but appeared more vivid in proportion as the ſun was clearer. Mr. Ferner, who obſerved at the ſame place, confirms the teſtimony of Mr Fouchy. "During the whole time (ſays he) of my obſerving with the teleſcope, and the blue and green glaſſes, I perceived a light round about Venus, which followed her like a luminous atmoſphere more or leſs lively, according as the air was more or leſs clear. Its extent altered in the ſame manner; nor was it well terminated; throwing out, as it were, ſome feeble rays on all ſides."

Plate LXI.

79
Dr Long's opinion on theſe obſervations.

"I am not clear (ſays Dr. Long) as to the meaning of the luminous circle here mentioned, whether, when the whole planet was upon the ſun, they ſaw a ring of light round it, diſtinct from the light of the ſun; or whether they mean only the light which ſurrounded that part of Venus that was not upon the ſun." Mr Chappe takes this and other accounts of the obſervations made in France in this latter ſenſe: and though he ſometimes called the luminous part of the creſcent that ſurrounded the part of the planet not upon the ſun a ring, he explains himſelf, that he did ſo, becauſe at the coming upon the ſun he perceived it at one ſide of the planet, and on the oppoſite ſide on its going off: for which reaſon he ſuppoſed that it ſurrounded it on all ſides. See fig. 13. 14.

80
Spots when firſt ſeen on Mars.

5. Much larger and more remarkable ſpots have been perceived on the diſk of Mars than that of any other primary planet. They were firſt obſerved in 1666 by Caſſini at Bologna, with a teleſcope of Campani about 16½ feet long; and continuing to obſerve them for a month, he found they came into the ſame ſituation in 24 hours and 40 minutes. The planet was obſerved by ſome aſtronomers at Rome with longer teleſcopes made by Euſtachio Divini; but they aſſigned to it a rotation in 13 hours only. This, however, was afterwards ſhown by Mr Caſſini to have been a miſtake, and to have ariſen from their not diſtinguiſhing the oppoſite ſides of the planet, which it ſeems have ſpots pretty much alike. He made further obſervations on the ſpots of this planet in 1670; from whence he drew an additional confirmation of the time the planet took to revolve. The ſpots were again obſerved in ſubſequent oppoſitions; particularly for ſeveral days in 1704 by Maraldi, who took notice that they were not always well defined, and that they not only changed their ſhape frequently in the ſpace between two oppoſitions, but even in the ſpace of a month. Some of them, however, continued of the ſame form long enough to aſcertain the time of the planet's revolution. Among theſe there appeared this year an oblong ſpot, reſembling one of the belts of Jupiter when broken. It did not reach quite round the body of the planet; but had, not far from the middle of it, a ſmall protuberance towards the north, ſo well defined that he was thereby enabled to ſettle the period of its revolution at 24 hours 39 minutes; only one minute leſs than what Caſſini had determined it to be. See fig. 45.

Plate LXVII.

The near approach of Mars to the earth in 1719 gave a much better opportunity of viewing him than had been obtained before; as he was then within 2¼ deg. of his perihelion, and at the ſame time in oppoſition to the ſun. His apparent magnitude and brightneſs were thus ſo much increaſed, that he was by the vulgar taken for a new ſtar. His appearance at that time, Plate LXVII.

time, as ſeen by Maraldi through a teleſcope of 34 feet long, is repreſented fig. 46. There was then a long belt that reached half way round, to the end of which another ſhorter belt was joined, forming an obtuſe angle with the former, as in fig. 47. This angular point was obſerved on the 19th and 20th of Auguſt, at 11 hours 15 minutes, a little eaſt of the middle of the diſk; and 37 days after, on the 25th and 26th of September, returned to the ſame ſituation. This interval, divided by 36, the number of revolutions contained in it gives 24 hours 40 minutes for the period of one revolution; which was verified by another ſpot of a triangular ſhape, one angle whereof was towards the north pole, and the baſe towards the ſouth, which on the 5th and 6th of Auguſt appeared as in fig. 48. and after 72 revolutions returned to the ſame ſituation on the 16th and 17th of October. The appearances of Mars, as delineated by Mr Hook, when viewed through a 36 feet teleſcope, are repreſented fig. 28. He appeared through this inſtrument as big as the full moon. Some of the belts of this planet are ſaid to be parallel to his equator; but that ſeen by Maraldi was very much inclined to it.

Plate LXIV.

81
Bright ſpots about the poles of Mars.

Beſides theſe dark ſpots, the former aſtronomers took notice, that a ſegment of his globe about the ſouth pole exceeded the reſt of his diſk ſo much in brightneſs, that it appeared beyond them as if it were the ſegment of a larger globe. Maraldi informs us, that this bright ſpot had been taken notice of for 60 years, and was more permanent than the other ſpots on the planet. One part of it is brighter than the reſt, and the leaſt bright part is ſubject to great changes, and has ſometimes diſappeared.

82
Mr Herſchel's account of theſe ſpots.

Plate LXVII.

A ſimilar brightneſs about the north pole of Mars was alſo ſometimes obſerved; and theſe obſervations are now confirmed by Mr Herſchel, who hath viewed the planet with much better inſtruments, and much higher magnifying powers than any other aſtronomer ever was in poſſeſſion of. His obſervations were made with a view to determine the figure of the planet, the poſition of his axis, &c. A very particular account of them is given in the 74th volume of the Philoſophical Tranſactions, but which our limits will not allow us to inſert. Figs 49—72. ſhow the particular appearances of Mars, as viewed on the days there marked. The magnifying powers he uſed were ſometimes as high as 932; and with this the ſouth polar ſpot was found to be in diameter $41''$. Fig. 73 ſhows the connection of the other figures marked 64, 65, 66, 67, 68, 69, 70, which complete the whole equatorial ſucceſſion of ſpots on the diſk of the planet. The centre of the circle marked 65 is placed on the circumference of the inner circle, by making its diſtance from the circle marked 67 anſwer to the interval of time between the two obſervations, properly calculated and reduced to ſidereal meaſure. The ſame is done with regard to the circles marked 66, 67, &c.; and it will be found by placing any one of theſe connected circles in ſuch a manner as to have its contents in a ſimilar ſituation with the figures in the ſingle repreſentation, which bears the ſame number, that there is a ſufficient reſemblance between them; though ſome allowance muſt undoubtedly be made for the diſtortions occaſioned by this kind of projection.

With regard to the bright ſpots themſelves, Mr Herſchel informs us, that the poles of the planet are not exactly in the middle of them, though nearly ſo. "From the appearance and diſappearance (ſays he) of the bright north polar ſpot in the year 1781, we collect that the circle of its motion was at ſome conſiderable diſtance from the pole. By calculation, its latitude muſt have been about 76 or 77° north; for I find that, to the inhabitants of Mars, the declination of the ſun, June 25th, 12 hours 15 minutes of our time was about 9° 56′ ſouth; and the ſpot muſt have been ſo far removed from the north pole as to fall a few degrees within the enlightened part of the diſk to become viſible to us. The ſouth pole of Mars could not be many degrees from the centre of the large bright ſouthern ſpot of the year 1781; though this ſpot was of ſuch a magnitude as to cover all the polar regions farther than the 70th or 65th degree; and in that part which was on the meridian, July 3d, at 10 hours 54 minutes, perhaps a little farther.

83
Cauſes of the appearance and diſappearance of theſe ſpots.

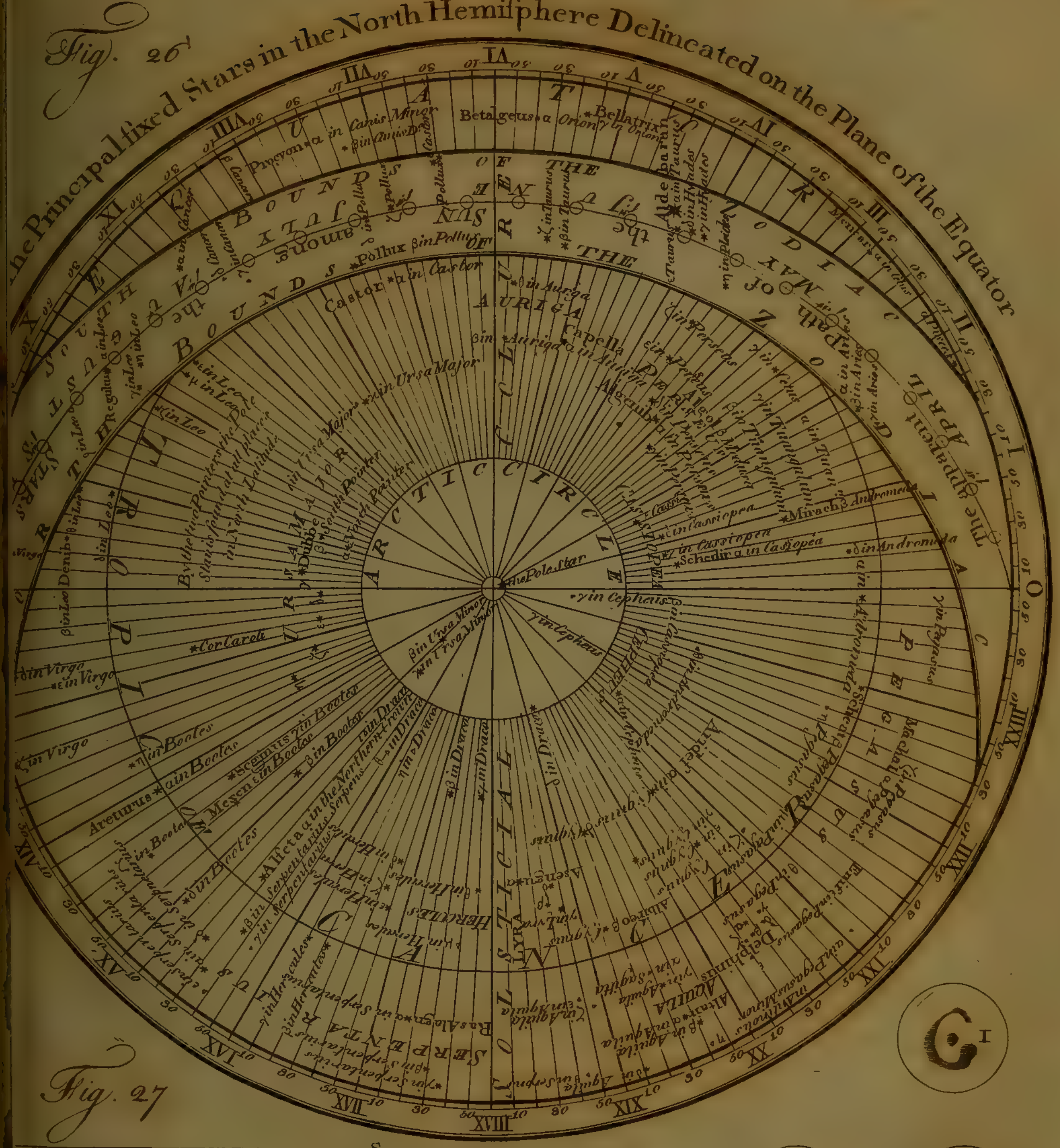
"From the appearances of the ſouth polar ſpot in 1781, we may conclude that its centre was nearly polar. We find it continued viſible all the time Mars revolved on his axis; and to preſent us generally with a pretty equal ſhare of the luminous appearance, a ſpot which covered from 45 to 60° of a great circle on the globe of the planet, could not have any conſiderable polar diſtance. From the obſervations and calculations made concerning the poles of Mars, we may conclude, that his north pole muſt be directed towards ſome point of the heavens, between $9^{s}\ 24^{\circ}\ 55'$ and $0^{s}\ 7^{\circ}\ 15'$; becauſe the change of the ſituation of the pole from left to right, which happened in the time the planet paſſed from one place to the other, is a plain indication of its having gone through the node of its axis. Next, we may alſo conclude, that the node muſt be conſiderably nearer the latter point of the ecliptic than the former; for, whatever be the inclination of the axis, it will be ſeen under equal angles at equal diſtances from the node. But by a trigonometrical proceſs of ſolving a few triangles, we ſoon diſcover both the inclination of the axis and the place where it interſects the ecliptic at rectangles (which, for want of a better term, I have perhaps improperly called it *node*). Accordingly I find by the calculation, that the node is in 17° 47′ of Piſces, the north pole of Mars being directed towards that part of the heavens; and that the inclination of the axis to the ecliptic is 59° 40′. By further calculations we find that the pole of Mars, on the 17th of April 1777, was then actually 81° 27′ inclined to the ecliptic, and pointed towards the left as ſeen from the ſun.

84
Of the exact poſition of the poles of Mars.

Plate LXVIII.

"The inclination and ſituation of the node of the axis of Mars, with reſpect to the ecliptic, being found, may be thus reduced to the orbit of the planet himſelf. Let E C (fig. 74.) be a part of the ecliptic, O M part of the orbit of Mars, P E O a line drawn from P, the celeſtial pole of Mars, through E, that point which has been determined to be the place of the node of the axis of Mars in the ecliptic, and continued to O, where it interſects his orbit. Now, if, according to M. de La Lande, we put the node of the orbit of Mars for 1783 in $1^{s}\ 17^{\circ}\ 58'$, we have from the place of the node of the axis, that is, $11^{s}\ 17^{\circ}\ 47'$, to the place of the node of the orbit, an arch E N of 60° 11′. In the triangle N E O, right angled at

Fig. 26



The Principal fixed Stars in the North Hemisphere Delineated on the Plane of the Equator

Fig. 27

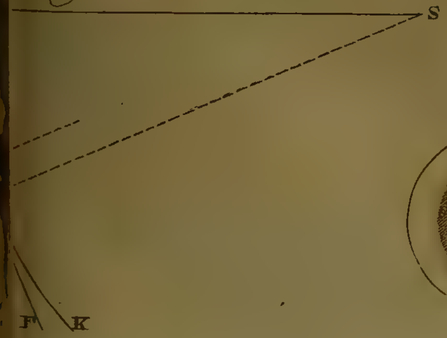
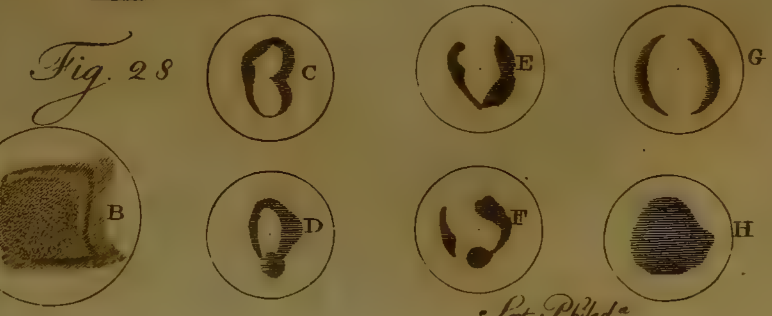


Fig. 28



Scot. Philad.a

at E, there is alſo given the angle E N O, according to the ſame author, 1° 51′, which is the inclination of the orbit of Mars to the ecliptic. Hence we find the angle E O N 89° 5′, and the ſide O N 60° 12′. Again, when Mars is in the node of its orbit N, we have by calculation the angle P N E = 63° 7′; to which adding the angle E N O = 1° 51′, we have P N O = 64° 58′: from which two angles, P O N and P N O, with the diſtance O N, we obtain the inclination of the axis of Mars, and place of its node with reſpect to its own orbit; the inclination being 61° 18′, and the place of the node of the axis 58° 31′ preceding the interſection of the ecliptic with the orbit of Mars, or in our 19° 28′ of Piſces."

85
Of the ſeaſons in Mars.

Our author next proceeds to ſhow how the ſeaſons in this planet may be calculated, &c. Which conjectures, though they belong properly to the next ſection, yet are ſo much connected with what has gone before, that we ſhall inſert here what he ſays upon the ſubject.

"Being thus acquainted with what the inhabitants of Mars will call the obliquity of their ecliptic, and the ſituation of their equinoctial and ſolſtitial points, we are furniſhed with the means of calculating the ſeaſons on that planet, and may account, in a manner which I think highly probable, for the remarkable appearance about its polar regions.

"But firſt, it may not be improper to give an inſtance how to reſolve any query concerning the Martial ſeaſons. Thus, let it be required to compute the declination of the ſun on Mars, June 25. 1781, at midnight of our time. If ♈, ♉, ♊, ♋, &c. (fig. 75.) repreſent the ecliptic of Mars, and ♈ ♋ ♎ ♑ the ecliptic of our planet, A *a*, *b* B, the mutual interſection of the Martial and terreſtrial ecliptics, then there is given the heliocentric longitude of Mars, ♈ *m* = 9^{s} 10° 30′: then taking away ſix ſigns, and ♎ *b* or ♈ *a* = 1^{s} 17° 58′, there remains *b m* = 1^{s} 22° 32′. From this arch, with the given inclination, 1° 51′ of the orbits to teach other, we have coſine of inclination to radius, as tangent of *b m* to tangent of B M = 1^{s} 22° 33′. And taking away B ♈ = 1^{s} 1° 29′, which is the complement to ♑ B (or ♋ A, already ſhown to be 1^{s} 28° 31′), there will remain ♈ M = 0^{s} 21° 4′, the place of Mars in its own orbit; that is, on the time above mentioned, the ſun's longitude on Mars will be 6^{s} 21° 4′; and the obliquity of the Martial ecliptic, 28° 42′, being alſo given, we find, by the uſual method, the ſun's declination, 9° 56′ ſouth.

86
Conſiderable reſemblance betwixt the earth and Mars.

"The analogy between Mars and the earth is perhaps by far the greateſt in the whole ſolar ſyſtem. Their diurnal motion is nearly the ſame; the obliquity of their reſpective ecliptics not very different; of all the ſuperior planets, the diſtance of Mars from the ſun is by far the neareſt alike to that of the earth: nor will the length of the Martial year appear very different from what we enjoy, when compared to the ſurpriſing duration of the years of Jupiter, Saturn, and the Georgium Sidus. If then we find that the globe we inhabit has its polar regions frozen and covered with mountains of ice and ſnow, that only partly melt when alternately expoſed to the ſun, I may well be permitted to ſurmiſe, that the ſame cauſes may probably have the ſame effect on the globe of Mars; that the bright polar ſpots are owing to the vivid reflection of light from frozen regions; and that the reduction of thoſe ſpots is to be aſcribed to their being expoſed to the ſun. In the year 1781, the ſouth polar ſpot was extremely large, which we might well expect as that pole had but lately been involved in a whole twelvemonth's darkneſs and abſence of the ſun; but in 1783, I found it conſiderably ſmaller than before, and it decreaſed continually from the 20th of May till about the middle of September, when it ſeemed to be at a ſtand. During this laſt period the ſouth pole had already been above eight months enjoying the benefit of ſummer, and ſtill continued to receive the ſun-beams, though, towards the latter end, in ſuch an oblique direction as to be but little benefited by them. On the other hand, in the year 1781, the north polar ſpot, which had then been its twelvemonth in the ſunſhine, and was but lately returning into darkneſs, appeared ſmall, though undoubtedly increaſing in ſize. Its not being viſible in the year 1783, is no objection to theſe phenomena; being owing to the poſition of the axis, by which it was removed out of ſight.

87
White ſpots about the poles of Mars ſuppoſed to be occaſioned by ſnow.

88
Of the ſpheroidal form of Mars.

"That a planetary globe, ſuch as Mars, turning on an axis, ſhould be of a ſpheroidical form, will eaſily find admittance, when two familiar inſtances in Jupiter and the earth, as well as the known laws of gravitation and the centrifugal force of rotatory bodies, lead the way to the reception of ſuch doctrines. So far from creating difficulties or doubts, it will rather appear ſingular, that the ſpheroidical form of this planet has not already been noticed by former aſtronomers; and yet, reflecting on the general appearances of Mars, we ſoon find, that opportunities of making obſervations on its real form cannot be very frequent: for when it is near enough to view it to an advantage, we ſee it generally gibbous; and its appoſitions are ſo ſcarce, and of ſo ſhort a duration, that in more than two years time we have not above three or four weeks for ſuch obſervations. Beſides, aſtronomers being generally accuſtomed to ſee this planet diſtorted, the ſpheroidical form might eaſily be overlooked.

89
Difference betwixt the equatorial and polar diameters of Mars.

"September 25. 1783. At 9h. 50′, the equatorial diameter of Mars meaſured 21″ 53‴; the polar diameter 21″ 15‴, *full meaſure*; that is certainly not too ſmall. This difference of the diameters was ſhown, on the 28th of the ſame month, to Mr Wilſon of Glaſgow, who ſaw it perfectly well, ſo as to be convinced that it was not owing to any defect or diſtortion occaſioned by the lens: and becauſe I wiſhed him to be ſatisfied of the reality of the appearance, I reminded him of ſeveral precautions; ſuch as cauſing the planet to paſs directly through the centre of the field of view, and judging of its figure when it was moſt diſtinct and beſt defined, &c. Next day the difference between the two diameters was ſhown to Dr Blagden and Mr Aubert. The former not only ſaw it immediately, but thought the flattening almoſt as much as that of Jupiter. Mr Aubert alſo ſaw it very plainly, ſo as to entertain no manner of doubt about the appearance.

"September 30th, 10h. 52′, the equatorial diameter was 22″ 9‴, with a magnifying power of 278. By a ſecond meaſure it was 22″ 31‴, full large; the polar diameter, very exact, was 21″ 26‴. On the 1ſt of October, at 10h. 50′, the equatorial diameter meaſured 103 by the micrometer, and the polar 98; the value of the diviſions in ſeconds and thirds not being well determined, on account of ſome changes lately made in the focal length of the object metals of the teleſcope. On the 13th, the equatorial diameter was exactly 22″ 35‴; the polar diameter 21″ 33‴." In a great number of ſucceeding obſervations, the ſame appearance occurred; but on account of the quick changes in the appearance of this planet, Mr Herſchel thought proper to ſettle the proportion betwixt the equatorial and polar diameters from thoſe which were made on the very day of the appoſition, and which were alſo to be preferred on account of their being repeated with a very high power, and in a fine clear air, with two different inſtruments of an excellent quality. From theſe he determined the proportions to be as 103 to 98, or 1355 to 1272.

90 Of the atmoſphere of Mars.

It has been commonly related by aſtronomers, that the atmoſphere of this planet is poſſeſſed of ſuch ſtrong refractive powers, as to render the ſmall fixed ſtars near which it paſſes inviſible. Dr Smith relates an obſervation of Caſſini, where a ſtar in the water of Aquarius, at the diſtance of ſix minutes from the diſk of Mars, became ſo faint before its occultation that it could not be ſeen by the naked eye, nor with a three-feet teleſcope. This would indicate an atmoſphere of a very extraordinary ſize and denſity; but the following obſervations of Mr Herſchel ſeem to ſhow that it is of much ſmaller dimenſions. "1783, Oct. 26th, There are two ſmall ſtars preceding Mars, of different ſizes; with 460 they appear both duſky red, and are pretty unequal; with 278 they appear conſiderably unequal. The diſtance from Mars of the neareſt, which is alſo the largeſt, with 227 meaſured 3′ 26″ 20‴. Some time after, the ſame evening, the diſtance was 3′ 8″ 55‴, Mars being retrograde. Both of them were ſeen very diſtinctly. They were viewed with a new 20 feet reflector, and appeared very bright. October 27th, the ſmall ſtar is not quite ſo bright in proportion to the large one as it was laſt night, being a good deal nearer to Mars, which is now on the ſide of the ſmall ſtar; but when the planet was drawn aſide, or out of view, it appeared as plainly as uſual. The diſtance of the ſmall ſtar was 2′ 5″ 25‴. The largeſt of the two ſtars (adds he), on which the above obſervations were made, cannot exceed the 12th, and the ſmalleſt the 13th or 14th magnitude; and I have no reaſon to ſuppoſe that they were any otherwiſe affected by the approach of Mars, than what the brightneſs of its ſuperior light may account for. From other phenomena it appears, however, that this planet is not without a conſiderable atmoſphere; for beſides the permanent ſpots on its ſurface, I have often noticed occaſional changes of partial bright belts, and alſo once a darkiſh one in a pretty high latitude; and theſe alterations we can hardly aſcribe to any other cauſe than the variable diſpoſition of clouds and vapours floating in the atmoſphere of the planet."

91 Belts of Jupiter, when firſt diſcovered.

6. Jupiter has the ſame general appearance with Mars, only that the belts on his ſurface are much larger and more permanent. Their general appearance, as deſcribed by Dr Long, is repreſented fig. 76—79.; by Mr Dun, fig. 18.; by Mr Wollaſton fig. 21. 22, 22.; and by Mr Ferguſon, fig. 153. But they are not to be ſeen but by an excellent teleſcope. They are ſaid to have been firſt diſcovered by Fontana and two other Italians; but Caſſini was the firſt who gave a good account of them. Their number is very variable, as ſometimes only one, and at others no fewer than eight, may be perceived. They are generally parallel to one another, but not always ſo; and their breadth is likewiſe variable, one belt having been obſerved to grow narrow, while another in its neighbourhood has increaſed in breadth, as if the one had flowed into the other: and in this caſe Dr Long obſerves, that a part of an oblique belt lay between them, as if to form a communication for this purpoſe. The time of their continuance is very uncertain, ſometimes remaining unchanged for three months; at others, new belts have been formed in an hour or two.

92 Spots ſometimes appear in them.

In ſome of theſe belts large black ſpots have appeared, which moved ſwiftly over the diſk from eaſt to weſt, and returned in a ſhort time to the ſame place; from whence the rotation of this planet about its axis has been determined. On the 9th of May 1664, Dr Hook, with a good 12 feet teleſcope, obſerved a ſmall ſpot in the biggeſt of the three obſcure belts of Jupiter; and obſerving it from time to time, found that in two hours it had moved from eaſt to weſt about half the viſible diameter of the planet. In 1665, Caſſini obſerved a ſpot near the largeſt belt of Jupiter which is moſt frequently ſeen. It appeared round, and moved with the greateſt velocity when in the middle, but appeared narrower, and moved ſlower, the nearer it was to the circumference. "Theſe circumſtances (ſays Dr Long), ſhowed that the ſpot adhered to the body of Jupiter, and was carried round upon it. It continued thereon till the year following; long enough to determine the periodical time of Jupiter's rotation upon his axis to be nine hours 56 minutes."

93 Account of one theſe ſpots.

This principal, or ancient ſpot as it is called, is the largeſt, and of the longeſt continuance of any hitherto known, has appeared and vaniſhed no fewer than eight times between the years 1665 and 1708: from the year laſt mentioned it was inviſible till 1713. The longeſt time of its continuing to be viſible was three years; and the longeſt time of its diſappearing was from 1708 to 1713: it ſeems to have ſome connection with the principal ſouthern belt; for the ſpot has never been ſeen when that diſappeared, though that belt has often been viſible without the ſpot. Beſides this ancient ſpot, Caſſini, in the year 1699, ſaw one of leſs ſtability that did not continue, of the ſame ſhape or dimenſions, but broke into ſeveral ſmall ones, whereof the revolution was but nine hours 51 minutes; and two other ſpots that revolved in nine hours 52 minutes and a half. The figure of Jupiter is evidently an oblate ſpheroid, the longeſt diameter of his diſk being to the ſhorteſt as 13 to 12. His rotation is from weſt to eaſt, like that of the ſun, and the plane of his equator is very nearly coincident with that of his orbit; ſo that there can ſcarce be any difference of ſeaſons in that planet.

94 No difference of ſeaſons in Jupiter.

His rotation has been obſerved to be ſomewhat quicker in his aphelion than his perihelion.

95 Is attended by four moons.

The moſt remarkable circumſtance attending this planet is his having four moons, which conſtantly revolve round him at different diſtances. See fig. 18. and 186. Theſe are all ſuppoſed to move in ellipſes; though the excentricities of all of them are too ſmall to be meaſured, excepting that of the fourth; and even this amounts to no more than 0.007 of its mean diſtance from the primary. The orbits of theſe planets were thought

Appearances of Celeſtial Bodies thro' Teleſcopes.

thought by Galileo to be in the ſame plane with that of their primary: but M. Caſſini has found that their orbits make a ſmall angle with it; and as he did not find any difference in the place of their nodes, he concluded that they were all in the ſame place, and that their aſcending nodes were in the middle of Aquarius. After obſerving them for more than 36 years, he found their greateſt latitude, or deviation from the plane of Jupiter's orbit, to be 2° 55′. The firſt of theſe ſatellites revolves at the diſtance of 5.697 of Jupiter's ſemidiameters, or 1′ 51″ as meaſured by proper inſtruments; its periodical time is 1 d. 18 h. 27′ 34″. The next ſatellite revolves at the diſtance of 9.017 ſemidiameters, or 2′ 56″, in 3 d. 13 h. 13′ 42″; the third at the diſtance of 14.384 ſemidiameters, or 4′ 42″, in 7 d. 3 h. 42′ 36″; and the fourth at the diſtance of 25.266, or 8′ 16″, in 16 d. 16 h. 32′ 09″.

96
Diſtances and periodical times of Jupiter's moons.

Since the time of Caſſini, it has been found that the nodes of Jupiter's ſatellites are not in the ſame place; and from the different points of view in which we have an opportunity of obſerving them from the earth, we ſee them ſometimes apparently moving in ſtraight lines, and at other times in elliptic curves. All of them, by reaſon of their immenſe diſtance, ſeem to keep near their primary, and their apparent motion is a kind of oſcillation like that of a pendulum, going alternately from the geateſt diſtance on one ſide to the greateſt diſtance on the other, ſometimes in a ſtraight line, and ſometimes in an elliptic curve. When a ſatellite is in its ſuperior ſemicircle, or that half of its orbit which is more diſtant from the earth than Jupiter is, its motion appears to us direct, according to the order of the ſigns; but in its inferior ſemicircle, when it is nearer to us than Jupiter, its motion appears retrograde; and both theſe motions ſeem quicker the nearer the ſatellites are to the centre of the primary, ſlower the more diſtant they are, and at the greateſt diſtance of all they appear for a ſhort time to be ſtationary.

97
Occultations and eclipſes of Jupiter's ſatellites.

From this account of the ſyſtem of Jupiter and his ſatellites, it is evident, that occultations of them muſt frequently happen by their going behind their primary, or by coming in betwixt us and it. The former takes place when they proceed towards the middle of the upper ſemicircle; the latter, when they paſs through the ſame part of their inferior ſemicircle. Occultations of the former kind happen to the firſt and ſecond ſatellite; at every revolution, the third very rarely eſcapes an occultation, but the fourth more frequently by reaſon of its greater diſtance. It is ſeldom that a ſatellite can be diſcovered upon the diſk of Jupiter, even by the beſt teleſcopes, excepting at its firſt entrance, when by reaſon of its being more directly illuminated by the rays of the ſun than the planet itſelf, it appears like a lucid ſpot upon it. Sometimes, however, a ſatellite in paſſing over the diſk, appears like a dark ſpot, and is eaſily to be diſtinguiſhed. This is ſuppoſed to be owing to ſpots on the body of theſe ſecondary planets; and it is remarkable, that the ſame ſatellite has been known to paſs over the diſk at one time as a dark ſpot, and at another ſo luminous that it could not be diſtinguiſhed from Jupiter himſelf, except at its coming on and going off. To account for this, we muſt ſay, that either the ſpots are ſubject to change; or if they be permanent, like thoſe of our moon, that the ſatellites at different times turn different parts of their globes towards us. Poſſibly both theſe cauſes may contribute to produce the phenomena juſt mentioned. For theſe reaſons alſo both the light and apparent magnitude of the ſatellites are variable: for the fewer ſpots there are upon that ſide which is turned towards us, the brighter it will appear; and as the bright ſide only can be ſeen, a ſatellite muſt appear larger the more of its bright ſide it turns towards the earth, and the leſs ſo the more it happens to be covered with ſpots. The fourth ſatellite, though generally the ſmalleſt, ſometimes appears bigger than any of the reſt: the third ſometimes ſeems leaſt, though uſually the largeſt; nay, a ſatellite may be ſo covered with ſpots as to appear leſs than its ſhadow paſſing over the diſk of the primary, though we are certain that the ſhadow muſt be ſmaller than the body which caſts it. To a ſpectator placed on the ſurface of Jupiter, each of theſe ſatellites would put on the phaſes of the moon; but as the diſtance of any of them from Jupiter is but ſmall when compared with the diſtance of that planet from the ſun, the ſatellites are therefore illuminated by the ſun very nearly in the ſame manner with the primary itſelf; hence they apper to us always round, having conſtantly the greateſt part of their enlightened half turned towards the earth; and indeed they are ſo ſmall, that were they to put on the phaſes of the moon, theſe phaſes could ſcarce be diſcerned through the beſt teleſcopes.

98
The ſatellites ſometimes appear as dark ſpots

Appearances of Celeſtial Bodies thro' Teleſcopes.

99
Why they vary in their light and apparent magnitude.

100
Their ſhadows ſometimes viſible on the diſk of Jupiter.

When the ſatellites paſs through their inferior ſemicircles, they may caſt a ſhadow upon their primary, and thus cauſe an eclipſe of the ſun to his inhabitants if there are any; and in ſome ſituations this ſhadow may be obſerved going before or following the ſatellite. On the other hand, in paſſing through their ſuperior ſemicircles, the ſatellites may be eclipſed in the ſame manner as our moon, by paſſing through the ſhadow of Jupiter: and this is actually the caſe with the firſt, ſecond, and third of theſe bodies; but the fourth, by reaſon of the largeneſs of its orbit, paſſes ſometimes above or below the ſhadow, as is the caſe with our moon. The beginnings and ending of theſe eclipſes are eaſily ſeen by a teleſcope when the earth is in a proper ſituation with regard to Jupiter and the ſun; but when this or any other planet is in conjunction with the ſun, the ſuperior brightneſs of that luminary renders both it and the ſatellites inviſible. From the time of its firſt appearing after a conjunction until near the oppoſition, only the immerſions of the ſatellites into his ſhadow, or the beginnings of the eclipſes, are viſible; at the oppoſition, only the occultations of the ſatellites, by going behind or coming before their primary, are obſervable; and from the oppoſition to the conjunction, only the emerſions, or end of the eclipſes, are to be ſeen. This is exactly true in the firſt ſatellite, of which we can never ſee an immerſion with its immediately ſubſequent emerſion: and it is but rarely that they can be both ſeen in the ſecond; as in order to their being ſo, that ſatellite muſt be near one of its limits, at the ſame time that the planet is near his perihelion and quadrature with the ſun. With regard to the third, when Jupiter is more than 46 degrees from conjunction with, or oppoſition to the ſun, both its immerſions and immediately ſubſequent emerſions are viſible; as they likewiſe are in the fourth, when the diſtance of Jupiter from conjunction or oppoſition is 24 degrees.

101
Three of Jupiter's moons eclipſed in every revolution.

102
At what time the eclipſes, occultations, &c. of Jupiter's ſatellites are viſible.

Appearances of Celeſtial Bodies thro' Teleſcopes.

When Jupiter is in quadrature with the ſun, the earth is fartheſt out of the line that paſſes through the centres of the ſun and Jupiter, and therefore the ſhadow of the planet is then moſt expoſed to our view; but even then the body of the planet will hide from us one ſide of that part of the ſhadow which is neareſt to it, through which the firſt ſatellite paſſes; which is the reaſon that, though we ſee the entrance of that ſatellite into the ſhadow, or its coming out from thence, as the earth is ſituated on the eaſt or weſt ſide thereof, we cannot ſee them both; whereas the other ſatellites going through the ſhadow at a greater diſtance from Jupiter, their ingreſs and egreſs are both viſible.

103 Teleſcopic appearance of Saturn.

104 His ring firſt diſcovered by Huygens.

7. Saturn, when viewed through a good teleſcope, makes a more remarkable appearance than any of the other planets. Galileo firſt diſcovered his uncommon ſhape, which he thought to be like two ſmall globes, one on each ſide of a large one: and he publiſhed his diſcovery in a Latin ſentence; the meaning of which was, that he had ſeen him appear with three bodies; though, in order to keep the diſcovery a ſecret, the letters were tranſpoſed. Having viewed him for two years, he was ſurpriſed to ſee him become quite round without theſe appendages, and then after ſome time to aſſume them as before. Theſe adjoining globes were what are now called the *anſæ* of his ring, the true ſhape of which was firſt diſcovered by Huygens about 40 years after Galileo, firſt with a teleſcope of 12 feet, and then with one of 23 feet, which magnified objects 100 times. From the diſcoveries made by him and other aſtronomers, it appears that this planet is ſurrounded by a broad thin ring, the edge of which reflects little or none of the ſun's light to us, but the planes of the ring reflect the light in the ſame manner that the planet itſelf does; and if we ſuppoſe the diameter of Saturn to be divided into three equal parts, the diameter of the ring is about ſeven of theſe parts. The ring is detached from the body of Saturn in ſuch a manner, that the diſtance between the innermoſt part of the ring and the body is equal to its breadth. If we had a view of the planet and his ring, with our eyes, perpendicular to one of the planes of the latter, we ſhould ſee them as in fig. 80.: but our eye is never ſo much elevated above either plane as to have the viſual ray ſtand at right angles to it; nor indeed is it ever elevated more than about 30 degrees above it; ſo that the ring, being commonly viewed at an oblique angle, appears of an oval form, and through very good teleſcopes double, as repreſented fig. 18. and 153. Both the outward and inward rim is projected into an ellipſis, more or leſs oblong according to the different degrees of obliquity with which it is viewed. Sometimes our eye is in the plane of the ring, and then it becomes inviſible; either becauſe the outward edge is not fitted to reflect the ſun's light, or more probably becauſe it is too thin to be ſeen at ſuch a diſtance. As the plane of this ring keeps always parallel to itſelf, that is, its ſituation in one part of the orbit is always parallel to that in any other part, it diſappears twice in every revolution of the planet, that is, about once in 15 years; and he ſometimes appears quite round for nine months together. At other times, the diſtance betwixt the body of the planet and the ring is very perceptible; inſomuch that Mr Whiſton tells us of Dr Clarke's father having ſeen a ſtar through the opening, and ſuppoſed him to have been the only perſon who ever ſaw a ſight ſo rare, as the opening, though certainly very large, appears very ſmall to us. When Saturn appears round, if our eye be in the plane of the ring, it will appear as a dark line acroſs the middle of the planet's diſk; and if our eye be elevated above the plane of the ring, a ſhadowy belt will be viſible, cauſed by the ſhadow of the ring as well as by the interpoſition of part of it betwixt the eye and the planet. The ſhadow of the ring is broadeſt when the ſun is moſt elevated, but its obſcure parts appear broadeſt when our eye is moſt elevated above the plane of it. When it appears double, the ring next the body of the planet appears brighteſt; when the ring appears of an elliptical form, the parts about the ends of the largeſt axis are called the *anſæ*, as has been already mentioned. Theſe, a little before and after the diſappearing of the ring, are of unequal magnitude: the largeſt anſa is longer viſible before the planets round phaſe, and appears again ſooner than the other. On the 1ſt of October 1714, the largeſt anſa was on the eaſt ſide, and on the 12th on the weſt ſide of the diſk of the planet, which makes it probable that the ring has a rotation round an axis: but whether or not this is the caſe with Saturn himſelf has not been diſcovered, on account of the deficiency of ſpots by which it might be determined. He has indeed two belts, diſcovered with very long teleſcopes, which appear parallel to that formed by the edge of the ring above mentioned; but theſe are rectilinear when the ring appears elliptic, as in fig. 81. and ſeem to be permanent. In 1683, however, Dom. Caſſini and Fatio perceived a bright ſtreak upon Saturn, which was not permanent like the dark belts, but was viſible one day and diſappeared the next, when another came into view near the edge of his diſk. This induced Caſſini to ſuppoſe, that Saturn might have a rotation round his axis; but the diſtance of this planet is ſo great, that we can ſcarce hope to determine his revolation ſo accurately as that of the others. It diſappeared in May 1789; the earth being about to paſs from its northern ſide, which is enlightened, to the ſouthern, which is obſcure.

105 Ring of Saturn probably has a revolution on its axis.

106 Belts diſcovered on Saturn.

The aſtronomer-royal (Dr Maſkelyne) informs us of this diſappearance in 1789, and reappearance in 1790, in the following manner: "On May 3d and Auguſt 26th 1789, the plane of Saturn's ring will paſs through the earth; in October 11th it will paſs through the ſun; and January 29th 1790 it will again paſs through the earth. Hence, and ſuppoſing with M. de la Lande that the ring is but juſt viſible with the beſt teleſcopes in common uſe, when the ſun is elevated 3′ above its plane, or 3 days before the plane paſſes through the ſun, and when the earth is elevated $2\frac{1}{4}'$ above the plane, or one day from the earth's paſſing it, the phenomena of diſappearance and reappearance may be expected to take place as follows.

"May 2d 1789, Saturn's ring will diſappear; the earth being about to paſs from its northern ſide, which is enlightened, to its ſouthern ſide, which is obſcure.

"Auguſt 27th, the earth having repaſſed to the northern or enlightened ſide, the ring will reappear.

"October 8th, the ring will diſappear; its plane being near paſſing through the ſun, when it will change its enlightened ſide from the northern to the ſouthern

Fig. 30

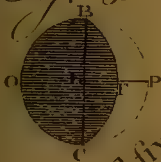


Fig. 29

The Principal fixed Stars in the South Hemisphere Delineated on the Plane of the Equator

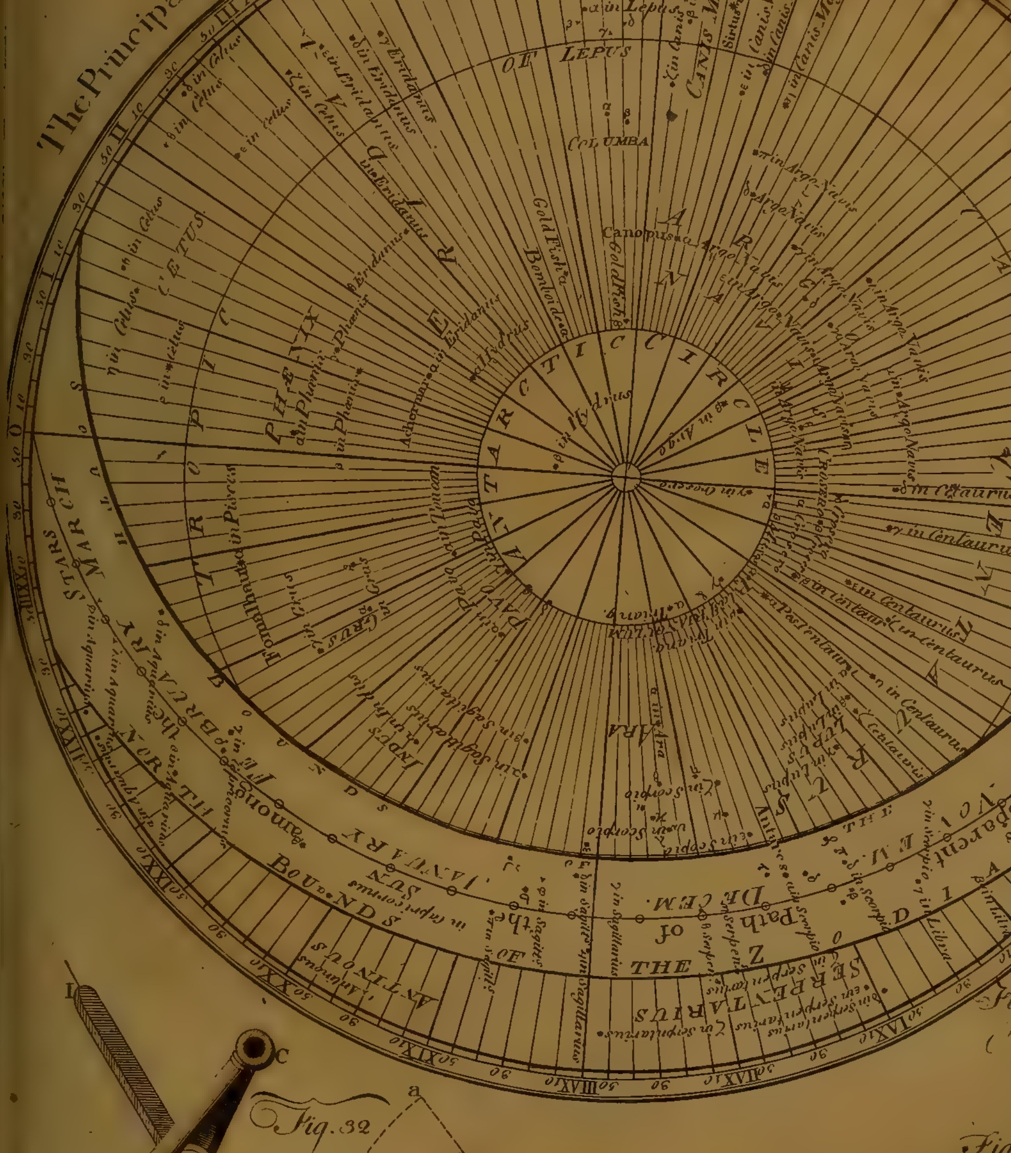


Fig. 31

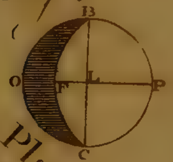


Fig. 32

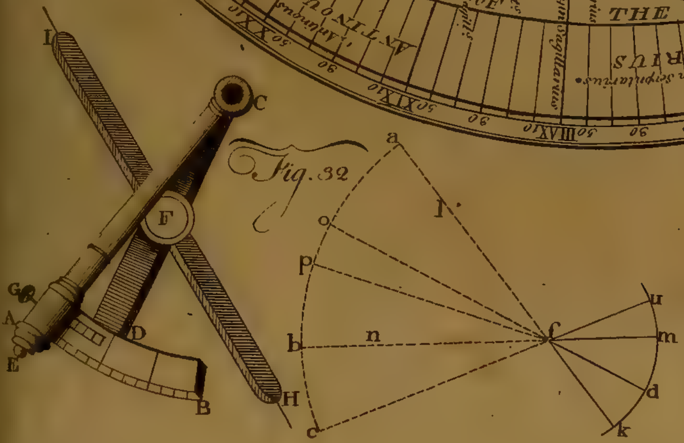


Fig. 33

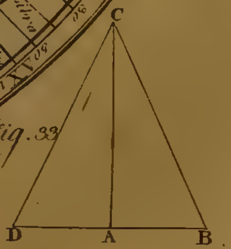
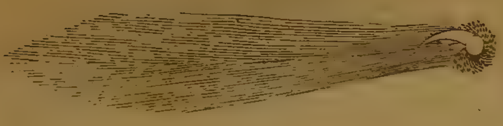


Fig. 34
Comet



Scot Philadª

Appearances of Celeſtial Bodies thro' Teleſcopes.

one, conſequently the dark ſide will be then turned to the earth.

“January 30th 1790, the earth having paſſed from the northern or dark ſide of the ring, to the ſouthern or enlightened one, the ring will become viſible, to continue ſo until the year 1803.”

In the diagram, fig. 159 are delineated the phaſes of the ring from its full appearance in the year 1782 to its diſappearance in 1789, and its full reappearance 1796.

107 His five ſatellites. Saturn is ſtill better attended than Jupiter (ſee fig. 18. and 186); having, beſides the ring abovementioned, no fewer than five moons continually circulating round him. The firſt, at the diſtance of 2.097 ſemidiameters of his ring, and 4.893 of the planet itſelf, performs its revolution in 1d. 21h. 18′ 27″; the ſecond, at 2.686 ſemidiameters of the ring, and 6.268 of Saturn, revolves in 2d. 17h. 41′ 22″: the third, at the diſtance of 8.754 ſemidiameters of Saturn, and 3.752 of the ring, in 4d, 12h. 25′ 12″; the fourth, called the *Huygenian ſatellite*, at 8.698 ſemidiameters of the ring, and 20.295 of Saturn, revolves in 15d. 21h. 41′ 12″; while the fifth, placed at the vaſt diſtance of 59.154 ſemidiameters of Saturn, or 25.348 of his ring, does not perform its revolution in leſs than 79d. 7h. 47′ 00″. The orbits of all theſe ſatellites, except the fifth, are nearly in the ſame plane, which makes an angle with the plane of Saturn's orbit of about 31°; and by reaſon of their being inclined at ſuch large angles, they cannot paſs either acroſs their primary or behind it with reſpect to the earth, except when very near their nodes; ſo that eclipſes of them happen much more ſeldom than of the ſatellites of Juper. There is, however, an account in the Philoſ. Tranſact. of an occultation of the fourth ſatellite behind the body of Saturn; and there is a curious account by Caſſini, in the Memoirs of the Royal Academy for 1692, of a fixed ſtar being covered by the fourth ſatellite, ſo that for 13 minutes they appeared both as one ſtar.

108 Fifth ſatellite ſometimes diſappears, and why. By reaſon of their extreme ſmallneſs, theſe ſatellites cannot be ſeen unleſs the air is very clear; and Dom. Caſſini for ſeveral years obſerved the fifth ſatellite to grow leſs and leſs as it went through the eaſtern part of its orbit until it became quite inviſible, while in the weſtern part it gradually became more and more bright until it arrived at its greateſt ſplendor.—“This phenomenon (ſays Dr Long) cannot be better accounted for than by ſuppoſing one half of the ſurface of this ſatallite to be unfit to reflect the light of the ſun in ſufficient quantity to make it viſible, and that it turns round its axis nearly in the ſame time as it revolves round its primary; and that, by means of this rotation, and keeping always the ſame face toward Saturn, we upon the earth may during one half of its periodical time, be able to ſee ſucceſſively more and more of its bright ſide, and during the other half of its period have more and more of the ſpotted or dark ſide turned toward us. In the year 1705, this ſatellite unexpectedly became viſible in all parts of its orbit through the very ſame teleſcopes that were before often made uſe of to view it in the eaſtern part without ſucceſs: this ſhows the ſpots upon this ſatellite, like thoſe upon Jupiter and ſome other of the primary planets, are not permanent, but ſubject to change.”

Appearances of Celeſtial Bodies thro' Teleſcopes.

109 Georgium Sidus attended by two ſatellites. 8. With regard to the Georgium Sidus, ſtill leſs is known than of Saturn. Its apparent magnitude is ſo ſmall, that it can ſeldom be ſeen with the naked eye; and even with the teleſcope it appears but of a few ſeconds diameter. It is attended by two ſatellites at the proportional diſtances marked in fig. 82. according to the obſervations of Mr. Herſchel; but he had not an opportunity of obſerving them long enough to determine their periodical times with exactneſs; though he ſuppoſes the innermoſt to perform its revolution in about eight days and three quarters, the other in thirteen days and a half.

110 Of the comets. 9. The Comets, viewed through a teleſcope, have a very different appearance from any of the planets. The nucleus, or ſtar, ſeems much more dim. Sturmius tells us, that obſerving the comet of 1680 with a teleſcope, it appeared like a coal dimly glowing; or a rude maſs of matter illuminated with a duſky fumid light, leſs ſenſible at the extremes than in the middle; and not at all like a ſtar, which appears with a round diſk and a vivid light.

Hevelius obſerved of the comet in 1661, that its body was of a yellowiſh colour, bright and conſpicuous, but without any glittering light. In the middle was a denſe ruddy nucleus, almoſt equal to Jupiter, encompaſſed with a much fainter, thinner matter.—Feb. 5th. The nucleus was ſomewhat bigger and brighter, of a gold colour, but its light more duſky than the reſt of the ſtars; it appeared alſo divided into a number of parts.—Feb. 6th. The nuclei ſtill appeared, though leſs than before. One of them on the left ſide of the lower part of the diſk appeared to be much denſer and brighter than the reſt; its body round, and repreſenting a little lucid ſtar; the nuclei ſtill encompaſſed with another kind of matter.—Feb. 10th. The nuclei more obſcure and confuſed, but brighter at top than at bottom.—Feb. 13th. The head diminiſhed much both in brightneſs and in magnitude.—March 2d. Its roundneſs a little impaired, and the edges lacerated.—March 28th. Its matter much diſperſed; and no diſtinct nucleus at all appearing.

Wiegelius, who ſaw through a teleſcope the comet of 1664, the moon, and a little cloud illuminated by the ſun, at the ſame time; obſerved that the moon appeared of a continued luminous ſurface, but the comet very different, being perfectly like the little cloud enlightened by the ſun's beams.

111 Their atmoſpheres and phaſes. The comets, too, are to appearance ſurrounded with atmoſpheres of a prodigious ſize, often ariſing ten times higher than the nucleus. They have often likewiſe different phaſes, like the moon.

112 Dr Long's account of them. “The head of a comet (ſays Dr Long) to the eye, unaſſiſted by glaſſes, appears ſometimes like a cloudy ſtar; ſometimes ſhines with a dull light like that of the planet Saturn; ſome comets have been ſaid to equal, ſome to exceed, ſtars of the firſt magnitude; ſome to have ſurpaſſed Jupiter, and even Venus; and to have caſt a ſhadow as Venus ſometimes does.

“The head of a comet, ſeen through a good teleſcope, appears to conſiſt of a ſolid globe, and an atmoſphere that ſurrounds it. The ſolid part is frequently called the *nucleus*; which through a teleſcope is eaſily diſtinguiſhed from the atmoſphere or hairy appearance.

“A comet is generally attended with a blaze or tail, whereby it is diſtinguiſhed from a ſtar or planet;

as it is alſo by its motion. Sometimes the tail only of a comet has been viſible at a place where the head has been all the while under the horizon; ſuch an appearance is called a *beam*.

113 Appearances of the comet of 1618.

“ The nucleus of the comet of 1618 is ſaid, a few days after coming into view, to have broken into three or four parts of irregular figures. One obſerver compares them to ſo many burning coals; and ſays they changed their ſituation while he was looking at them, as when a perſon ſtirs a fire; and a few days after were broken into a great number of ſmaller pieces. Another account of the ſame is that on the 1ſt and 4th of December, the nucleus appeared to be a round, ſolid, and luminous body, of a duſky lead colour, larger than any ſtar of the firſt magnitude. On the 8th of the ſame month it was broken into three or four parts of irregular figures; and on the 20th was changed into a cluſter of ſmall ſtars.

114 Phenomena of their tails.

“ As the tail of a comet is owing to the heat of the ſun, it grows larger as the comet approaches near to, and ſhortens as it recedes from, that luminary. If the tail of a comet were to continue of the ſame length, it would appear longer or ſhorter according to the different views of the ſpectator; for if his eye be in a line drawn through the middle of the tail lengthwiſe, or nearly ſo, the tail will not be diſtinguiſhed from the reſt of the atmoſphere, but the whole will appear round; if the eye be a little out of that line, the tail will appear ſhort as in fig. 83. and it is called a *bearded comet* when the tail hangs down towards the horizon, as in that figure. If the tail of a comet be viewed ſideways, the whole length of it is ſeen. It is obvoius to remark, that the nearer the eye is to the tail, the greater will be the apparent length thereof.

“ The tails of comets often appear bent, as in fig. 84 and 85, owing to the reſiſtance of the æther; which, though extremely ſmall, may have a ſenſible effect on ſo thin a vapour as the tails conſiſts of. This bending is ſeen only when the earth is not in the plane of the orbit of the comet continued. When that plane paſſes thro' the eye of the ſpectator, the tail appears ſtraight, as in fig. 86, 87.

“ Longomontanus mentions a comet, that, in 1618, Dec. 10th; had a tail above 100 degrees in length; which ſhows that it muſt then have been very near the earth. The tail of a comet will at the ſame time appear of different length in different places, according as the air in one place is clearer than in another. It need not be mentioned, that in the ſame place, the difference in the eyes of their ſpectators will be the cauſe of their diſagreeing in their eſtimate of the length of the tail of a comet.

115 Difference between the obſervations of Hevelius and Hooke.

“ Hevelius is very particular in telling us, that he obſerved the comet of 1665 to caſt a ſhadow upon the tail; for in the middle thereof there appeared a dark line. It is ſomewhat ſurpriſing, that Hooke ſhould be poſitive in affirming, on the contrary, that the place where the ſhadow of that comet ſhould have been, if there had been any ſhadow, was brighter that any other part of the tail. He was of opinion that comets have ſome light of their own. His obſervations were made in a hurry; he owns they were ſhort and tranſitory: Hevelius's were made with ſo much care, that there is more reaſon to depend upon them. Dom. Caſſini obſerved, in the tail of the comet of 1680, a darkneſs in the middle; and the like was taken notice of by a curious obſerver in that of 1744.

116 Account of the comet of 1680.

“ There are three comets, viz. of 1680, 1744, and 1759, that deſerve to have a farther account given of them. The comet of 1680 was remarkable for its near approach to the ſun; ſo near, that in its perihelion it was not above a ſixth part of the diameter of that luminary from the ſurface thereof. Fig. 85, taken from Newton's Principia, repreſents ſo much of the trajectory of this comet as it paſſed through while it was viſible to the inhabitants of our earth, in going from and returning to its perihelion. It ſhows alſo the tail as it appeared on the days mentioned in the figure. The tail, like that of other comets, increaſed in length and brightneſs as it came nearer to the ſun; and grew ſhorter and fainter as it went farther from him and from the earth, till that and the comet were too far off to be any longer viſible.

117 Of that of 1744.

“ The comet of 1744 was firſt ſeen at Lauſanne in Switzerland, Dec. 13th, 1743, N. S. From that time it increaſed in brightneſs and magnitude as it was coming nearer to the ſun. The diameter of it, when at the diſtance of the ſun from us, meaſured about one minute; which brings it out equal to three times the diameter of the earth. It came ſo near Mercury, that, if its attraction had been proportionable to its magnitude, it was thought probable it would have diſturbed the motion of that planet. Mr Betts of Oxford, however, from ſome obſervations made there, and at Lord Macclesfield's obſervatory at Sherburn, found, that when the comet was at its leaſt diſtance from Mercury, and almoſt twice as near the ſun as that planet was, it was ſtill diſtant from him a fifth part of the diſtance of the ſun from the earth; and could therefore have no effect upon the planet's motions. He judged the comet to be at leaſt equal in magnitude to the earth. He ſays, that in the evening of Jan. 23, this comet appeared exceedingly diſtinct and bright, and the diameter of its nucleus nearly equal to that of Jupiter. Its tail extended above 16 degrees from its body; and was in length, ſuppoſing the ſun's parallax 10″, no leſs than 23 millions of miles. Dr Bevis, in the month of May 1744, made four obſervations of Mercury, and found the places of that planet, calculated from correct tables, differed ſo little from the places obſerved, as to ſhow that the comet had no influence upon Mercury's motion.

“ The nucleus, which had before been always round, on the 10th of February appeared oblong in the direction of the tail, and ſeemed divided into two parts by a black ſtroke in the middle. One of the parts had a ſort of beard brighter than the tail; this beard was ſurrounded by two unequal dark ſtrokes, that ſeparated the beard from the hair of the comet. The odd phenomena diſappeared the next day, and nothing was ſeen but irregular obſcure ſpaces like ſmoke in the middle of the tail; and the head reſumed its natural form. Feb. 15th, the tail was divided into two branches; the eaſtern part about ſeven or eight degrees long, the weſtern 24. On the 23d, the tail began to be bent; it ſhowed no tail till it was as near to the ſun as the orbit of Mars; the tail grew longer as it approached nearer the ſun; and at its greateſt length was computed to equal a third part of the diſtance of the earth from the ſun. Fig. 84. is a view of this comet; taken by an obſerver at Cambridge. I remember that in viewing it I thought the tail ſeemed to ſparkle, or vibrate luminous particles. Hevelius mentions the like in other comets; and that their tails lengthen and ſhorten while we are viewing. This is probably owing to the motion of our air.

118 Of the comet of 1759.

“ The comet of 1759 did not make any conſiderable appearance by reaſon of the unfavourable ſituation of the earth all the time; its tail might otherwiſe have been conſpicuous; the comet being then too near the ſun to be ſeen by us; but deſerves our particular conſideration, as it was the firſt that ever had its return foretold.” See the following Section.

Hevelius gives pictures of comets of various ſhapes; as they are deſcribed by hiſtorians to have been like a ſword, a buckle, a tun, &c. Theſe are drawn by fancy only, from the deſcription in words. He gives, however, alſo pictures of ſome comets, engraved by his own hand from the views he had of them through a very long and excellent teleſcope. In theſe we find changes in the nucleus and the atmoſphere of the ſame comet. The nucleus of the comet of 1661, which in one obſervation appeared as one round body, as it is repreſented in fig. 87. in ſubſequent views ſeemed to conſiſt of ſeveral ſmaller ones ſeparated from one another, as in fig. 86. The atmoſphere ſurrounding the nucleus, at different times, varied in the extent thereof; as did alſo the tail in length and breadth. The nuclei of other comets, as has already been obſerved, have ſometimes phaſes like the moon. Thoſe of 1744 and 1769 had both this kind of appearance. See fig. 34.

119 Number of fixed ſtars increaſed by teleſcopes.

10. The fixed ſtars, when viewed through the beſt teleſcopes, appear not at all magnified, but rather diminiſhed in bulk; by reaſon, as is thought by ſome, that the teleſcope takes off that twinkling appearance they make to the naked eye; but by others more probably, that the teleſcopic tube excludes a quantity of the rays of light, which are not only emitted from the particular ſtars themſelves, but by many thouſands more, which falling upon our eye-lids and the aërial particles about us, are reflected into our eyes ſo ſtrongly as to excite vibrations, not only on thoſe points of the retina where the images of the ſtars are formed, but alſo in other points at the ſame diſtance round about. This without the teleſcope makes us imagine the ſtars to be much bigger than when we ſee them only by a few rays coming directly from them, ſo as to enter our eyes without being intermixed with others. The number of ſtars appears increaſed prodigiouſly through the teleſcope; 70 ſtars have been counted in the conſtellation called *Pleiades*, and no fewer than 2000 in that of Orion. The late improvements of Mr Herſchel, however, have ſhown the number of ſtars to be exceedingly beyond even what the diſcoveries of former aſtronomers would induce us to ſuppoſe. He has alſo ſhown, that many which to the eye, or through ordinary glaſſes, appear ſingle, do in fact conſiſt of two or more ſtars; and that the galaxy or milky-way owes its light entirely to multitudes of ſmall ſtars placed ſo cloſe that the naked eye, or even ordinary teleſcopes, cannot diſcover them.

120 Of the nebulæ.

He has ſhown alſo, that the nebulæ, or ſmall whitiſh ſpecks, diſcoverable by teleſcopes in various parts of the heavens, are owing to the ſame cauſe. Former aſtronomers could only reckon 103; but Dr Herſchel has diſcovered upwards of 1250. He has alſo diſcovered a ſpecies of them, which he calls *planetary nebulæ*, on account of their brightneſs and ſhining with a well-defined diſk, being alſo capable of being magnified more than the fixed ſtars.

Sect. III. *Concluſions from the foregoing Appearances.*

The conjectures which have been formed concerning the nature of the celeſtial bodies are ſo numerous, that a recital of them would fill a volume; while at the ſame time many of them are ſo ridiculous, that abſurdity itſelf would ſeem almoſt to have been exhauſted on this ſubject.

121 Opinions of the ancients concerning the ſun.

1. As a ſpecimen of what were the opinions of the ancient philoſophers concerning the nature of the ſun, it may ſuffice to mention that Anaximander and Anaximenes held, that there was a circle of fire all along the heavens, which they called *the circle of the ſun*; between the earth and this fiery circle was placed another circle of ſome opaque matter, in which there was a hole like the mouth of a German flute. Through this hole the light was tranſmitted, and appeared to the inhabitants of this earth as a round and diſtinct body of fire. The eclipſes of the ſun were occaſioned by ſtopping this hole.

We muſt not, however, imagine, that the opinions of all the ancients were equally abſurd with thoſe of Anaximander and Anaximenes. Many of them had more juſt notions, though very imperfect and obſcure. Anaxagoras held the ſun to be a fiery globe of ſome ſolid ſubſtance, bigger than Peloponneſus; and many of the moderns have adopted this notion, only increaſing the magnitude of the globe prodigiouſly.

122 Of Sir Iſaac Newton.

Sir Iſaac Newton has propoſed it as a query, Whether the ſun and fixed ſtars are not great *Earths* made vehemently hot, whoſe parts are kept from fuming away by the vaſt weight and denſity of their ſuperincumbent atmoſpheres, and whoſe heat is preſerved by the prodigious action and reaction of their parts upon one another?

123 Of the exiſtence of a ſolar atmoſphere.

But though Sir Iſaac has propoſed this as a query and taken the exiſtence of a ſolar atmoſphere for granted, there have yet been no proofs adduced in favour of that opinion beſides thoſe of analogy and probability.

124 Semita luminoſa, or zodiacal light.

There is however, an appearance in the heavens termed the *ſemita luminoſa*, or *zodiacal light*, which is now generally ſuppoſed to be owing to the ſun's atmoſphere. This was firſt diſcovered by Dom. Caſſini in 1683. It is ſomething like the milky-way, a faint twilight, or the tail of a comet, thin enough to let ſtars be ſeen through it, and ſeems to ſurround the ſun in the form of a lens, the plane whereof is nearly coincident with that of the ſun's equator. It is ſeen ſtretched along the zodiac, and accompanies the ſun in his annual motion through the twelve ſigns. Each end terminates in an angle of about 21°: the extent of it in length from either of the angular points varies from 50 to 100°; it reaches beyond the orbit of Venus, but not ſo far as that of the earth. The breadth of it near the horizon is alſo various; from 12 almoſt to 30°: near the ſun, where it may reaſonably be ſuppoſed to be broadeſt, it cannot be ſeen. This light is weakeſt in the morning and ſtrongeſt at night; diſappearing in full moonlight or in ſtrong twilight, and therefore is not at all viſible about midſummer in places ſo near either of the poles as to have their twilight all the night long, but may be ſeen in thoſe places in the middle of winter both morning and evening, as it may in places under and near the equator all the year round. In north latitude it is moſt conſpicuous after the evening twilight about the latter end of February, and before the morning twilight in the beginning of October; for at thoſe times it ſtands moſt erect above the horizon, and is therefore cleareſt from the thick vapours of the twilight. Beſides the difference of real extenſion of this light in length and breadth at different times, it is diminiſhed by the nearneſs of any other light in the ſky; not to mention that the extent of it will be differently determined by different ſpectators according to the goodneſs of their eyes.

125 Caſſini's explanation of this phenomenon.

Caſſini inquiring into the cauſe of this light, ſays firſt, that it might be owing to a great number of ſmall planets ſurrounding the ſun within the orbit of Venus; but ſoon rejects this for what he thinks a more probable ſolution, viz. that as by the rotation of the ſun ſome groſs parts are thrown up on his ſurface, whereof ſpots and nebuloſities are formed; ſo the great rapidity wherewith the equatorial parts are moved, may throw out to a conſiderable diſtance a number of particles of a much finer texture, of ſufficient denſity to reflect light: now, that this light was cauſed by an emanation from the ſun, ſimilar to that of the ſpots, he thought probable from the following obſervation: That after the year 1688, when this light began to grow weaker, no ſpots appeared upon the ſun; whereas, in the preceding years, they were frequently ſeen there; and that the great inequality in the intervals between the times of the appearances of the ſolar ſpots has ſome analogy to the irregular returns of weakneſs and ſtrength in this light, in like circumſtances of the conſtitution of the air, and of the darkneſs of the ſky. Caſſini was of opinion that this light in the zodiac, as it is ſubject to great increaſe at one time and diminution at another, may ſometimes become quite imperceptible; and thought this was the caſe in the years 1665, 1672, and 1681, when he ſaw nothing of it, though he ſurveyed with great attention thoſe parts of the heaven where, according to his theory, it muſt have appeared if it had been as viſible then as it was in others. He cites alſo paſſages out of ſeveral authors both ancient and modern, which make it probable that it had been ſeen both in former and latter ages, but without being ſufficiently attended to, or its nature inquired into. It had been taken for the tail of a comet, part of the twilight, or a meteor of ſhort continuance; and he was fully convinced of its having appeared formerly, from a paſſage in an Engliſh book of Mr Childrey's, printed in 1661. This paſſage is as follows:

126 Suppoſes ſome analogy between the ſolar ſpots and zodiacal light.

“ There is ſomething more that we would recommend to the obſervation of the mathematicians; namely, that in the month of February, and a little before and after it (as I have obſerved for ſeveral years), about ſix o'clock in the evening, when the twilight has entirely left the horizon, a path of light tending from the twilight towards the Pleiades, and touching them as it were, preſented itſelf very plainly to my view. This path is to be ſeen when the weather is clear, but beſt of all when the moon does not ſhine.” The ſame appearance is taken notice of in Gregory's Aſtronomy, and there expreſsly attributed to the ſun's atmoſphere.

127 Dr Long's opinion of the ſolar ſpots.

With regard to the ſolar ſpots, Dr Long informs us, that “ they do not change their places upon the ſun, but adhere to his ſurface, or float in his atmoſphere, very near his body; and if there be 20 ſpots or faculæ upon him at a time, they all keep in the ſame ſituation with reſpect to one another; and, as long as they laſt are carried round together in the ſame manner: by the motion of the ſpots therefore we learn what we ſhould not otherwiſe have known, that *the ſun is a globe, and has a rotation* about his axis.” Notwithſtanding this he tells us afterwards, “ The ſpots, generally ſpeaking, may be ſaid to adhere to the ſun, or to be ſo near him as to be carried round upon him uniformly; nevertheleſs, ſometimes, though rarely, a ſpot has been ſeen to move with a velocity a little different from the reſt; ſpots that were in different parallels have appeared to be carried along, not keeping always the ſame diſtance, but approaching nearer to each other; and when two ſpots moved in the ſame parallel, the hindmoſt has been obſerved to overtake and paſs by the other. The revolution of ſpots near the equator of the ſun is ſhorter than of thoſe that are more diſtant from it.”

128 Of the ſun's revolution on his axis.

The apparent change of ſhape in the ſpots, as they approach the circumference of the diſk, according to our author, is likewiſe a proof of the ſun's rotation round his axis, and that they either adhere to the ſurface of the luminary, or are carried round his atmoſphere very near his ſurface.

“ The rotation of the ſun (ſays Dr Long) being known, we may conſider his axis and poles, and their ſituation, as alſo his equator, or a circle imagined to be drawn upon that luminous globe equally diſtant from his poles; we may alſo imagine leſſer circles drawn thereon, parallel to his equator.

“ The rotation of the ſun is according to the order of the ſigns; that is, any point on the ſurface of that vaſt globe turns round ſo as to look ſucceſſively at Aries, Taurus, Gemini, &c. which is alſo the way that all the primary planets are carried round him, though each of them in a plane a little different from that of the reſt. We muſt likewiſe obſerve, that the plane of the ſun's equator produced does not coincide with the heliocentric orbit of any of the planets, but cuts every one of them at a ſmall angle; it is neareſt to coincidence with the orbit of Venus.

129 Viſible part of the ſun's globe leſs than the inviſible.

“ The ſun being a globe at a great diſtance from us, we always ſee nearly one-half of that globe at a time; but the viſible half is continually changing, by the rotation of the ſun, and the revolution of the earth in her orbit. To ſpeak accurately, we do not ſee quite half the ſun's globe at a time, we want ſo much of it as the ſun's apparent diameter amounts to; which, at his mean diſtance, is about 32 minutes; ſo much is the diameter of the inviſible part of the ſun greater than that of the viſible part: for this reaſon a ſpot may be about two hours longer inviſible than viſible.

“ The time between the entrance of a ſpot upon the diſk and its exit therefrom, gives us nearly half the apparent period of the ſun's rotation, which is uſually in about 13 days; a ſpot that, after paſſing the diſk and diſappearing, returns again, gives the whole

Concluſions from the foregoing Appearances.

time, but not with preciſion; becauſe the ſpot may perhaps not keep all the while exactly in the ſame place, but have ſome floating motion of its own upon the ſurface of the ſun. Dom. Caſſini, taking notice that ſeveral ſpots had often appeared in the ſame parallel, thought that ſome particular places of the ſun might be more diſpoſed than others to ſupply the matter of theſe ſpots; and if ſo, that they would not move far from the place of their origin, juſt as the ſmoke of mount Ætna, if it could be ſeen from the ſun, would appear always to return to the ſame place of the diſk of the earth once every 24 hours, very nearly; ſometimes a little ſooner, ſometimes a little later, according as the ſmoke was driven by the wind from the place of its eruption. In conſequence of this ſuppoſition, he compared ſeveral large intervals between the appearances of ſpots carried in the ſame parallel, which he judged to be returns of the ſame ſpots ariſing out of the ſame place on the ſurface of the ſun, and found that 27 days 22 hours and 20 ſeconds was a common meaſure of thoſe intervals very nearly; this, therefore, he thought the moſt proper period to be taken for an apparent revolution of the ſolar ſpots, and conſequently of the ſun himſelf as ſeen from the earth. Theſe obſervations were made in April and May, nearly in the ſame time of the year, and therefore are not much affected by the inequality of the earth's motion. The ſame period is confirmed by Dom. Caſſini.

130 How to find the true time of a revolution of the ſpots. Fig. 3.

The time of the apparent revolution of a ſpot being known, the true time of its going round upon the ſun may be thus found: In fig. 3. the arc AC, which in the month of May, the earth goes through in her orbit in 27 days 12 hours and 20 minutes, is 26° 22′; the arc *a c* being equal to AC: the apparent revolution of a ſpot is the whole circle *a b c d*, or 360°, with the addition of the arc *a c* of 26° 22′, which makes 386° 22′: then ſay, as 386.22 is to 27 d. 12 h. 20′; ſo is 360° to 25 d. 15 h. 16′; the true time of the rotation of the ſun, as it would be ſeen from a fixed ſtar.

131 Sun's nodes and limits.

The angle of interſection of the ſun's equator with the ecliptic is but ſmall, according to Scheiner being never more than 8°, nor leſs than 6°; for which reaſon he ſettled it at 7°, though Caſſini makes it 7½. This plane continued cuts the ecliptic in two oppoſite points, which are called the *ſun's nodes*, being 8° of ♊ and 8° of ♐; and two points in the ecliptic, 90° from the nodes, may be called the *limits*. Theſe are 8° of ♓ and 8° of ♍. When the earth is in either of theſe nodes, the equator of the ſun, if viſible, would appear as a ſtraight line; and, by reaſon of the vaſt diſtance of the ſun from us, all his parallels would likewiſe appear as ſtraight lines; but in every other ſituation of the earth, the equator and parallels of the ſun would, if viſible, appear as ellipſes growing wider the farther the earth is from the nodes, and wideſt of all when the earth is in one of her limits.

"In the preſent age (ſays Dr Long), on the 18th, of May, the earth is in the 8° of ♐, one of the nodes of the ſun, and conſequently the ſun's equator and parallels, if viſible, would appear as ſtraight lines, fig. 92. From that time the ſun's equator, and every parallel, begin to appear as half of an ellipſis convex, or ſwelling towards the ſouth, and growing wider every day to the 20th of Auguſt, where it is at the wideſt, as in fig. 93, the earth being then in the 8° of ♓, one of the limits. Immediately after, the apparent curvature of the ſun's equator and parallels continually decreaſes to the 19th of November, when they again appear as ſtraight lines, the earth being then in the other node. From that time the equator of the ſun and parallels become elliptical, convex towards the north; their curvature continually increaſing to the 15th of February, when the earth is arrived at the other limit; and their curvature then decreaſes continually to the 18th of May, when they again appear as ſtraight lines. Every ſpot is carried round the ſun in his equator, or in a parallel; therefore the apparent motion of the ſpots upon the ſun is rectilinear every year in May and November, at all other times elliptical." See fig. 16, 17. where the paths of ſome ſolar ſpots are delineated by Mr Dunn, in a manner ſeemingly inconſiſtent with what is juſt now delivered from Dr Long. From a farther conſideration of the nature of the paths deſcribed by the ſolar ſpots, the Doctor concludes that their appearance may be retarded about four hours by the unequal motion of the earth in its orbit.

132 Of the nature and formation of the ſolar ſpots.

The nature and formation of the ſolar ſpots have been the ſubject of much ſpeculation and conjecture. Some have thought that the ſun is an opaque body, mountainous and uneven, as our earth is, covered all over with a fiery and luminous fluid; that this fluid is ſubject to ebbing and flowing, after the manner of our tides, ſo as ſometimes to leave uncovered the tops of rocks or hills, which appear like black ſpots; and that the nebuloſities about them are cauſed by a kind of froth. Others have imagined, that the fluid which ſends us ſo much light and heat, contains a nucleus or ſolid globe, wherein are ſeveral volcanoes, which, like Ætna or Veſuvius, from time to time caſt up quantities of bituminous matter to the ſurface of the ſun, and form thoſe ſpots which are ſeen thereon; and that as this matter is gradually conſumed by the luminous fluid, the ſpots diſappear for a time, but are ſeen to riſe again in the ſame places when thoſe volcanoes caſt up new matter. A third opinion is, that the ſun conſiſts of a fiery luminous fluid, wherein are immerſed ſeveral opaque bodies of irregular ſhapes; and that theſe bodies, by the rapid motion of the ſun, are ſometimes buoyed or raiſed up to the ſurface, where they form the appearance of ſpots, which ſeem to change their ſhapes according as different ſides of them are preſented to the view. A fourth opinion is, that the ſun conſiſts of a fluid in continual agitation; that, by the rapid motion of this fluid, ſome parts more groſs than the reſt are carried up to the ſurface of the luminary, like the ſcum of melted metal riſing up to the top in a furnace: that theſe ſcums, as they are differently agitated by the motion of the fluid, form themſelves into thoſe ſpots we ſee on the ſolar diſk; and, beſides the optical changes already mentioned, grow larger, are diminiſhed in their apparent magnitude, recede a little from, or approach nearer to, each other, and are at laſt entirely diſſipated by the continual rapid motion of the fluid, or are otherwiſe conſumed or abſorbed.

133 Spots of the ſun ſuppoſed by Dr Wilſon to be hollows.

In the 64th volume of the Philoſophical Tranſactions, Dr Wilſon advances a new opinion concerning the ſolar ſpots, viz. that they are hollows in the ſurface of the luminary. "All the foregoing appearances (ſays he), when taken together, and when duly conſidered, ſeem to prove in the moſt convincing manner,

Concluſions from the foregoing Appearances.

that the nucleus of this ſpot (December 1762) was conſiderably beneath the level of the ſun's ſpherical ſurface.

" The next thing which I took into conſideration was, to think of ſome means whereby I could form an eſtimate of its depth. At the time of the obſervation I had, on December 12th, remarked that the breadth of the ſide of the umbra next the limb was about 14″; but, for determining the point in queſtion, it was alſo requiſite to know the inclination of the ſhelving ſide of the umbra to the ſun's ſpherical ſurface. And here it occurred, that, in the caſe of a large ſpot, this would in ſome meaſure be deduced from obſervation. For, at the time when the ſide of the umbra is juſt hid, or begins firſt to come in view, it is evident, that a line joining the eye and its obſerved edge, or uppermoſt limit, coincides with the plane of its declivity. By meaſuring therefore the diſtance of the edge from the limb, when this change takes place, and by repreſenting it by a projection, the inclination or declivity may in ſome meaſure be aſcertained. For in fig. 27, let ILDK be a portion of the ſun's limb, and A B C D a ſection of the ſpot, S L the ſun's ſemidiameter, L G the obſerved diſtance from the limb, when the ſide of the umbra changes; then will the plane of the umbra CD coincide with the line E D G drawn perpendicular to S L at the point G. Let F H be a tangent to the limb at the point D, and join S D.

134
His method of meaſuring their depth.

" Since G L, the verſed ſine of the angle L S D, is given by obſervation, that angle is given, which by the figure is equal to F D E or G D H; which angle is therefore given, and is the angle of inclination of the plane of the umbra to the ſun's ſpherical ſurface. In the ſmall triangle therefore CMD, which may be conſidered as rectangular, the angle M D C is given, and the ſide D C equal to A B is given nearly by obſervation; therefore the ſide M C is given, which may be regarded as the depth of the nucleus without any material error.

" I had not an opportunity, in the courſe of the foregoing obſervations, to meaſure the diſtance G L, not having ſeen the ſpot at the time when either of the ſides of the umbra changed. It is, however, certain, that when the ſpot came upon the diſk for the ſecond time, this change happened ſome time in the night between the 11th and 12th of December, and I judge that the diſtance of the plane of the umbra, when in a line with the eye, muſt have been about 1′ 55″ from the ſun's eaſtern limb; from which we may ſafely conclude, that the nucleus of the ſpot was, at that time, not leſs than a ſemidiameter of the earth below the level of the ſun's ſpherical ſurface, and made the bottom of an amazing cavity, from the ſurface downwards, whoſe other dimenſions were of much greater extent."

135
His conjectures concerning the nature of the ſun.

Having thus demonſtrated that the ſolar ſpots are vaſt cavities in the ſun, the Doctor next proceeds to offer ſome queries and conjectures concerning the nature of the ſun himſelf, and to anſwer ſome objections to his hypotheſis. He begins with aſking, Whether it is not reaſonable to think, that the vaſt body of the ſun is made up of two kinds of matter very different in their qualities; that by far the greateſt part is ſolid and dark; and that this dark globe is encompaſſed with a thin covering of that reſplendent ſubſtance, from which the ſun would ſeem to derive the whole of his vivifying heat and energy?—This, if granted, will afford a ſatisfactory ſolution of the appearance of ſpots; becauſe, if any part of this reſplendent ſurface ſhall be by any means diſplaced, the dark globe muſt neceſſarily appear; the bottom of the cavity correſponding to the nucleus, and the ſhelving ſides to the umbra. The ſhining ſubſtance, he thinks, may be diſplaced by the action of ſome elaſtic vapour generated within the ſubſtance of the dark globe. This vapour, ſwelling into ſuch a volume as to reach up to the ſurface of the luminous matter, would thereby throw it aſide in all directions: and as we cannot expect any regularity in the production of ſuch a vapour, the irregular appearance and diſappearance of the ſpots is by that means accounted for; as the reflux of the luminous matter muſt always occaſion the dark nucleus gradually to decreaſe, till at laſt it becomes indiſtinguiſhable from the reſt of the ſurface.

Concluſions from the foregoing Appearances.

Here an objection occurs, viz. That, on this ſuppoſition, the nucleus of a ſpot whilſt on the decreaſe ſhould always appear nearly circular, by the gradual deſcent of the luminous matter from all ſides to cover it. But to this the Doctor replies, that in all probability the ſurface of the dark globe is very uneven and mountainous, which prevents the regular reflux of the ſhining matter. This, he thinks, is rendered very probable by the enormous mountains and cavities which are obſerved in the moon; and why, ſays he, may there not be the ſame on the ſurface of the ſun? He thinks his hypotheſis alſo confirmed by the dividing of the nucleus into ſeveral parts, which might ariſe from the luminous matter flowing in different channels in the bottom of the hollow.—The appearance of the umbra after the nucleus is gone, he thinks, may be owing to a cavity remaining in the luminous matter, tho' the dark globe is entirely covered.

As to a motion of the ſpots, diſtinct from what they are ſuppoſed to receive from the rotation of the ſun round his axis, he ſays he never could obſerve any, except what might be attributed to the enlargement or diminution of them when in the neighbourhood of one another. " But (ſays he) what would farther contribute towards forming a judgment of this kind is, the apparent alteration of the relative place, which muſt ariſe from the motion acroſs the diſk on a ſpherical ſurface; a circumſtance which I am uncertain if it has been ſufficiently attended to."

The above mentioned hypotheſis, the Doctor thinks, is further confirmed by the diſappearance of the umbræ on the ſides of the ſpots contiguous to one another; as the action of the elaſtic vapour muſt neceſſarily drive the luminous matter away from each, and thus as it were accumulate it between them, ſo that no umbra can be perceived. As to the luminous matter itſelf, he conjectures, that it cannot be any very ponderous fluid, but that it rather reſembles a denſe fog which broods on the ſurface of the ſun's dark body. His general concluſion we ſhall give in his own words.

" According to the view of things given in the foregoing queries, there would ſeem to be ſomething very extraordinary in the dark and unignited ſtate of the great internal globe of the ſun. Does not this ſeem to indicate that the luminous matter that encompaſſes it derives not its ſplendor from any intenſity of heat? For, if this were the caſe, would not the parts underneath,

neath, which would be perpetually in contact with that glowing matter, be heated to ſuch a degree as to become luminous and bright? At the ſame time it muſt be confeſſed, that although the internal globe was in reality much ignited, yet when any part of it forming the nucleus of a ſpot is expoſed to our view, and is ſeen in competition with a ſubſtance of ſuch amazing ſplendor, it is no wonder that an inferior degree of light ſhould, in theſe caſes, be unperceivable.

136 Experiment propoſed in order to confirm his hypotheſis.

"In order to obtain ſome knowledge of this point, I think an experiment might be tried, if we had an opportunity of a very large ſpot, by making a contrivance in the eye-piece of a teleſcope, whereby an obſerver could look at the nuclues alone with the naked eye, without being in danger of light coming from any other part of the ſun. In this caſe, if the obſerver found no greater ſplendor than what might be expected from a planet very near the ſun, and illumined by as much of his ſurface as correſponds to the ſpot's umbra, we might reaſonably conclude, that the ſolar matter, at the depth of the nucleus, is in reality not ignited. But from the nature of the thing, doth there ſeem any neceſſity for thinking that there prevails ſuch a raging and fervent heat as many have imagined? It is proper here to attend to the diſtinction between this ſhining matter of the ſun and the rays of light which proceed from it. It may perhaps be thought, that the reaction of the rays upon the matter, at their emiſſion, may be productive of a violent degree of heat. But whoever would urge this argument in favour of the ſun being intenſely heated, as ariſing from the nature of the thing, ought to conſider that all poliſhed bodies are leſs and leſs diſpoſed to be heated by the action of the rays of light, in proportion as their ſurfaces are more poliſhed, and as their powers of reflection are brought to a greater degree of perfection. And is there not a ſtrong analogy betwixt the reaction of light upon matter in caſes where it is reflected and in caſes where it is emitted?"

To this account of the ſolar ſpots, ſome objections have been made, particularly by Mr Wollaſton, in the Philoſophical Tranſactions, and M. de la Lande in the Memoirs of the Academy of Sciences; and to theſe Dr Wilſon replied in the Philoſophical Tranſactions for 1783, to the following purpoſe.

137 The Doctor's reply to objections.

"Firſt of all (ſays he) it has been urged, as an objection of great weight, that the abſence of the umbra on one ſide, where ſpots are near the limb, is not always conſtant; and of this I was ſufficiently aware, having ſtated three caſes from my own obſervation, when I did not perceive this change to take place. The reverend Francis Wollaſton is the only perſon who, in the Philoſophical Tranſactions, has beſtowed any remarks on my publication; and though he acknowledges that the umbra generally changes in the manner I have determined, yet he expreſſes a difficulty as to my concluſion, on account of this circumſtance not obtaining univerſally. Under ſimilar expreſſions, M. de la Lande produces from his own obſervations, which appear to have been long continued, only three caſes of the ſame kind, and four more from the ancient obſervations of M. Caſſini and De la Hire. In regard to theſe laſt, I am not ſure if ſuch obſolete ones ought to be referred to in a queſtion of the preſent kind. Theſe excellent obſervers, entertaining no thought that any thing of moment depended upon a nice attention to the form of the ſpots, might eaſily overlook leſs obvious circumſtances, eſpecially when they were found near the limb. We may add further, that even when they were ſo ſituated, they retain the umbra at both ends; and that whole ſide of it which lies fartheſt from the centre of the diſk and theſe parts in the aggregate, they might ſometimes miſtake for the umbra as not deficient in any particular place. But, even admitting the anomaly we at preſent conſider to be much more frequent than can be contended for, ſtill ſuch caſes can only be brought as ſo many exceptions to the general law or uniformity of appearance, from which the condition of by far the greateſt number of ſpots is moſt undeniably deduced. The utmoſt therefore that can be alleged is, that ſome few ſpots differ from all the reſt, or from the multitude; and are not, like them, excavations in the ſun. But notwithſtanding theſe few inſtances where the umbra is not found to change, when we conſider how perfectly all ſpots reſemble one another in their moſt ſtriking features, there naturally riſes ſome preſumption for all under that deſcription we have given, partaking of one common nature; and for this only difference in the phenomena depending upon ſomething, which does not neceſſarily imply a complete generical diſtinction. It comes therefore to be inquired, how far ſpots, which when near the middle of the diſk appear equal and ſimilar in all things, may yet differ from one another as excavations, or as poſſeſſing the third dimenſion of depth? and how far the peculiar circumſtances by which they may diſagree, can contribute to make ſome reſiſt this change of the umbra when near the limb much more than others?

"In order to this, ſuppoſe two ſpots which occupy a ſpace upon the ſun correſponding to the equal arches GD, fig. 94. and let GM, DM, be drawn ſo as to coincide with the plane of the excavation in ſuch a caſe. The breadth of the nucleus being commonly equal to that of the ſurrounding umbra, if the baſe MD of the triangle GDM conceived rectilineal, be divided in L, ſo as ML : LD :: MD : DG; and if through L be drawn LS parallel to DG, then will DGSL be the ſection of two ſpots having this condition; and which, as to ſenſe, would, when far away from the limb, be equal in all apparent meaſures; tho' very unequal in the third dimenſion HE, or depth of the nucleus SL, and alſo in the inclination DGM of their ſides parallel to the ſpherical ſurface of the ſun. Now it is manifeſt from the conſtruction of the figure, that the diſtances AB, AK, from the limb A, when the ſides GS of the umbra diſappear, muſt depend very much on the latter of theſe two circumſtances; and when, according as the angle of inclination, DGM is ſmaller, the reſpective ſpot will go nearer to the limb than the other before the ſide of the umbra GS vaniſhes. But theſe very exceptions to the general phenomena which we are at preſent examining are of this kind; and may perhaps, from what has been now ſhown, proceed wholly from the ſhallowneſs and the very gradual ſhelving of ſome few ſpots which break out in certain tracts of the ſun's body, over which the luminous matter lies very thinly mantled.

"In order to avoid circumlocution, we may call that ſide of the umbra which lies neareſt the limb the *neareſt umbra*, and the ſide oppoſite the *fartheſt umbra*;

Concluſions from the foregoing Appearances.

and to enter more particularly into the conſideration now before us, let us ſuppoſe a ſpot of 40″ over all, with its nucleus and umbra equally broad: then will the depth of the nucleus, and the apparent breadth of the neareſt umbra, when the plane of the fartheſt comes to coincide with the viſual ray, be expreſſed as in the following examples, where the apparent ſemidiameter of the ſun is ſuppoſed to be 16′, and his parallax 8.5″.

	Fartheſt umbra ſuppoſed to vaniſh when diſtant from the limb.		Depth of nucleus in Engliſh miles and ſeconds.		Apparent breadth of neareſt umbra.
I.	1′	0″	4.54″	2118	8.58
II.	0	30	3.09	1442	6.02
III.	0	15	2.09	975	4.13
IV.	0	8	1.44	672	2.87

“ Now becauſe in every aſpect of a ſpot the real breadth of either the fartheſt or neareſt umbra muſt be to the projected or apparent breadth as radius to the ſine of the angle which this reſpective plane makes with the viſual ray, it follows, that at any time before the ſpot comes ſo near the limb as is expreſſed in the above examples, the apparent breadth of the neareſt and fartheſt umbra cannot differ ſo much as by the quantity there ſet down for the apparent breadth of the neareſt when the other is ſuppoſed to vaniſh. Regarding, therefore, the fartheſt and neareſt umbra of the ſpot in Caſe IV. as two neighbouring viſible objects which turn narrower by degrees as the ſpot goes towards the limb, we ſhould undoubtedly judge that they contract as to ſenſe alike; ſince, ſo long as the fartheſt could be perceived, the other cannot appear to exceed it by a quantity that we could diſtinguiſh; and by the time the former coincides with the viſual ray, the extreme nearneſs to the limb would prevent our forming any certain judgment of either.

“ From this laſt example, therefore, it appears manifeſt, that a ſpot anſwering to the deſcription and conditions therein mentioned, or one a little more ſhallow, would approach the limb, and finally go off the diſk, without that peculiar change of the umbra on one ſide which is ſo obvious on common occaſions, notwithſtanding it were an excavation whoſe nucleus or bottom is ſo many miles below the level of the ſurface. In the four caſes above ſtated, the diſtance of the remoteſt part of the nucleus from the ſun's limb, when the viſual ray coming from it is juſt interrupted by the lip of the excavation, or, in other words, the diſtance of the nucleus from the limb when it was totally hid, was alſo computed. Theſe diſtances are as follows:

Caſe I. -	16.93″	Caſe III. -	4.70″
II. -	8.90	IV. -	2.70

And it is remarkable, from the two laſt, how very near the limb a ſhallow ſpot of not more than 40″ in diameter may come before the nucleus wholly diſappears.”

After deſcribing the method in which theſe computations were made, the doctor proceeds thus: “ Perhaps it may be urged, that very ſhallow ſpots ought always to be known from the reſt, and diſcover themſelves, by a ſurrounding umbra, very narrow, compared to the extent of the nucleus; but we know far too little of the qualities of the luminous matter, and of the proximate cauſes of the ſpots, to ſay any thing at all upon a point of this kind. The breadth of the umbra is, as aſſumed in the computations, about equal to that of the nucleus, though ſometimes it varies more or leſs; but how far theſe relative dimenſions indicate depth or ſhallowneſs muſt be expounded only by obſervation, and not by any vague and imperfect notions of the nature and conſtitution of the ſun.

Concluſions from the foregoing Appearances.

“ The mention of a pit, or hollow or excavation ſeveral thouſands of miles deep, reaching to that extent down through a luminous matter to darker regions, is ready to ſtrike the imagination in a manner unfavourable to a juſt conception of the nature of the ſolar ſpots as now deſcribed. Upon firſt thoughts it may look ſtrange how the ſides and bottom of ſuch vaſt abyſſes can remain ſo very long in ſight, whilſt, by the ſun's rotation, they are made to preſent themſelves more and more obliquely to our view. But when it is conſidered how extremely inconſiderable their greateſt depth is compared to the diameter of the ſun, and how very wide and ſhelving they are, all difficulties of this ſort will be entirely removed.” Unleſs, however, we duly attend to theſe proportions, our notions upon the ſubject muſt be very erroneous; and it ſeems the more neceſſary to offer this caution, as this very thing is inaccurately repreſented in fig. 9. belonging to the Memoir under view, and in a way that may lead to miſtakes. Inſtead of exhibiting a ſpot as depreſſed below the ſurface of the ſun one hundredth part of his ſemidiameter, the ſection of it is there determined by two lines drawn from the circumference, and meeting in a point at the prodigious diſtance of one-fifth of the ſemidiameter below. Any reader, therefore, who pleaſes, by turning to fig. 95. may ſee how very ſmall a portion of the ſun's body is made up of the luminous matter when ſuppoſed every where 3967 Engliſh miles deep. A is a ſection of a ſpot 50″ diameter, ſituated in the deepeſt part of this reſplendent ſubſtance.

“ What has now been inſiſted on at ſo much length concerning the ſhallowneſs and more gradual ſhelving of ſome few ſpots, will alſo apply to another objection which Mr de la Lande views in a ſtrong light.

138 How a ſpot may appear to make an indentation on the ſun's limb.

“ Here we find quoted the great ſpot in 1719, ſeen by M. Caſſini; and, for the ſecond time, that of June 1703, ſeen by M. de la Hire; both which, on their arrival at the limb, are ſaid to have made an indentation or dark notch in the diſk; and this phenomenon is mentioned as abſolutely incompatible with ſpots being below the ſurface.

“ It is moſt true, that if we look for any thing like this when the plane which coincides with the external boundary of the ſpots paſſes through the eye, the way that M. de la Lande conſiders the matter, it muſt be very large indeed before the diſk could be perceived deficient by any dark ſegment. But may not a ſpot, even no larger than M. Caſſini's, conſidered as an excavation, make, in a manner very different from this, ſomething like a notch; for, by the way, this phenomenon is not in the *Mem. Acad.* nor any where elſe that I know of, deſcribed with any ſort of preciſion.—M. Caſſini's great ſpot, by which we underſtood the nucleus, was of 30″; and ſuppoſing the umbra equally broad, its diameter over all muſt have been 1′ 30″. It would therefore occupy an extent upon the ſun's ſurface of 5° 22′ fully. Now, ſuppoſe a circular ſpace of that ſize upon the ſun diſtinguiſhed from the ſurround-

Fig. 35

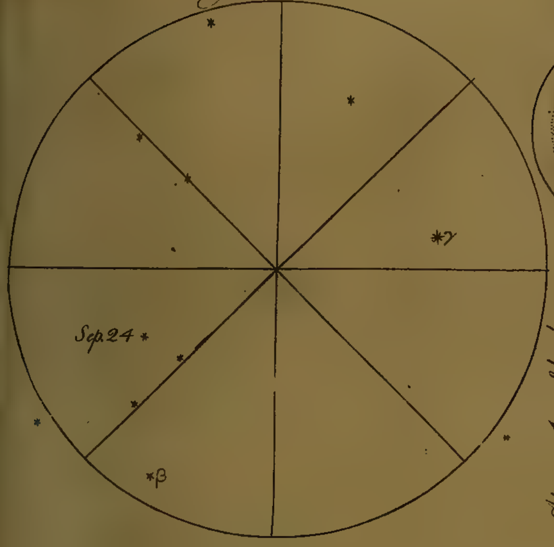


Fig. 37

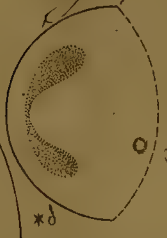


Fig. 38

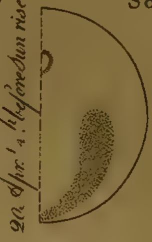


Fig. 39

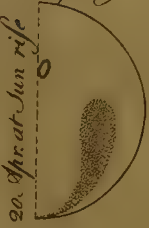


Fig. 40

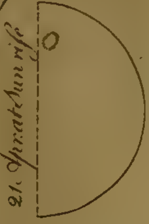


Fig. 41

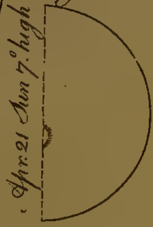


Fig. 42

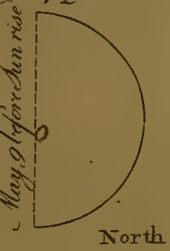


Fig. 43

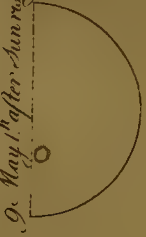


Fig. 44

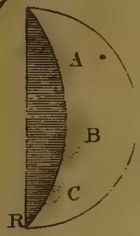
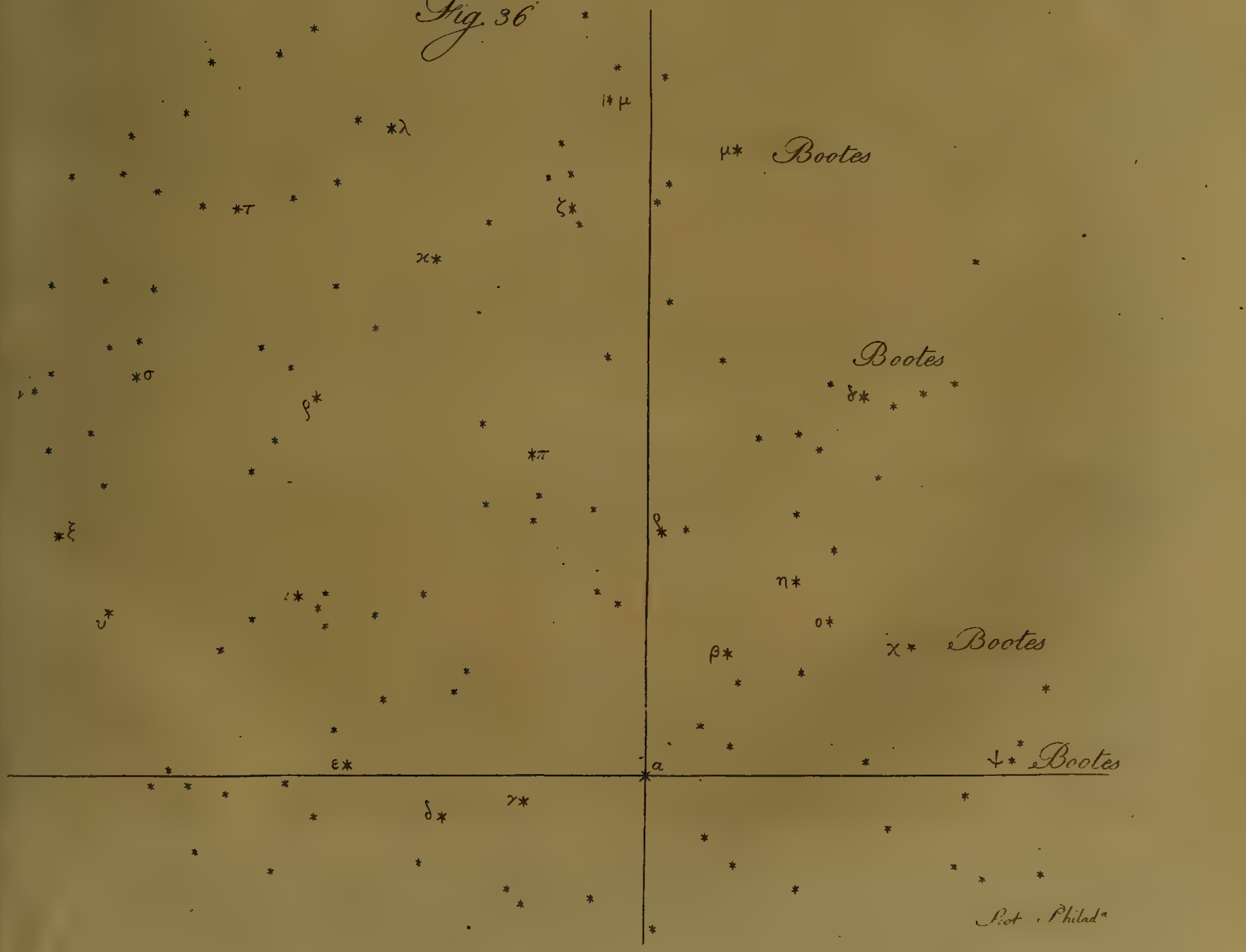


Fig. 36



Scot Philada

Concluſions from the foregoing Appearances.

ing luſtre by ſuch a failure of light as is peculiar to ſome ſpots, and ſuppoſe that it juſt touches the limb, it would ſtill ſubtend an angle of more than 4″. This being the caſe, might not a duſky ſhade, more or leſs remarkable according to the darkneſs of the umbra, commencing at the limb, and reaching inwards upon the diſk, or in other words, a notch be perceived? Had M. Caſſini's ſpot been a very ſhallow excavation, it appears by Caſe IV. that when viewed in this aſpect, ſome ſmall part of the nucleus might have yet been viſible; and might have contributed, along with the ſhade of the fartheſt umbra, and the ſtill broader and deeper ſhade of the two ends of the umbra, to mark out the indentation.

"Should it be ſaid, that theſe notches are always diſtinct and jet-black impreſſions on the diſk, of an obvious breadth, and originating entirely from the opaque nucleus conceived as ſomething prominent above the general ſurface, this can be ſhewn inconſiſtent with ſome circumſtances we find accidentally mentioned in the caſe of M. de la Hire's ſpot; for of this great one it was ſaid, that when only 8″ diſtant from the limb, the nucleus was ſeen as a very narrow line. This was on June 3d 1703, at ſix o'clock in the morning. Now, foraſmuch as at that time its alleged elevation muſt have been to its apparent ſubtenſe very nearly as radius to coſine of that arch of the ſun's circumference whoſe verſed ſine was the 8′ of diſtance from the limb, it is impoſſible that its breadth could have increaſed ſenſibly in its further progreſs towards the limb; and how any obvious black notch could be produced by the elevation contended for in this caſe is not conceivable.

"I do not imagine, therefore, that the phenomena of notches in the diſk, ſo inconſiderable and dubious as theſe ſeem to be, are by any means a proof of projecting nuclei, or that they are not reconcileable to ſpots being depreſſions on the ſun. A large ſhallow excavation, with the ſloping ſides or umbra darker than the common, may, as has been ſhown, be more or leſs perceptible at the limb; and what perhaps is a further confirmation of this, and ſeems to evince that ſuch a concurrence of circumſtances is neceſſary, is, that ſometimes even large ſpots make no indentation. M. Caſſini, in *Mem. Acad.* Tom X. p. 581. deſcribes the great ſpot of 1676, which he ſaw at its entrance with a teleſcope of 35 feet, as an obſcure line, parallel to the limb: but no where mentions that it made a notch in it.

"Though we now and then ſee the ſurrounding umbra darker than at other times; yet when ſpots are deep, and the umbræ but little duſky, it is indeed impoſſible that we ſhould ſee any thing of them, even though large, very near the limb: for here even the nucleus, which lies buried, cannot in the leaſt contribute to the effect, as it may do a little before its ſtate of evaneſcence, when ſpots are very ſhallow. Accordingly, caſes of this kind are perfectly agreeable to experience.

"In reaſoning concerning the nature of the ſpots, and particularly about their third dimenſion, the only arguments which are admiſſible, and which carry with them a perfect conviction, are thoſe grounded upon the principles of optical projection. If, for example, the far greater number of them be excavations ſome thouſands of miles deep, certain changes of the umbra would be obſervable when near the limb, as has been ſhown at ſo much length. Were they very ſhallow, or quite ſuperficial, both ſides of the umbra would as to ſenſe contract alike in their progreſs toward the limb; for if, in caſe 4th above ſtated, the ſpot had been ſuppoſed ſuperficial, the apparent breadth of the ſide of the umbra next the centre of the diſk would have made them only 1.62′, and that of the ſide oppoſite 1.27′. Now, the whole of either of theſe quantities, and much more their difference, would be quite inſenſible. Again, if the nucleus extended much above the common level, whilſt the ſurrounding umbra was ſuperficial, we ſhould behold the manifeſt indications of this by ſuch an opaque body when ſeen very obliquely being projected acroſs the fartheſt ſide of the umbra, and by hiding the whole or part of it before the time it would otherwiſe diſappear. According to this or that condition of the ſpot, ſuch things muſt infallibly obtain by the known laws of viſion; and hence arguments reſting upon ſuch principles may be denominated optical ones. On the other hand, when ſpots are contemplated near the middle of the diſk, a great variety of changes are obſerved in them, which depend not upon poſition, but upon certain phyſical cauſes producing real alterations in their form and dimenſions. It is plain, that arguments derived from the conſideration of ſuch changes, and which, on that account, may be called *phyſical arguments*, can aſſiſt us but little in inveſtigating their third dimenſions; and, from the nature of the thing, muſt be liable to great uncertainty. The author of the *Memoire*, in p. 511, &c. takes new ground, and proceeds with a number of objections depending upon that ſort of reaſoning which we have laſt defined. I muſt take notice, that a certain diſtinction has been here overlooked, which in my paper I have endeavoured to point out. Preſuming upon our great ignorance of many things which doubtleſs affect deeply the conſtitution of that wonderful body the ſun, I offered in part II. an account of the productions, changes, and decay of the ſpots, conſidered as excavations, in the moſt looſe and problematical manner; ſtating every thing on this head in the form of queries.—— Hence I would remark, that whatever inconſiſtencies are imagined in the account I have delivered Part II. though ſuch may be juſtly chargeable on certain principles there aſſumed, yet they ought not to be ſtated as preſumptions againſt the ſpots being really excavations or depreſſions in the luminous matter of the ſun. This opinion muſt reſt entirely upon the evidence held forth in the firſt part of the paper, whatever be the fate of the account laid down in the ſecond. It does not enter there as an *hypotheſis*, but as a matter of fact previouſly eſtabliſhed by *optical arguments*; and from optical arguments alone can there ariſe even any juſt preſumptions againſt it.

Concluſions from the foregoing Appearances.

139
Remarks on M. de la Lande's theory of the ſolar ſpots.

"It remains now only to make a few ſtrictures upon M. de la Lande's theory of the ſolar ſpots, humbly ſubmitting them to the conſideration of the reader. The import of it is, 'that the ſpots as phenomena ariſe from dark bodies like rocks, which by an alternate flux and reflux of the liquid igneous matter of the ſun, ſometimes raiſe their heads above the general ſurface. That part of the opaque rock, which at any time thus ſtands above, gives the appearance of the nucleus, whilſt thoſe parts,

Concluſions from the foregoing Appearances.

parts, which in each lie only a little under the igneous matter, appear to us as the ſurrounding umbra.’

“ In the firſt place it may be remarked, that the whole proceeds upon mere ſuppoſition. This indeed the author himſelf very readily acknowledges. Though therefore it could not be diſputed by arguments derived from obſervation, yet conjecture of any kind, if equally plauſible, might fitly be employed to ſet aſide its credit. Without entering into any tedious diſcuſſion, however, we ſhall confine ourſelves to ſuch particulars as appertain to the more obvious characters of the ſpots, and which alſo ſeem to be irreconcileable with the theory; and firſt of all with regard to the diſtinguiſhing features of the umbra.

“ M. Caſſini, Mem. Acad. tom. x. p. 582. Pl. VII. and M. de la Hire, Mem. Acad. 1703. p. 16. and I may add all other obſervers, and all good repreſentations of the ſpots, bear teſtimony to the exterior boundary of the umbra being always well defined, and to the umbra itſelf being leſs and leſs ſhady the nearer it comes to the nucleus. Now it may be aſked, how this could poſſibly be, according to M. de la Lande’s theory? If the umbra be occaſioned by our ſeeing parts of the opaque rock which lie a little under the ſurface of the igneous matter, ſhould it not always be darkeſt next the nucleus? and, from the nucleus outward, ſhould it not wax more and more bright, and at laſt loſe itſelf in the general luſtre of the ſun’s ſurface, and not terminate all at once in the darkeſt ſhade, as in fact it does? Theſe few incongruities, which meet as it were in the very threſhold of the theory, are ſo very palpable, that of themſelves they raiſe unſurmountable doubts. For, generally ſpeaking, the umbra immediately contiguous to the nucleus, inſtead of being very dark, as it ought to be, from our ſeeing the immerſed parts of the opaque rock through a thin ſtratum of the igneous matter, is on the contrary very nearly of the ſame ſplendor as the external ſurface.

“ Concerning the nucleus, or that part of the opaque rock, which ſtands above the ſurface of the ſun, M. de la Lande produces no optical arguments in ſupport of this third dimenſion or height. Neither does he ſay any thing particular as to the degree of elevation above the ſurface. But from what has been already hinted in the courſe of this paper, it appears that if this were any thing ſenſible, it ought to be diſcovered by phenomena very oppoſite to thoſe which we have found to be ſo general.

“ Again, a flux and reflux of the igneous matter, ſo conſiderable as ſometimes to produce a great number of ſpots all over the middle zone, might affect the apparent diameter of the ſun, making that which paſſes through his equator leſs than the polar one, by the retreat of the igneous matter towards thoſe regions where no ſpots ever appear. But as a difference of this kind, of nearly one thouſandth part of the whole would be perceivable, as we learn from M. de la Lande’s own obſervations, compared with thoſe of Mr. Short in *Hiſtoire Acad.* 1760, p. 123. it would ſeem, that the theory had this difficulty alſo to combat. Further, when among ſpots very near one another ſome are obſerved to be increaſing whilſt others are diminiſhing, how is it poſſible this can be the effect of ſuch a ſuppoſed flux and reflux? This laſt inconſiſtency is mentioned by the author himſelf, who endeavours to avoid it by making a new demand upon the general fund of hypotheſis, deriving from thence ſuch qualities of the igneous matter as the caſe ſeems to require; and ſuch muſt be the method of proceeding in all ſyſtems merely theoretical. But it is unneceſſary to purſue at more length illuſive ſpeculations of this kind, eſpecially as we lie under a conviction founded on fact, of the theory being utterly erroneous. It hardly differs in any reſpect from that propoſed by M. de la Hire, and a little amended by the writer of the *Hiſtoire de l’Academie* for 1707, p. 111. Views very much of the ſame kind were even entertained by ſome ſo long ago as the days of Scheiner, as we find mentioned by that indefatigable author in his *Roſa Urſina*, p. 746.”

Concluſions from the foregoing Appearances.

140 Great inequalities on the ſurface of the moon.

2. Concerning the moon, it is allowed on all hands, that there are prodigious inequalities on her ſurface. This is proved by looking at her through a teleſcope, at any other time than when ſhe is full; for then there is no regular line bounding light and darkneſs; but the confines of theſe parts appear as it were toothed and cut with innumerable notches and breaks; and even in the dark part, near the borders of the lucid ſurface, there are ſeen ſome ſmall ſpaces enlightened by the ſun’s beams. Upon the fourth day after new moon, there may be perceived ſome ſhining points like rocks or ſmall iſlands within the dark body of the moon; but not far from the confines of light and darkneſs there are obſerved other little ſpaces which join to the enlightened ſurface, but run out into the dark ſide, which by degrees change their figure, till at laſt they come wholly within the illuminated face, and have no dark parts round them at all. Afterwards many more ſhining ſpaces are obſerved to ariſe by degrees, and to appear within the dark ſide of the moon, which before they drew near to the confines of light and darkneſs were inviſible, being without any light, and totally immerſed in the ſhadow. The contrary is obſerved in the decreaſing phaſes, where the lucid ſpaces which joined the illuminated ſurface by degrees recede from it, and after they are quite ſeparated from the confines of light and darkneſs, remain for ſome time viſible, till at laſt they alſo diſappear. Now it is impoſſible that this ſhould be the caſe, unleſs theſe ſhining points were higher than the reſt of the ſurface, ſo that the light of the ſun may reach them.

141 Method of meaſuring the lunar mountains. Fig. 20.

Not content with perceiving the bare exiſtence of theſe lunar mountains, aſtronomers have endeavoured to meaſure their hight in the following manner. Let EGD be the hemiſphere of the moon illuminated by the ſun, ECD the diameter of the circle bounding light and darkneſs, and A the top of a hill within the dark part when it firſt begins to be illuminated. Obſerve with a teleſcope the proportion of the right line AE, or the diſtance of the point A from the lucid ſurface to the diameter of the moon ED; and becauſe in this caſe the ray of light ES touches the globe of the moon, AEC will be a right angle by 16 prop. of Euclid’s third book; and therefore in the triangle AEC having the two ſides AE and EC, we can find out the third ſide AC; from which ſubducting BC or EC, there will remain AB the height of the mountain. Ricciolus affirms, that upon the fourth day after new moon he has obſerved the top of the hill called *St Catharine’s* to be illuminated, and that it was diſtant from the confines of the lucid ſurface about a ſixteenth part of

Concluſions from the foregoing Appearances.

of the moon's diameter. Therefore, if CE=8, AE will be 1, and $AC^2=CE^2+AE^2$ by prop. 47. of Euclid's firſt book. Now the ſquare of CE being 64, and the ſquare of AE being 1, the ſquare of AC will be 65, whoſe ſquare root is 8,062, which expreſſes the length of AC. From which deducting BC=8, there will remain AB=0,062. So that CB or CE is therefore to AB as 8 is to 0,062, that is, as 8000 is to 62. If the diameter of the moon therefore was known, the height of this mountain would alſo be known. This demonſtration is taken from Dr Keil, who ſuppoſes the ſemidiameter of the moon to be 1182 miles; according to which, the mountain muſt be ſomewhat more than nine miles of perpendicular height: but aſtronomer's having now determined the moon's ſemidiameter to be only 1090 miles, the height of the mountain will be nearly $8\frac{1}{2}$ miles.

142
Height of the lunar mountains over-rated.

In the former edition of this work, we could not help making ſome remarks on the improbability that the mountains of the moon, a planet ſo much inferior in ſize to the earth, ſhould exceed in ſuch vaſt proportion to the higheſt of our mountains, which are computed at little more than one-third of the height juſt mentioned. Our remark is now confirmed by the obſervations of Mr Herſchel. After explaining the method uſed by Galileo, Hevelius, &c. for meaſuring the lunar mountains, he tells us, that the former takes the diſtance of the top of a lunar mountain from the line that divides the illuminated part of the diſk from that which is in the ſhade to be equal to one-twentieth of the moon's diameter; but Hevelius makes it only one-twenty-ſixth. When we calculate the height of ſuch a mountain, therefore, it will be found, according to Galileo, almoſt $5\frac{1}{2}$ miles; and according to Hevelius $3\frac{1}{4}$ miles, admitting the moon's diameter to be 2180 miles. Mr Ferguſon, however, ſays, (Aſtronomy explained, § 252.), that ſome of her mountains, by comparing their height with her diameter, are found to be three times higher than the higheſt hills on earth; and Keil, in his Aſtronomical Lectures, has calculated the height of St. Catharine's hill, according to the obſervations of Ricciolus, and finds it nine miles. Having premiſed theſe accounts, Mr Herſchel explains his method of taking the height of a lunar mountain from obſervations made when the moon was not in her quadrature as the method laid down by Hevelius anſwers only to that particular caſe: for in all others the projection muſt appear ſhorter than it really is. "Let SLM, ſays he, or *s l m*, (fig. 96.) be a line drawn from the ſun to the mountain, touching the moon at L or *l*, and the mountain at M or *m*. Then, to an obſerver at E or *e*, the lines L M, *l m*, will not appear of the ſame length, though the mountains ſhould be of an equal height; for L M will be projected into *o n*, and *l m* into O N. But theſe are the quantities that are taken by a micrometer when we obſerve a mountain to project from the line of illumination. From the obſerved quantity *o n*, when the moon is not in her quadrature, to find L M, we have the following analogy. The triangles *o* O L, *r* M L, are ſimilar; therefore $Lo : LO :: Lr : LM$, or $\frac{LO \times on}{Lo} = LM$: but L O is the radius of the moon, and L *r* or *o n* is the obſerved diſtance of the mountain's projection; and L *o* is the ſine of the angle $ROL = oLS$; which

143
Mr Herſchel's obſervations on them.

we may take to be the diſtance of the ſun from the moon without any material error, and which therefore we may find at any given time from an ephemeris.

Concluſions from the foregoing Appearances.

"The teleſcope uſed in theſe obſervations was a Newtonian reflector of ſix feet eight inches focal length, to which a micrometer was adopted, conſiſting of two parallel hairs, one of which was moveable by means of a fine ſcrew. The value of the parts ſhown by the index was determined by a trigonometrical obſervation of a known object at a known diſtance, and was verified by ſeveral trials. The power was always 222, excepting where another is expreſsly mentioned; and this was alſo determined by experiment which frequently differs from theory on account of ſome ſmall errors in the data, hardly to be avoided. The moon having ſufficient light, an aperture of no more than four inches was made uſe of; and, ſays Mr Herſchel, "I believe, that, for diſtinctneſs of viſion, this inſtrument is perhaps equal to any that ever was made."

With this inſtrument he obſerved a prominence, which he calls *a rock*, ſituated near the *Lacus Niger* of Hevelius, and found that it projected 41.56″. To reduce this into miles, put R for the ſemidiameter of the moon in ſeconds, as given by the nautical almanack at the time of obſervation, and Q for the obſerved quantity, alſo in ſeconds and centeſimals; then it will be in general, $R : 1090 :: Q : \frac{1090Q}{R} = on$ in miles. Thus it is found, that 41.56″ is 46.79 miles. The diſtance of the ſun from the moon at that time was, by the nautical almanack, about 93° $57\frac{1}{2}'$; the ſine of which to the radius 1 is .9985, &c. and $\frac{on}{Lo}$ in this caſe is $LM = 46.85$ miles. Then, by Hevelius's method, the perpendicular height of the rock is found to be about one mile. At the ſame time, a great many rocks, ſituated about the middle of the diſk, projected from 25.92″ to 26.56″; which gives *on* about 29.3 miles: ſo that theſe rocks are all leſs than half a mile high.

Theſe obſervations were made on the 13th of November 1779. On the 13th of January 1780, examining the mountains of the moon, he found that there was not one of them fairly placed on level ground, which is very neceſſary for an exact meaſurement of the projection: for if there ſhould be a declivity on the moon before the mountains, or a tract of hills placed ſo as to caſt a ſhadow upon that part before them which would otherwiſe be illuminated, the projection would appear too large; and on the contrary, ſhould there be a riſing ground before them, it would appear too little.

Proceeding in this cautious manner, Mr Herſchel meaſured the height of many of the lunar prominences, and draws at laſt the following concluſions.—"From theſe obſervations I believe it is evident, that the height of the lunar mountains in general is greatly over-rated; and that, when we have excepted a few, the generality do not exceed half a mile in their perpendicular elevation. It is not ſo eaſy to find any certain mountain exactly in the ſame ſituation it has been meaſured in before; therefore ſome little difference muſt be expected in theſe meaſures. Hitherto I have not had an opportunity of particularly obſerving the three mountains mentioned by Hevelius; nor that which

Conclusions from the foregoing Appearances.

144 Caution to be obſerved in uſing Dollond's teleſcopes.

which Ricciolus found to project a ſixteenth part of the moon's diameter. If Keill had calculated the height of this laſt mentioned hill according to the theorem I have given, he would have found (ſuppoſing his obſervation to have been made, as he ſays, on the fourth day after new moon) that its perpendicular height could not well be leſs than between 11 and 12 miles. I ſhall not fail to take the firſt opportunity of obſerving theſe four, and every other mountain of any eminence; and if other perſons, who are furniſhed with good teleſcopes and micrometers, would take the quantity of the projection of the lunar mountains, I make no doubt but that we ſhould be nearly as well acquainted with their heights, as we are with the elevation of our own. One caution I would beg leave to mention to thoſe who may uſe the excellent $3\frac{1}{2}$ feet refractors of Mr Dollond. The admirable quantity of light, which on moſt occaſions is ſo deſirable, will probably give the meaſure of the projection ſomewhat larger than the true, if not guarded againſt by proper limitations placed before the object-glaſs. I have taken no notice of any allowance to be made for the refraction a ray of light muſt ſuffer in paſſing through the atmoſphere of the moon, when it illuminates the top of the mountain, whereby its apparent height will be leſſened, as we are too little acquainted with that atmoſphere to take it into conſideration. It is alſo to be obſerved, that this would equally affect the concluſions of Hevelius, and therefore the difference in our inferences would ſtill remain the ſame."

In the continuation of his obſervations Mr Herſchel informs us that he had meaſured the height of one of the mountains which had been meaſured by Hevelius. "Antitaurus (ſays he), the mountain meaſured by Hevelius, was badly ſituated; becauſe Mount Moſchus, and its neighbouring hills caſt a deep ſhadow which may be miſtaken for the natural convexity of the moon. A good, full, but juſt meaſure, 25.105″; in miles, 29.27: therefore LM 31.7 miles, and the perpendicular height not quite half a mile. As great exactneſs was deſired in this obſervation, it was repeated with very nearly the ſame reſult. Several other mountains were meaſured by the ſame method, and all his obſervations concurred in making the height of the lunar mountains much leſs than what former aſtronomers had done. Mount Lipulus was found to be near two-thirds of a mile; one of the Appenine mountains between Lacus Traſimenus and Pontus Euxinus meaſured a mile and a quarter; Mons Armenia, near Taurus, two-thirds of a mile; Mons Leucoptera three quarters of a mile. Mons Sacer projected 45.625″; 'but (ſays he) I am almoſt certain that there are two very conſiderable cavities or places where the ground deſcends below the level of the convexity, juſt before theſe mountains; ſo that theſe meaſures muſt of courſe be a good deal too large; but ſuppoſing them to be juſt, it follows, that *o n* is 50.193 miles, LM=64 miles, and the perpendicular height above $1\frac{3}{4}$ miles.'

145 Volcanoes diſcovered in the moon.

As the moon has on its ſurface mountains and valleys in common with the earth, ſome modern aſtronomers have diſcovered a ſtill greater ſimilarity, viz. that ſome of theſe are really volcanoes, emitting fire as thoſe on earth do. An appearance of this kind was diſcovered ſome years ago by Don Ulloa in an eclipſe of the ſun. It was a bright ſmall ſpot like a ſtar near the margin of the moon, and which he at that time ſuppoſed to have been a hole with the ſun's light ſhining through it. Succeeding obſervations, however, have induced aſtronomers to attribute appearances of this kind to the eruption of volcanic fire; and Mr Herſchel has particularly obſerved ſeveral eruptions of the lunar volcanoes, the laſt of which he gives an account of in the Phil. Tranſ. for 1787. "April 19. 10h. 36, ſidereal time. I perceive (ſays he) three volcanoes in different places of the dark part of the new moon. Two of them are either already nearly extinct, or otherwiſe in a ſtate of going to break out; which perhaps may be decided next lunation. The third ſhows an actual eruption of fire or luminous matter. I meaſured the diſtance of the crater from the northern limb of the moon, and found it 3′ 57.3″: its light is much brighter than the nucleus of the comet which M. Mechain diſcovered at Paris the 10th of this month.

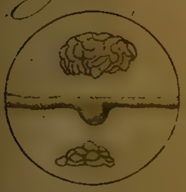
"April 20. 10 h. 2′ ſidereal time. The volcano burns with greater violence than laſt night. Its diameter cannot be leſs than 3″, by comparing it with that of the Georgian planet: as Jupiter was near at hand, I turned the teleſcope to his third ſatellite, and eſtimated the diameter of the burning part of the volcano to be equal to at leaſt twice that of the ſatellite; whence we may compute that the ſhining or burning matter muſt be above three miles in diameter. It is of an irregular round figure, and very ſharply defined on the edges. The other two volcanoes are much farther towards the centre of the moon, and reſemble large, pretty faint nebulæ, that are gradually much brighter in the middle; but no well-defined luminous ſpot can be diſcerned in them. Theſe three ſpots are plainly to be diſtinguiſhed from the reſt of the marks upon the moon; for the reflection of the ſun's rays from the earth is, in its preſent ſituation, ſufficiently bright, with a ten-feet reflector, to ſhow the moon's ſpots, even the darkeſt of them; nor did I perceive any ſimilar phenomena laſt lunation, though I then viewed the ſame places with the ſame inſtrument.

"The appearance of what I have called the *actual fire*, or eruption of a volcano, exactly reſembled a ſmall piece of burning charcoal when it is covered by a very thin coat of white aſhes, which frequently adhere to it when it has been ſome time ignited; and it had a degree of brightneſs about as ſtrong as that with which ſuch a coal would be ſeen to glow in faint daylight. All the adjacent part of the volcanic mountain ſeemed to be faintly illuminated by the eruption, and were gradually more obſcure as they lay at a greater diſtance from the crater. This eruption reſembled much that which I ſaw on the 4th of May in the year 1783, but differed conſiderably in magnitude and brightneſs; for the volcano of the year 1783, though much brighter than that which is now burning, was not near ſo large in the dimenſions of its eruption: the former ſeen in the teleſcope reſembled a ſtar of the fourth magnitude as it appears to the naked eye; this, on the contrary, ſhows a viſible diſk of luminous matter very different from the ſparkling brightneſs of ſtar-light."

146 Conjectures concerning her ſurface.

Concerning the nature of the moon's ſubſtance there have been many conjectures formed. Some have imagined,

Fig. 45.



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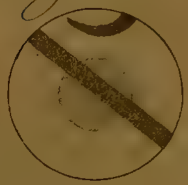

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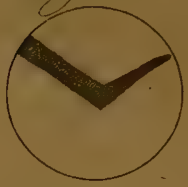

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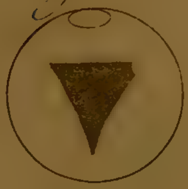

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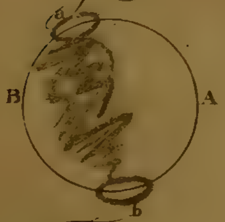

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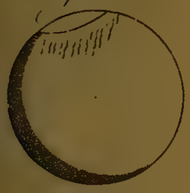

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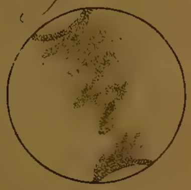

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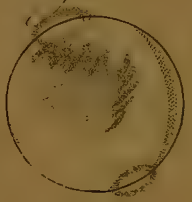

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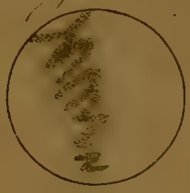

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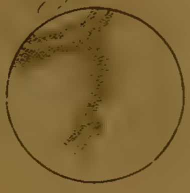

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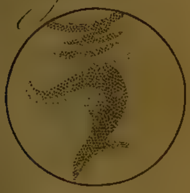

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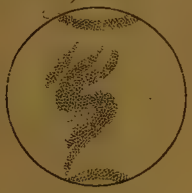

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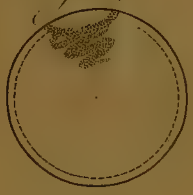

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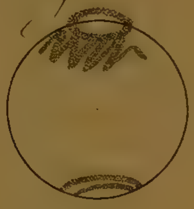

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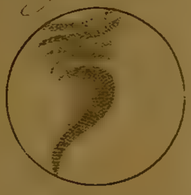

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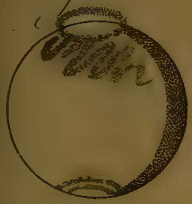

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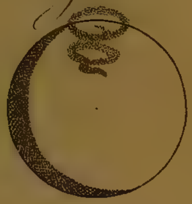

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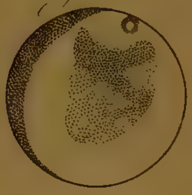

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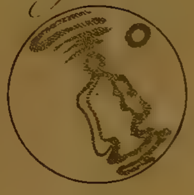

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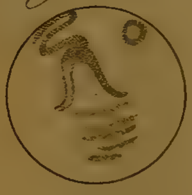

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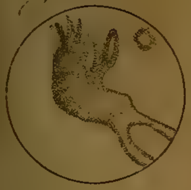

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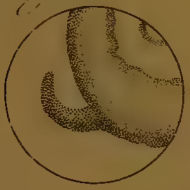

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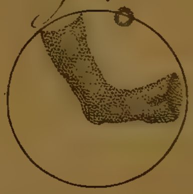

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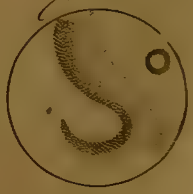

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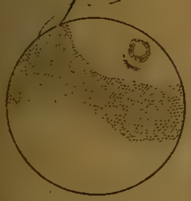

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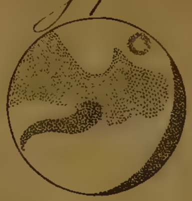

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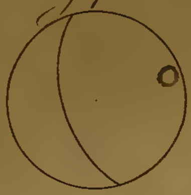

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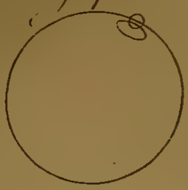

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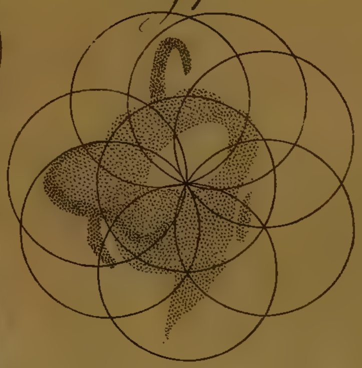

Thackara & Vallance sculpt

Conclusions from the foregoing Appearances.

gined, that, beſides the light reflected from the ſun, the moon hath alſo ſome obſure light of her own, by which ſhe would be viſible without being illuminated by the ſun-beams. In proof of this it is urged, that during the time of even total eclipſes the moon is ſtill viſible, appearing of a dull red colour, as if obſcured by a great deal of ſmoke. In reply to this it hath been advanced, that this is not always the caſe; the moon ſometimes diſappearing totally in the time of an eclipſe, ſo as not to be diſcernable by the beſt glaſſes, while little ſtars of the fifth and ſixth magnitudes were diſtinctly ſeen as uſual. This phenomenon was obſerved by Kepler twice, in the years 1580 and 1583; and by Hevelius in 1620. Ricciolus and other Jeſuits at Bologna, and many people throughout Holland, obſerved the ſame on April 14, 1642; yet at Venice and Vienna ſhe was all the time conſpicuous. In the year 1703, Dec. 23, there was another total obſcuration. At Arles, ſhe appeared of a yellowiſh brown; at Avignon, ruddy and tranſparent, as if the ſun had ſhone through her: at Marſeilles, one part was reddiſh and the other very duſky; and at length, though in a clear ſky, ſhe totally diſappeared. The general reaſon for her appearance at all during the time of eclipſes ſhall be given afterwards: but as for theſe particular phenomena, they have not yet, as far as we know, been ſatisfactorily accounted for.

Different conjectures have alſo been formed concerning the ſpots on the moon's ſurface. Some philoſophers have been ſo taken with the beauty of the brighteſt places obſerved in her diſk, that they have imagined them to be rocks of diamonds; and others have compared them to pearls and precious ſtones. Dr Keill and the greateſt part of aſtronomers now are of opinion, that thoſe are only the tops of mountains which by reaſon of their elevation are more capable of reflecting the ſun's light than others which are lower. The duſkiſh ſpots, he ſays, cannot be ſeas, nor any thing of a liquid ſubſtance; becauſe, when examined by the teleſcope, they appear to conſiſt of an infinity of caverns and empty pits, whoſe ſhadows fall within them, which can never be the caſe with ſeas, or any liquid ſubſtance: but, even within theſe ſpots, brighter places are alſo to be obſerved; which, according to his hypotheſis, ought to be the points of rocks ſtanding up within the cavities. Dr Long, however, is of opinion that ſeveral of the dark ſpots on the moon are really water. May not the lunar ſeas and lakes (ſays he) have iſlands in them, wherein there may be pits and caverns? And if ſome of theſe dark parts be brighter than others, may not that be owing to the ſeas and lakes being of different depths, and to their having rocks in ſome places and flats in others?

It has alſo been urged, that if all the dark ſpots obſerved on the moon's ſurface were really the ſhadows of mountains, or of the ſides of deep pits, they could not poſſibly be ſo permanent as they are found to be; but would vary according to the poſition of the moon with regard to the ſun, as we find ſhadows on earth are varied according as the earth is turned towards or from the ſun. Accordingly it is pretended, that variable ſpots are actually diſcovered on the moon's diſk, and that the direction of theſe is always oppoſite to the ſun. Hence they are found among thoſe parts which are ſooneſt illuminated in the increaſing moon, and in the decreaſing moon loſe their light ſooner than the intermediate ones; running round, and appearing ſometimes longer, and ſometimes ſhorter. The permanent dark ſpots, therefore, it is ſaid, muſt be ſome matter which is not fitted for reflecting the rays of the ſun ſo much as the bright parts do; and this property, we know by experience, belongs to water rather than land: whence theſe philoſophers conclude, that the moon, as well as our earth, is made up of land and ſeas.

Conclusions from the foregoing Appearances.

147
Whether the moon has any atmoſphere.

It has been a matter of diſpute whether the moon has any atmoſphere or not. The following arguments have been urged by thoſe who take the negative ſide. 1. The moon conſtantly appears with the ſame brightneſs when there are no clouds in our atmoſphere; which could not be the caſe if ſhe were ſurrounded with an atmoſphere like ours, ſo variable in its denſity, and ſo frequently obſcured by clouds and vapours. 2. In an appulſe of the moon to a ſtar, when ſhe comes ſo near it that part of her atmoſphere is interpoſed between our eye and the ſtar, refraction would cauſe the latter ſeem to change its place, ſo that the moon would appear to touch it later than by her own motion ſhe would do. 3. Some philoſophers are of opinion, that becauſe there are no ſeas or lakes in the moon, there is therefore no atmoſphere, as there is no water to be raiſed up in vapours.

All theſe arguments, however, have been anſwered by other aſtronomers in the following manner. 1. It is denied that the moon appears always with the ſame brightneſs, even when our atmoſphere appears equally clear. Hevelius relates, that he has ſeveral times found in ſkies perfectly clear, when even ſtars of the ſixth and ſeventh magnitude were viſible, that at the ſame altitude of the moon and the ſame elongation from the earth, and with one and the ſame teleſcope, the moon and its maculæ do not appear equally lucid, clear, and conſpicuous at all times; but are much brighter and more diſtinct at ſome times than at others. From the circumſtances of this obſervation, ſay they, it is evident that the reaſon of this phenomenon is neither in our air, in the tube, in the moon, nor in the ſpectator's eye; but muſt be looked for in ſomething exiſting about the moon. An additional argument is drawn from the different appearances of the moon already mentioned in total eclipſes, which are ſuppoſed to be owing to the different conſtitutions of the lunar atmoſphere.

To the ſecond argument Dr Long replies, that Sir Iſaac Newton has ſhown (*Princip.* prop. 37. cor. 5.), that the weight of any body upon the moon is but a third part of what the weight of the ſame would be upon the earth: now the expanſion of the air is reciprocally as the weight that compreſſes it: the air, therefore, ſurrounding the moon, being preſſed together by a weight, or being attracted towards the centre of the moon by a force equal only to one-third of that which attracts our air towards the centre of the earth, it thence follows, that the lunar atmoſphere is only one-third as denſe as that of the earth, which is too little to produce any ſenſible refraction of the ſtar's light. Other aſtronomers have contended that ſuch refraction was ſometimes very apparent. Mr. Caſſini ſays that he frequently obſerved Saturn, Jupiter, and the fixed ſtars, to have their circular figure changed into an elliptical one, when they approached either to the moon's dark or illuminated limb, though they own,

148
Why the light is not refracted by the moon's atmoſphere.

own; that, in other occultations, no ſuch change could be obſerved. With regard to the fixed ſtars, indeed, it has been urged, that, granting the moon to have an atmoſphere of the ſame nature and quantity as ours, no ſuch effect as a gradual diminution of light ought to take place; at leaſt, that we could by no means be capable of perceiving it. Our atmoſphere is found to be ſo rare at the height of 44 miles as to be incapable of refracting the rays of light. This height is the 180th part of the earth's diameter; but ſince clouds are never obſerved higher than four miles, we muſt conclude that the vaporous or obſcure part is only one 1980th. The mean apparent diameter of the moon is 31′ 29″, or 1889 ſeconds: therefore the obſcure parts of her atmoſphere, when viewed from the earth, muſt ſubtend an angle of leſs than one ſecond; which ſpace is paſſed over by the moon in leſs than two ſeconds of time. It can therefore hardly be expected that obſervation ſhould generally determine whether the ſuppoſed obſcuration takes place or not.

149 Luminous ring obſerved about the moon in total eclipſes.

The third argument is neceſſarily inconcluſive, becauſe we know not whether there is any water in the moon or not; nor, though this could be demonſtrated, would it follow that the lunar atmoſphere anſwers no other purpoſe than the raiſing of water into vapour. There is, however, a ſtrong argument in favour of the exiſtence of a lunar atmoſphere, taken from the appearance of a luminous ring round the moon in the time of ſolar eclipſes. In the eclipſe of May 1, 1706, Captain Stanyan, from Bern in Switzerland, writes, that "the ſun was totally darkened there for the ſpace of four minutes and a half: that a fixed ſtar and planet appeared very bright: that his getting out of the eclipſe was preceded by a blood-red ſtreak of light from his left limb, which continued not longer than ſix or ſeven ſeconds of time; then part of the ſun's diſk appeared, all on a ſudden, brighter than Venus was ever ſeen in the night; and in that very inſtant gave light and ſhadow to things as ſtrong as moon-light uſes to do." The publiſher of this account obſerves, that the red ſtreak of light preceding the emerſion of the ſun's body, is a proof that the moon has an atmoſphere; and its ſhort continuance of five or ſix ſeconds ſhows that its height is not more than the five or ſix hundredth part of her diameter.

Fatio, who obſerved the ſame eclipſe at Geneva, tells us, that "there was ſeen, during the whole time of the total immerſion, a whiteneſs which ſeemed to break out from behind the moon, and to encompaſs her on all ſides equally: this whiteneſs was not well defined on its outward ſide, and the breadth of it was not a twelfth part of the diameter of the moon. The planet appeared very black, and her diſk very well defined with the whiteneſs which encompaſſed it about, and was of the ſame colour as that of a white crown or halo of about four or five degrees in diameter, which accompanied it, and had the moon for its centre. A little after the ſun had begun to appear again, the whiteneſs, and the crown which had encompaſſed the moon did entirely vaniſh." "I muſt add (ſays Dr Long), that this deſcription is a little perplexed, either through the fault of the author or of the tranſlator; for I ſuppoſe Fatio wrote in French; however, it plainly appears by it that the moon's atmoſphere was viſible, ſurrounded by a light of larger extent, which I think muſt be that luminous appearance (the zodiacal light) mentioned from Caſſini." Flamſtead, who publiſhed this account, takes notice, that, according to theſe obſervations, the altitude of the moon's atmoſphere cannot be well ſuppoſed leſs than 130 geographical miles; and that probably this atmoſphere was never diſcovered before this eclipſe, by reaſon of the ſmallneſs of the refraction, and the want of proper obſervations.

An account of the ſame eclipſe as it appeared at Zurich, is given by Dr Scheuchzer, in the following words: "We had an eclipſe of the ſun, which was both total and annular: total, becauſe the whole ſun was covered by the moon; annular, not what is properly ſo called, but by refraction; for there appeared round the moon a bright ſhining, which was owing to the rays of the ſun refracted through the atmoſphere of the moon."

Dom. Caſſini, from a number of accounts ſent him from different parts, ſays, that in all thoſe places where it was total, during the time of total darkneſs, there was ſeen round the moon a crown or broad circle of pale light, the breadth whereof was about a 12th part of the moon's diameter: that at Montpelier, where the obſervers were particularly attentive to ſee if they could diſtinguiſh the zodiacal light already mentioned, they took notice of a paler light of a larger extent, which ſurrounded the crown of light before mentioned, and ſpread itſelf on each ſide of it, to the diſtance of four degrees. He then mentions Kepler's opinion, that the crown of light which appears round the moon during the total darkneſs in an eclipſe of the ſun, is cauſed by ſome celeſtial matter ſurrounding the moon, of ſufficient denſity to receive the rays of the ſun and ſend them to us; and that the moon may have an atmoſphere ſimilar to that of our earth, which may refract the ſun's light.

150 Dr Halley's account of a ſolar eclipſe in 1715.

A total eclipſe of the ſun was obſerved on the 22d of April O. S. in the year 1715, by Dr Halley at London, and by M. Louville of the Academy of Sciences at Paris. Dr Halley relates, that "when the laſt part of the ſun remained on his eaſt ſide, it grew very faint, and was eaſily ſupportable to the naked eye even through the teleſcope, for above a minute of time before the total darkneſs; whereas, on the contrary, the eye could not endure the ſplendor of the emerging beams through the teleſcope even from the firſt moment. To this two cauſes perhaps concurred: the one, that the pupil of the eye did neceſſarily dilate itſelf during the darkneſs, which before had been much contracted by looking on the ſun: the other, that the eaſtern parts of the moon, having been heated with a day near as long as 30 of ours, muſt of neceſſity have that part of its atmoſphere replete with vapours raiſed by the ſo long continued action of the ſun; and, by conſequence, it was more denſe near the moon's ſurface, and more capable of obſtructing the ſun's beams; whereas at the ſame time the weſtern edge of the moon had ſuffered as long a night, during which there might fall in dews all the vapours that were raiſed in the preceding long day; and for that reaſon, that part of its atmoſphere might be ſeen much more pure and tranſparent.

"About two minutes before the total immerſion, the remaining part of the ſun was reduced to a very fine horn, whoſe extremities ſeemed to looſe their acuteneſs,

Conclusions from the foregoing Appearances.

neſs, and to become round like ſtars; and for the ſpace of about a quarter of a minute a ſmall piece of the ſouthern horn of the eclipſe ſeemed to be cut off from the reſt by a good interval, and appeared like an oblong ſtar rounded at both ends: which appearance would proceed from no other cauſe but the inequalities of the moon's ſurface: there being ſome elevated parts thereof near the moon's ſouthern pole, by whoſe interpoſition part of that exceedingly fine filament of light was intercepted. A few ſeconds before the ſun was totally hid there diſcovered itſelf round the moon a luminous ring about a digit, or perhaps a tenth part of the moon's diameter in breadth. It was of a pale whiteneſs, or rather of a pearl colour, ſeeming to me a little tinged with the colour of the iris and to be concentric with the moon; whence I concluded it the moon's atmoſphere. But the great height of it, far exceeding that of our earth's atmoſphere, and the obſervations of ſome who found the breadth of the ring to increaſe on the weſt ſide of the moon as the emerſion approached, together with the contrary ſentiments of thoſe whoſe judgments I ſhall always revere, make me leſs confident, eſpecially in a matter to which I gave not all the attention requiſite.

151
Flaſhes of light appear to dart from behind the moon.

"Whatever it was, this ring appeared much brighter and whiter near the body of the moon than at a diſtance from it; and its outward circumference, which was ill defined, ſeemed terminated only by the extreme rarity of the matter of which it was compoſed, and in all reſpects reſembled the appearance of an enlightened atmoſphere ſeen from far: but whether it belonged to the ſun or moon, I ſhall not pretend to determine. During the whole time of the total eclipſe, I kept my teleſcope conſtantly fixed on the moon, in order to obſerve what might occur in this uncommon appearance; and I ſaw perpetual flaſhes or coruſcations of light, which ſeemed for a moment to dart out from behind the moon, now here, now there, on all ſides, but more eſpecially on the weſtern ſide, a little before the emerſion; and about two or three ſeconds before it, on the ſame weſtern ſide, where the ſun was juſt coming out, a long and very narrow ſtreak of duſky but ſtrong red light ſeemed to colour the dark edge of the moon, though nothing like it had been ſeen immediately after the immerſion. But this inſtantly vaniſhed after the appearance of the ſun, as did alſo the aforeſaid luminous ring."

152
Mr Louville's obſervations.

Mr Louville relates, that a luminous ring of a ſilver colour appeared round the moon as ſoon as the ſun was entirely covered by her diſk, and diſappeared the moment he recovered his light; that this ring was brighteſt near the moon, and grew gradually fainter towards its outer circumference, where it was, however, defined; that it was not equally bright all over, but had ſeveral breaks in it: but he makes no doubt of its being occaſioned by the moon's atmoſphere, and thinks that the breaks in it were occaſioned by the mountains of the moon: he ſays alſo, that this ring had the moon, and not the ſun, for its centre, during the whole time of its appearance. Another proof brought by him of the moon having an atmoſphere is, that, towards the end of the total darkneſs, there was ſeen on that ſide of the moon on which the ſun was going to appear, a piece of a circle of a lively red, which might be owing to the red rays that are leaſt refrangible being tranſmitted through the moon's atmoſphere in the greateſt quantity: and that he might be aſſured this redneſs did not proceed from the glaſſes of his teleſcope, he took care to bring the red part into the middle of his glaſſes.

Conclusions from the foregoing Appearances.

153
Lightning ſuppoſed to be frequent in the moon.

He lays great ſtreſs on the ſtreaks of light which he ſaw dart inſtantaneouſly from different places of the moon during the time of total darkneſs, but chiefly near the eaſtern edge of the diſk: theſe he takes to be lightning, ſuch as a ſpectator would ſee flaſhing from the dark hemiſphere of the earth, if he were placed upon the moon and ſaw the earth come between himſelf and the ſun. "Now (ſays Dr Long) it is highly probable, that if a man had, at any time, a view of that half of the earth where it is night, he would ſee lightning in ſome part of it or other." Louville farther obſerves, that the moſt mountainous countries are moſt liable to tempeſts; and that mountains being more frequent in the moon, and _higher, than on earth_*, thunder and lightning muſt be more frequent there than with us; and that the eaſtern ſide of the moon would be moſt ſubject to thunder and lightning, thoſe parts having been heated by the ſun for half the month immediately preceding. It muſt here be obſerved, that Halley, in mentioning theſe flaſhes, ſays they ſeemed to come from behind the moon; and Louville, though he ſays they came ſometimes from one part and ſometimes from another, owns, that he himſelf only ſaw them near the eaſtern part of the diſk; and that, not knowing at that time what it was that he ſaw, he did not take notice whether the ſame appearance was to be ſeen on the other parts of the moon or not. He tells us, however, of an Engliſh aſtronomer, who preſented the Royal Society with a draught of what he ſaw in the moon at the time of this eclipſe; from which Louville ſeems to conclude that lightnings had been obſerved by that aſtronomer near the centre of the moon's diſk. "Now (ſays Dr Long) thunder and lightning would be a demonſtration of the moon having an atmoſphere ſimilar to ours, wherein vapours and exhalations may be ſupported, and furniſh materials for clouds, ſtorms, and tempeſts. But the ſtrongeſt proof brought by Louville of the moon having an atmoſphere is this, that as ſoon as the eclipſe began, thoſe parts of the ſun which were going to be hid by the moon grew ſenſibly paliſh as the former came near them, ſuffering beforehand a kind of imperfect eclipſe or diminution of light; this could be owing to nothing elſe but the atmoſphere of the moon, the eaſtern part whereof going before her reached the ſun before the moon did. As to the great height of the lunar atmoſphere, which from the breadth of the luminous ring being about a whole digit would upon a calculation come out 180 miles, above three times as high as the atmoſphere of the earth, Louville thinks that no objection; ſince, if the moon were ſurrounded with an atmoſphere of the ſame nature with that which encompaſſes the earth, the gravitation thereof towards the moon would be but one-third of that of our atmoſphere towards the earth; and conſequently its expanſion would make the height of it three times as great from the moon as is the height of our atmoſphere from the earth."

154
Great height of the lunar atmoſphere accounted for.

The ſame luminous ring has been obſerved in other total eclipſes, and even in ſuch as are annular, though without the luminous ſtreaks or flaſhes of lightning a-

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* See n°142 et ſeq.

Concluſions from the foregoing Appearances.

bovementioned; it is even taken notice of by Plutarch: however, ſome members of the academy at Paris have endeavoured to account for both theſe phenomena without having recourſe to a lunar atmoſphere; and for this purpoſe they made the following experiments.

155
Theſe phenomena otherwiſe accounted for.

The image of the ſun coming through a ſmall hole into a darkened room, was received upon a circle of wood or metal of a diameter a good deal larger than that of the ſun's image; then the ſhadow of this opaque circle was caſt upon white paper, and there appeared round it, on the paper, a luminous circle ſuch as that which ſurrounds the moon. The like experiment being made with a globe of wood, and with another of ſtone not poliſhed, the ſhadows of both theſe caſt upon paper were ſurrounded with a paliſh light, moſt vivid near the ſhadows, and gradually more diluted at a diſtance from them. They obſerve alſo, that the ring round the moon was ſeen in the eclipſe of 1706 by Wurzelbaur, who caſt her ſhadow upon white paper. The ſame appearance was obſerved on holding an opaque globe in the ſun, ſo as to cover his whole body from the eye; for, looking at it through a ſmoked glaſs, in order to prevent the eye from being hurt by the glare of light it would otherwiſe be expoſed to, the globe appeared ſurrounded with a light reſembling that round the moon in a total eclipſe of the ſun.

Thus they ſolve the phenemenon of the ring ſeen round the moon by the inflection, or *diffraction* as they call it, of the ſolar rays paſſing near an opaque ſubſtance. As for the ſmall ſtreaks of light abovementioned, and which are ſuppoſed to be lightning, they explain theſe by an hypotheſis concerning the cavities of the moon themſelves; which they conſider as concave mirrors reflecting the light of the ſun nearly to the ſame point; and as theſe are continually changing their ſituation with great velocity by the moon's motion from the ſun, the light which any one of them ſends to our eye is ſeen but for a moment. This, however, will not account for the flaſhes, if any ſuch there are, ſeen near the centre of the diſk, though it does, in no very ſatisfactory manner, account for thoſe at the edges.

156
Occultations of the fixed ſtars by the moon.

It has already been obſerved, that the occultations of the fixed ſtars and planets by the moon in general happen without any kind of refraction of their light by the lunar atmoſphere. The contrary, however, has ſometimes been obſerved, and the ſtars have been ſeen manifeſtly to change their ſhape and colour on going behind the moon's diſk. An inſtance of this happened on the 28th of June N. S. in the year 1715, when an occultation of Venus by the moon happened in the day-time. Some aſtronomers in France obſerving this with a teleſcope, ſaw Venus change colour for about a minute before ſhe was hid by the moon; and the ſame change of colour was obſerved immediately after her emerſion from behind the diſk. At both times the edge of the diſk of Venus that was neareſt the moon appeared reddiſh, and that which was moſt diſtant of a bluiſh, colour. Theſe appearances, however, which might have been taken for proofs of a lunar atmoſphere, were ſuppoſed to be owing to the obſervers having directed the axes of their teleſcopes towards the moon. This would neceſſarily cauſe any planet or ſtar near the edge of the moon's diſk to be ſeen through thoſe parts of the glaſſes which are near their circumference, and conſequently to appear coloured. This

Concluſions from the foregoing Appearances.

was evidently the caſe from other obſervations of an occultation of Jupiter by the moon the ſame year, when no ſuch appearance of refraction could be perceived while he was kept in the middle of the teleſcope. Maraldi alſo informs us, that he had obſerved before this two other occultations of Venus and one of Jupiter; and was always attentive to ſee whether thoſe planets changed their figure or colour either upon the approach of the moon to cover them, or at their firſt coming again into ſight; but never could perceive any ſuch thing. Nor could he, in a great number of occultations of the fixed ſtars, perceive the ſmalleſt apparent change in any of them, excepting once that a fixed ſtar ſeemed to increaſe its diſtance a little from the moon as it was going to be covered by her; but this, he ſuſpected, might be owing to his teleſcope being directed ſo as to have the ſtar ſeen too far from the middle of its aperture. He concludes, therefore, that the moon has no atmoſphere: and he remarks, that at Montpelier, perhaps becauſe the air is clearer there than at London, the luminous ring round the moon appeared much larger than at London; that it was very white near the moon, and gradually decreaſing in brightneſs formed round her a circular area of about eight degrees in diameter. If, ſays he, this light was cauſed by the atmoſphere of the moon, of what a prodigious extent muſt that atmoſphere be?

157
Of a plurality of worlds.

Before we enter upon any further ſpeculations concerning the celeſtial bodies, we ſhall here take ſome notice of the doctrine of a plurality of worlds; to which we are naturally led by the queſtion, Whether the moon is inhabited or not? This is an hypotheſis of very antient date, and which in modern times has been revived in ſuch a manner as now to be almoſt adopted as an undoubted truth. Plutarch, Diogenes, Laertius, and Stobæus, informs us, that this doctrine was embraced by ſeveral of the ancient Greek philoſophers; from which authors Gregory has given us extracts in the Preface to his Aſtronomy. "Among the moderns (ſays Dr Long), Huygens has written a treatiſe, which he calls *Coſmotheoros*, or *A view of the world*, worth peruſing. One thing, however, I muſt find fault with; that, in peopling the planets with reaſonable creatures, he inſiſts upon their being in all points exactly ſimilar to the human race, as to the ſhape of their bodies and the endowments of their minds: this is too confined a thought; for we cannot but acknowledge that infinite power and wiſdom is able to form rational beings of various kinds, not only in ſhape and figure different from the human, but endowed alſo with faculties and ſenſes very different; ſuch as in our preſent ſtate we can have no idea of." With regard to the probability of the doctrine itſelf, the Doctor expreſſes himſelf in the following manner. "That the earth and all the creatures thereon were created to be ſubſervient to the uſe of man, we may believe upon the authority of the ſacred writer, Pſalm viii. but that the ſtars and planets were formed only to beſpangle the canopy of heaven with their glimmering, which does not furniſh us with the twentieth part of the light the moon gives, I think is not at all probable: this is contrary to the obſervation made by the beſt philoſophers, that nature is magnificent in all her deſigns, but frugal in the execution of them. It is commonly ſaid, that

ASTRONOMY.

Plate LXVIII

Fig. 75.

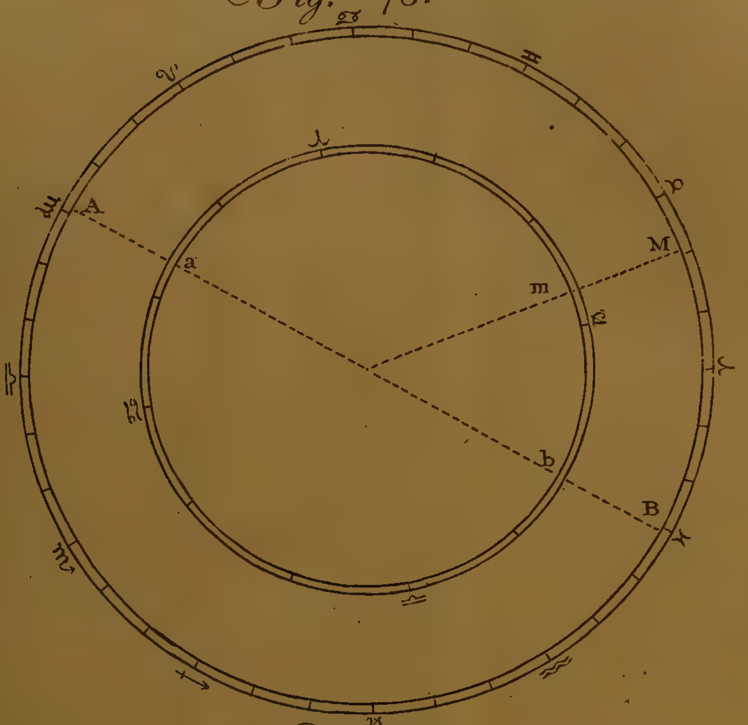


Fig. 76.

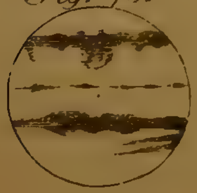


Fig. 74.

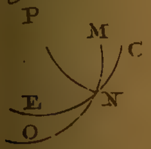


Fig. 77.

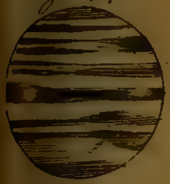


Fig. 78.

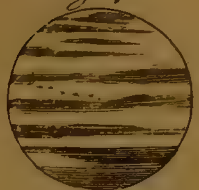


Fig. 79.

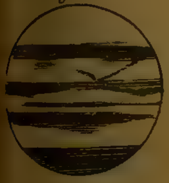


Fig. 80.

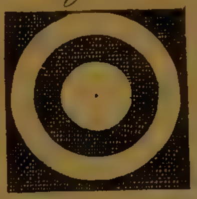


Fig. 82.

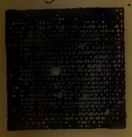


Fig. 84.

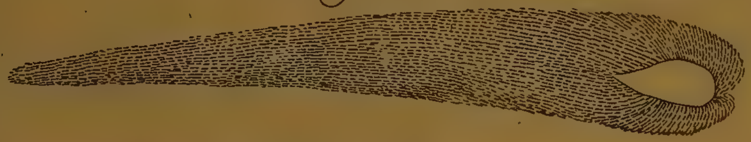


Fig. 81.

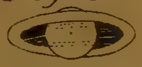


Fig. 83.

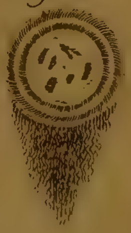


Fig. 85.

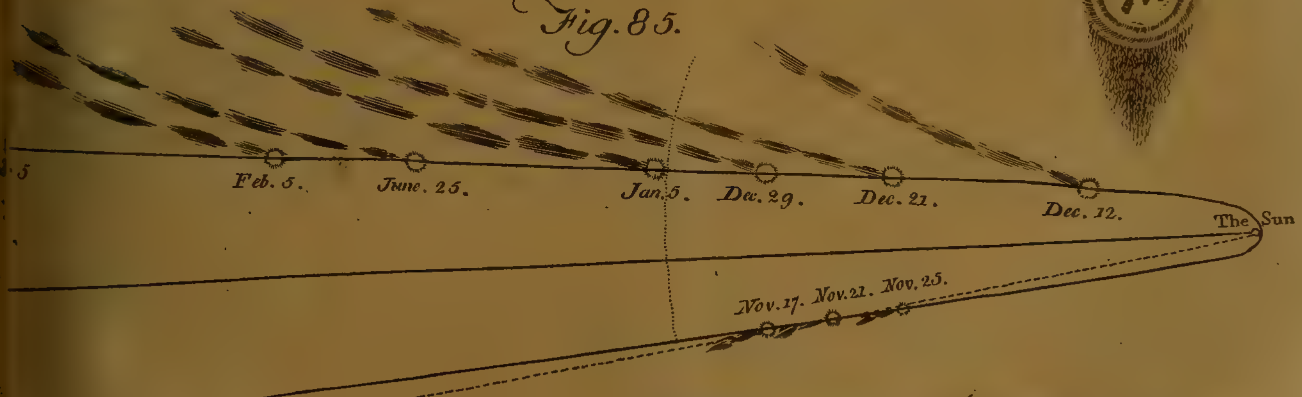


Fig. 86.

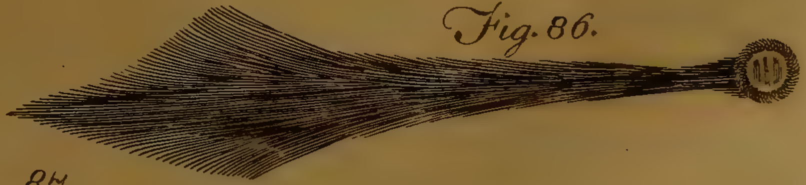
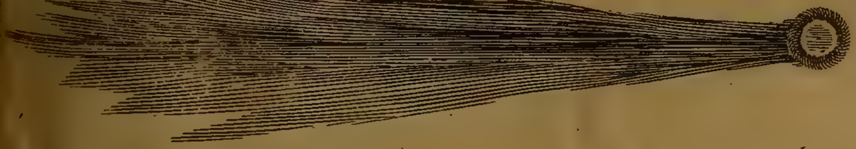


Fig. 87.



Concluſions from the foregoing Appearances.

nature does nothing in vain: now by *Nature*, in a ſound ſenſe, muſt be underſtood the preſent order and diſpoſition of things according to the will of the ſupreme Being."

158 Objections to the poſſibility of this doctrine.

Objections have been made to the poſſibility of this hypotheſis from the different degrees of heat and light which the planets receive from the ſun, according to their various diſtances from him. On Venus, for inſtance, the heat muſt be more than double what it is with us, and on Mercury upwards of ten times as great; ſo that were our earth brought as near the ſun as Mercury, every drop of liquid would be evaporated into ſteam, and every combuſtible ſolid ſet on fire; while, on the other hand, were we removed to the diſtance of the ſuperior planets, ſuch as the Georgium Sidus, Saturn, or even Jupiter, there is the higheſt probability that our liquids would all be congealed into ice, at the ſame time that the climate would be utterly inſupportable by ſuch creatures as we are. Objections of the ſame kind are drawn from the ſmall quantity of light which falls upon the more diſtant planets, which it is thought would be inſufficient for the purpoſes of living and rational creatures. Such arguments as theſe, however, are by no means concluſive; for as Dr Long juſtly obſerves, "we are ſure, that if the all-wiſe ſupreme Being hath placed animals on the planets, he has fitted the inhabitants to the places, and the places to the inhabitants." We ſhall therefore only add the following quotation from Mr Nicholſon † concerning final cauſes, which ſums up all that can be ſaid with propriety in favour of the doctrine in queſtion.—"The purpoſes or motives (ſays he) which determine the actions of intelligent beings, and produce their effects in a manner ſimilar to the operation of the laws of nature, or the properties of matter in caſes where thought is not ſuppoſed to concerned, are called *final cauſes*. In the works of nature we behold enough of exquiſite contrivance, and can ſee far enough into many final cauſes, to convince us that the arrangement of the univerſe has been made, and probably ſtill is occaſionally adjuſted, by a Being whoſe intelligence and power are immenſely beyond what we poſſeſs. To judge properly of his intentions, or, in other words, to be equal to the taſk of exploring final cauſes, requires no leſs than a perfect knowledge and recollection of every purpoſe to which the objects around us may be applied, together with a clear conception of the ideas of fitneſs and order that form the prototypes in the mind of that Great Being who directs their motions. Theſe conſiderations ſhow the abſurdity of attempting to explain the final cauſes of every event we ſee; but they by no means require that we ſhould neglect them in caſes where we have reaſon to believe that we underſtand the phenomena, and have ſufficient experience to be aſſured that we diſcern the principal, or at leaſt one of the principal, purpoſes to which things may have been deſtined. Thus it is ſcarcely to be imagined that we can err in concluding, that the eyes, ears, legs, wings, and other parts of animals were made for the purpoſes of ſeeing, hearing, walking, flying, and ſo forth. Neither can we avoid inferring, that the Power who conſtructed living creatures with mouths, teeth, and organs to digeſt and aſſimilate food for their nutriment, did likewiſe form other organized bodies, which we call *vegetables*, for the expreſs purpoſe of affording that food. It is needleſs to multiply inſtances. We cannot avoid ſeeing them every moment; and their effect is ſo ſtriking, that we are inſenſibly forced from analogy to allow the exiſtence of a final cauſe in all caſes, whether we are able to diſcover it or not.

160 Inconcluſive.

161 Of the various climates of the planets.

"On this ground, an inquiry into the final cauſes of the planetary bodies offers itſelf to our conſideration. The earth is ſhown to be a planet in circumſtances very ſimilar to the other five: we know its final cauſe—to ſupport a number of inhabitants: And by analogy we may conclude that the others are alſo habitable worlds; though, from their different proportions of heat, it is credible that beings of our make and temperature could not live upon them. However, even that can ſcarcely be affirmed of all the planets; for the warmeſt climate on the planet Mars is not colder than many parts of Norway or Lapland are in the ſpring or autumn. Jupiter, Saturn, and the Georgium Sidus, it muſt be granted, are colder than any of the inhabited parts of our globe. The greateſt heat on the planet Venus exceeds the heat on the iſland of St Thomas on the coaſt of Guinea, or Sumatra in the Eaſt Indies, about as much as the heat in thoſe places exceeds that of the Orkney iſlands, or the city of Stockholm in Sweden: therefore, at 60° north latitude on that planet, if its axis were perpendicular to the plane of its orbit, the heat would not exceed the greateſt heat on the earth; and of courſe vegetation like ours might be there carried on, and animals of the ſpecies on earth might ſubſiſt. If Mercury's axis be ſuppoſed to have a like poſition, a circle of about 20° diameter round each pole would enjoy the ſame temperature as the warmer regions of the earth, though in its hotteſt climate water would continually boil, and moſt inflammable ſubſtances would be parched up, deſtroyed, or converted into vapour. But it is not at all neceſſary that the planets ſhould be peopled with animals like thoſe on the earth; the Creator has doubtleſs adapted the inhabitants of each to their ſituation.

162 Compariſon of the light of the ſuperior planets with our day.

"From the obſervations that have been juſt made, a better idea may be formed of the proportions of heat on the planets than can be conveyed by numbers. It will not, however, be remote from our purpoſe to compare the light of the ſuperior planets with that of our day; from whence it will appear, that they are by no means in a ſtate of darkneſs notwithſtanding their great diſtance from the ſun. This might be inſtanced by ſeveral different methods; as by the ſun's light admitted into a dark chamber, and received on paper with different degrees of obliquity; by a greater or leſs number of candles brought into a room for the purpoſe of illuminating it with various degrees of light; or by various optical methods that need not here be deſcribed. It will be ſufficient for the illuſtration of the ſubject to compare their different proportions of light with that of a moonſhine night at the time of full.

"When the moon is viſible in the day-time, its light is ſo nearly equal to that of the lighter thin clouds, that it is with difficulty diſtinguiſhed among them. Its light continues the ſame during the night; but the abſence of the ſun ſuffering the pupil of the eye to dilate itſelf, it become more conſpicuous. It therefore follows, that if every part of the ſky were equally luminous with the moon's diſk, the light would be the ſame as if in the day-time it were covered with the thin clouds abovementioned. This day-light is conſequently in proportion to that of the moon as the whole ſurface of the ſky or viſible hemiſphere is to the ſurface of the moon; that is to ſay, nearly as 90,000 to 1. The light of the Georgium Sidus being to that of the earth as 0.276 to 100, will be equal to the effect of 248 full moons. Jupiter's day will equal the light of 3,330 moons; and that of Mars will require 38,700, a number ſo great that they would almoſt touch one another. It is even probable, that the comets in the moſt diſtant parts of their orbits enjoy a degree of light much exceeding moonſhine."

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† *Introd. to Nat. Phil.* page 141. Philad. Edition.

Of all the celeſtial bodies, comets have given riſe to the greateſt number of ſpeculations and conjectures. Their ſtrange appearance has in all ages been a matter of terror to the vulgar, who uniformly have looked upon them to be evil omens and forerunners of war, peſtilence, &c. Others, leſs ſuperſtitious, ſuppoſed them to be meteors raiſed in the higher regions of the air. But we find that ſome part of the modern doctrine concerning them had been received into the ancient Italic and Pythagorean ſchools: for they held them to be ſo far of the nature of planets, that they had their periodical times of appearing; that they were out of ſight for a long time, while they were carried aloft at an immenſe diſtance from the earth, but become viſible when they deſcended into the lower regions of the air, when they were nearer to us.

163
Suppoſed by the ancients to be planets.

Theſe opinions were probably brought from Egypt, from whence the Greeks borrowed great part of their learning. However, it ſeems not to have been generally received; for Ariſtotle, who mentions it, aſſerted that the heavens were unchangeable, and not liable to generation or corruption. Comets, therefore, which he believed to be generated when they firſt made their appearance, and deſtroyed when they vaniſhed from our ſight, he maintained could not be heavenly bodies, but rather meteors or exhalations raiſed into the upper regions of the atmoſphere, where they blazed out for a while, and diſappeared when the matter of which they were formed was conſumed. Seneca, who lived in the firſt century, mentions Appollonius of Myndus, a very careful obſerver of natural cauſes, to have been of the ſame ſentiments with the moſt ancient Greek philoſophers with regard to comets. He himſelf had ſeen two; one in the reign of Claudius, the other in that of Nero; beſides another which he ſaw while a boy, before the death of Auguſtus. He plainly intimates, that he thought them above the moon; and argues ſtrongly againſt thoſe who ſuppoſed them to be meteors, or held other abſurd opinions concerning them; declaring his belief that they were not fires ſuddenly kindled, but the eternal productions of nature. He points out alſo the only way to come at a certainty on this ſubject, viz. by collecting a number of obſervations concerning their appearance, in order to diſcover whether they return periodically or not. "For this purpoſe (ſays he) one age is not ſufficient; but the time will come when the nature of comets and their magnitudes will be demonſtrated, and the routs they take, ſo different from the planets, explained. Poſterity will then wonder that the preceding ages ſhould be ignorant of matters ſo plain and eaſy to be known."

164
Ariſtotle's opinion concerning them.

For a long time this prediction of Seneca ſeemed very unlikely to be fulfilled. The great authority which Ariſtotle maintained for many ages, determined them to be nothing but meteors caſually lighted up in the air; though they were manifeſtly at a great height, not only above the clouds, but ſubject to the diurnal revolution of the earth. In the dark and ſuperſtitious ages, they were held to be the forerunners of every kind of calamity, and were ſuppoſed to have different degrees of malignity according to the ſhape they aſſumed; from whence alſo they were differently denominated. Thus, ſome were ſaid to be bearded, ſome hairy; ſome to repreſent a beam, ſword, or ſpear; others a target, &c.; whereas modern aſtronomers acknowledge only one ſpecies of comets, and account for their different appearances from their different ſituations from the ſun and earth.

165
Only one ſpecies of them exiſts.

166
Kepler and Bodin's opinion of them.

It was not till ſome time after people began to throw off the fetters of ſuperſtition and ignorance which had ſo long held them, that any rational hypotheſis was formed concerning comets. Kepler, in other reſpects a very great genius, indulged the moſt extravagant conjectures, not only concerning comets, but the whole ſyſtem of nature in general. The planets he imagined to be huge animals who ſwam round the ſun by means of certain fins acting upon the ethereal fluid, as thoſe of fiſhes do on the water; and agreeable to this notion, he imagined the comets to be monſtrous and uncommon animals generated in the celeſtial ſpaces; and he explained how the air engendered them by an animal faculty. A yet more ridiculous opinion, if poſſible, was that of John Bodin, a learned man of France in the 16th century. He maintained that comets "are ſpirits, which having lived on the earth innumerable ages, and being at laſt arrived on the confines of death, celebrate their laſt triumph, or are recalled to the firmament like ſhining ſtars! This is followed by famine, plague, &c. becauſe the cities and people deſtroy the governors and chiefs who appeaſe the wrath of God." This opinion he ſays he borrowed from the philoſopher Democritus, who imagined them to be the ſouls of famous heroes: but that being irreconcileable with Bodin's Chriſtian ſentiments, he was obliged to ſuppoſe them to be a kind of genii, or ſpirits ſubject to death, like thoſe ſo much mentioned in the Mahometan fables. Others, again, have denied even the exiſtence of comets, and maintained that they were only falſe appearances occaſioned by the refraction or reflection of light.

167
Bernouilli's opinion.

The firſt rational conjecture we meet with is that of James Bernouilli, an Italian aſtronomer, who imagined them to be the ſatellites of ſome very diſtant planet, which was inviſible to us on account of its diſtance, as were alſo the ſatellites unleſs when in a certain part of their courſe.

168
True doctrine concerning them revived by Tycho Brache.

Tycho Brache was the firſt who reſtored the comets to their true rank in the creation. Before his time, ſeveral comets had been obſerved with tolerable exactneſs by Regiomontanus, Appian, Fabricius, and others; yet they all thought them below the moon. But Tycho, being provided with much better inſtruments ſet himſelf with great diligence to obſerve the

Concluſions from the foregoing Appearances.

famous comet of 1577: and from many careful obſervations, deduced that it had no ſenſible diurnal parallax; and therefore was not only far above the regions of our atmoſphere, but much higher than the moon. But though few have come ſo near the earth as to have any diurnal parallax, all of them have what may be called an annual parallax; that is, the revolution of the earth in her orbit cauſes their apparent motion to be very different from what it would be if viewed from the ſun; and this ſhows them to be much nearer than the fixed ſtars, which have no ſuch parallax. Kepler, the diſciple of Tycho, notwithſtanding his ridiculous conjecture already mentioned, was very attentive to the motions of the comets, and found that they did not move in ſtraight lines, as had been ſuppoſed. He ſhowed that their paths were concave towards the ſun, and ſuppoſed them to move in parabolic trajectories.

169 Their motion exactly determined by Sir Iſaac Newton.

Their true motion, however, was only diſcovered from the obſervations made by Sir Iſaac Newton on the great comet of 1680. This deſcended almoſt perpendicularly towards the ſun with a prodigious velocity; aſcending again with the ſame velocity retarded, as it had been before accelerated. It was ſeen in the morning by a great number of aſtronomers in different parts of Europe, from the 4th to the 25th of November, in its way towards the ſun; and in the evening from the 12th of December to the 9th of March following. The many exact obſervations made on this comet, enabled Sir Iſaac Newton to determine that they are a kind of planets which move in very eccentric ellipſis; and this opinion is now looked upon to be certainly eſtabliſhed. It was oppoſed, however, by M. de la Hire, and ſome other French philoſophers; and it is evident that the whole diſpute now turned on mere practical obſervation. If the return of any comet could be predicted, and its periodical time calculated like that of a planet, then the doctrine might be concluded certainly true, but not otherwiſe. Dr Halley therefore ſet himſelf to collect all the obſervations he could on comets; and afterwards calculated the orbits of twenty-four of them, on a ſuppoſition of their being paraboles; but afterwards found that they agreed better with the ſuppoſition of their motion being performed in very eccentric elliptical orbits. On this he calculated a table of their elements; from which it was manifeſt that they were not comprehended in the zodiac, ſome of them making an angle of upwards of 80° with the ecliptic.

170 Dr Halley predicts a comet's return.

171 Periodical times of different comets determined.

By computations founded on theſe elements, the Doctor concluded that the comet of 1682, was the ſame which had appeared in 1607 and 1531; that it had a period of 75 or 76 years; and he ventured to foretel that it would return about the year 1758. The comet which appeared in 1661 was ſuppoſed to be the ſame with that of 1532, and to have a period of 129 years; and from the equality of periods, and ſimilitude of appearances, it was concluded that the great comet of 1680 was the ſame which had appeared in 1106 in the time of Henry I. and the conſulate of Lampadius and Oreſtes about the year 531, and in the year 44 B. C. before Julius Cæſar was murdered; and thence concluded that its period was 575 years. Mr Dunthorne, however, has endeavoured to ſhow from a MS. in Pembroke-hall library, that the comet of 1106 could not be the ſame with that of 1680; but M. de la Lande thinks the four appearances related by Dr Halley ſtronger proofs than a ſingle obſervation, which might be very faulty.

Concluſions from the foregoing Appearances.

Since the time of Dr Halley other aſtronomers have calculated the elements of 25 other comets: all of which, excepting one of three which appeared in 1759, and which differs but little from that of 1531, 1607, and 1682, and is therefore accounted the ſame; differ very much from each other; ſo that we cannot help concluding them all to be different, and that the number of theſe bodies is very great. "It is not, however, unlikely (ſays Dr Long), from the immenſe interval between the orbit of Saturn and the neareſt fixed ſtars, that many of them have not deſcended into the planetary regions ſince they have been looked upon as celeſtial bodies, and obſerved accordingly; beſides, it may often happen, that a body may finiſh its whole period without being obſerved by us, on account of the unfavourable ſituation of the earth in her orbit when the comet is in its perihelion. Thus, if the comet be either behind or before the ſun, or nearly ſo, it muſt be above our horizon in the day-time, and conſequently inviſible, except the ſun ſhould at that time be in a total eclipſe; for then the comet might be ſeen near the ſun, as well as the ſtars and planets are: and this caſe is ſaid to have happened; for Seneca relates from Poſſidonius, that a comet was ſeen when the ſun was eclipſed, which had before been inviſible by being near that luminary."

172 Why comets may ſometimes be inviſible even in their perihelion.

173 Why more are ſeen in the hemiſphere towards the ſun than in the oppoſite.

A greater number of comets are ſeen in the hemiſphere towards the ſun than in the oppoſite; the reaſon of which will eaſily appear from fig. 97. wherein S repreſents the ſun, E the earth, ABCD the ſphere of the fixed ſtars: and becauſe comets either do not reflect the light enough to be viſible, or emit tails conſpicuous enough to attract our notice, till they come within the planetary regions, commonly a good way within the ſphere of Jupiter, let KLMN be a ſphere concentric to the ſun, at ſuch a diſtance from him, that no comet can be ſeen by us till it come within that diſtance; through E draw the plane BD perpendicular to SE, which will divide the ſphere KLMN into two hemiſpheres, one of which BCD, is towards the ſun, the other, DAB, oppoſite. Now it is manifeſt, that the ſpherical portion LMN, which is in the hemiſphere BCD towards the ſun, is larger than the portion NKL in the hemiſphere oppoſite to him; and conſequently a greater number of comets will appear in the hemiſphere BCD than in that marked DAB.

174 Great differences in the eccentricities of the orbits of comets.

Though the orbits of all comets are very eccentric ellipſes, there are vaſt differences among them; but excepting Mercury, there are no great differences among the planets either as to the eccentricity of their orbits, or the inclination of their planes; the planes of ſome comets are almoſt perpendicular to others, and ſome of their ellipſes are much wider than others. The narroweſt ellipſis of any comet hitherto obſerved was that of 1680. There is alſo a much greater inequality in the motion of the comets than of the planets; the velocity of the former being incomparably greater in their perihelion than in their aphelion; but the planets are but very little accelerated.

175 Opinions concerning their ſubſtance.

Aſtronomers are now generally agreed, that comets are opaque bodies, enlightened by the ſun. Hevelius, in a large work, wherein he gives the opinion of various authors on the ſubject, mentions ſome who were of the ſame ſentiments with himſelf, that comets were ſo far tranſparent as to let the light of the ſun paſs through them, which formed their tails. Sir Iſaac Newton was of opinion, that they are quite opaque; and in confirmation of this, he obſerves, that if a comet be ſeen in two parts of its orbit, at equal diſtances from the earth, but at unequal diſtances from the ſun, it always ſhines brighteſt in that neareſt the ſun. They are of very different magnitudes, which may be conjectured from their apparent diameter and brightneſs. Thus the head of a comet, when of the ſame brightneſs and apparent diameter with Saturn, may be ſuppoſed to be nearly about the ſame magnitude with that planet; though this muſt be attended with ſome uncertainty, as we know not whether the heads of comets reflect the ſun's light in the ſame manner the planets do. Their diſtance may be known from their parallax, in the manner related in a ſubſequent ſection.

176 Diſtances, diameters, &c. of ſome comets computed.

In this manner he found the diſtance of the comet of 1577 to be about 210 ſemidiameters of the earth, or about 840,000 miles diſtant from us, its apparent diameter being ſeven minutes; whence he concluded, that the true diameter of the comet was to that of the earth as 3 to 14. "But (ſays Dr Long) it was the atmoſphere of the comet which was then meaſured." Hevelius, from the parallax and apparent diameter of the head of the comet in 1652, computed its diameter to be to that of the earth as 52 to 100. By the ſame method he found the diameter of the head of the comet of 1664 to be at one time 12 ſemidiameters of the earth, and at another not much more than 5. "That the head of a comet muſt appear leſs the farther it is from the earth (ſays Dr Long) is obvious; but beſides this apparent change, there is alſo a real one in the dimenſions of the head of the ſame comet; for, when near the ſun, the atmoſphere is diminiſhed by the heat raiſing more of it into the tail; whereas, at a greater diſtance, the tail is diminiſhed and the head enlarged." Hevelius computed the diameter of the nucleus of the comets of 1661 and 1665 to be only about a tenth part of that of the earth; and Cyſatus makes the true diameter of the comet of 1618 to be about the ſame ſize.

177 Eclipſes occaſioned by comets.

Some comets, however, from their apparent magnitude and diſtance, have been ſuppoſed much larger than the moon, or even equal in magnitude to ſome of the primary planets; and ſome have imagined, that by an interpoſition of theſe bodies betwixt the earth and ſun, we might account for thoſe darkneſſes which cannot be derived from any interpoſition of the moon. Such are thoſe mentioned by Herodotus, l. 7. c. 37. and l. 9. c. 70. likewiſe the eclipſe mentioned by Dion, which happened a little before the death of Auguſtus; and it is obſervable that Seneca ſaw a comet that year. Some have even attempted to account in this manner for the darkneſs which happened at our Saviour's crucifixion; and indeed it is certain, that were a comet in its perigee to come between the earth and ſun, and to be moving the ſame way with the earth, it muſt cauſe a darkneſs much more intenſe, as well as of more conſiderable duration, than what could take place in any lunar eclipſe.

178 Conjectures concerning their tails.

Various conjectures have been formed reſpecting the tails of comets; though it is acknowledged by all, that they depend on the ſun ſomehow or other; and for this plain reaſon, that they are always turned from him; but in what manner this is accompliſhed, we cannot eaſily determine. Apian, Tycho-Brache, and others, thought the tail was formed by the ſun's rays tranſmitted through the nucleus of the comet, which they fancied tranſparent, and was there refracted as in a lens of glaſs, ſo as to form a beam of light behind the comet: but this cannot be the caſe, as well becauſe the figure of a comet's tail does not anſwer to ſuch a refraction, as that ſuch refracted light would not be ſeen by a ſpectator placed ſideways to it, unleſs it fell upon ſome ſubſtance ſufficiently denſe to cauſe a reflexion.

179 Opinion of Des Cartes.

Des Cartes and his followers were of opinion, that the tail of a comet was owing to the refraction of its head: but if this were the caſe, the planets and principal fixed ſtars muſt have tails alſo; for the rays from them paſs through the ſame medium as the light from the comets. Sir Iſaac Newton was of opinion, that the tail of a comet is a very thin vapour which the head ſends out by reaſon of its heat: that it aſcends from the ſun juſt as ſmoke does from the earth: that as the aſcent of ſmoke is cauſed by the rarefaction of the air wherein it is entangled, cauſing ſuch air to aſcend and carry the ſmoke up with it; ſo the ſun's rays acting upon the coma or atmoſphere of the comet, do by rarefaction and refraction heat the ſame; that this heated atmoſphere heats, and by heating rarefies, the ether that is involved therein; and that the ſpecific gravity with which ſuch ether tends to the ſun, is ſo diminiſhed by its rarefaction, that will now aſcend from him by its relative lightneſs, and carry with it the reflecting particles whereof the tail is compoſed. Tho' the immenſely large tails of ſome comets ſeem to require a great quantity of matter to produce them, this is no objection to the foregoing ſolution: for every day's experience ſhows what a great quantity of ſmoke is produced from a very little wood or coal; and Newton has demonſtrated, that a cubic inch of air equally rarefied with that at the diſtance of a ſemidiameter from the earth's ſurface, would fill all the planetary regions to the orbit of Saturn and beyond. Mairan entertained a very different opinion. He ſuppoſed the tails of the comets to be formed out of the luminous matter whereof the ſun's atmoſphere conſiſts. This he ſuppoſes to extend as far as the orbit of the earth, and to furniſh matter for the aurora borealis. M. de la Lande is for joining the two laſt opinions together. Part of the matter which forms the tails of comets he ſuppoſes to ariſe from their own atmoſphere rarefied by heat and puſhed forward by the force of the light ſtreaming from the ſun; and alſo that a comet paſſing through the ſun's atmoſphere is drenched therein, and carries away ſome of it. Mr Rowning objects to Newton's account, that it can hardly be ſuppoſed the thin vapour of the tail ſhould go before the more ſolid body of the comet, when the motion thereof is ſometimes ſo extremely ſwift, as that of ſome of the comets is ſaid to be after the rate, as Sir Iſaac Newton calculated the motion of the comet of 1680 to be, of no leſs than 880,000 miles an hour. He therefore ſuppoſes the atmoſphere of the comet to extend every way round it as far as the tail reaches; and that the part of it which makes the tail is diſtinguiſhed from the reſt, ſo as to fall thick upon that part of the atmoſphere which goes before the comet in its progreſs along its elliptic orbit.

The greateſt objection to this is the immenſe magnitude of the atmoſpheres ; as it muſt now be ſuppoſed to account for the vaſt lengths of the tails of ſome comets, which have been ſaid to meaſure above 80 millions of miles.

180
Dr Hamilton of Dublin's opinion.

The many diſcoveries which, ſince the time of Newton, Halley, and other celebrated mathematicians, have been made in electricity, having brought in a new element unknown to former ages, and which ſhows a vaſt power through every part of the creation with which we are acquainted, it became natural to imagine that it muſt extend alſo into thoſe higher regions which are altogether inacceſſible to man. The ſimilarity of the tails of comets to the aurora borealis, which is commonly looked upon to be an electrical phenomenon, therefore ſuggeſted an opinion at preſent far from being generally diſbelieved, that the tails of comets are ſtreams of electric matter. An hypotheſis of this kind was publiſhed by Dr Hamilton of Dublin in a ſmall treatiſe, entitled, *Conjectures on the Nature of the Aurora Borealis, and on the Tails of Comets.* His hypotheſis is, that the comets are of uſe to bring back the electric fluid to the planets, which is continually diſcharged from the higher regions of their atmoſpheres. Having given at length the abovementioned opinion of Sir Iſaac, "We find (ſays he) in this account, that Sir Iſaac aſcribes the aſcent of comets tails to their being rarer and lighter, and moving round the ſun more ſwiftly, than the ſolar atmoſphere, with which he ſuppoſes them to be ſurrounded whilſt in the neighbourhood of the ſun ; he ſays alſo, that whatever poſition (in reſpect to each other) the head and tail of a comet then receive, they will keep the ſame afterwards moſt freely ; and in another place he obſerves, 'That the celeſtial ſpaces muſt be entirely void of any power of reſiſting, ſince not only the ſolid bodies of the planets and comets, but even the exceeding thin vapours of which comets tails are formed, move thro' thoſe ſpaces with immenſe velocity, and yet with the greateſt freedom.' I cannot help thinking that this account is liable to many difficulties and objections, and that it ſeems not very conſiſtent with itſelf or with the phenomena.

"I do not know that we have any proof of the exiſtence of a ſolar atmoſphere of any conſiderable extent, nor are we any where taught how to gueſs at the limits of it. It is evident that the exiſtence of ſuch an atmoſphere cannot be proved merely by the aſcent of comets tails from the ſun, as that phenomenon may poſſibly ariſe from ſome other cauſe. However, let us ſuppoſe for the preſent, that the aſcent of comets tails is owing to an atmoſphere ſurrounding the ſun, and ſee how the effects ariſing from thence will agree with the phenomena. When a comet comes into the ſolar atmoſphere, and is then deſcending almoſt directly to the ſun, if the vapours which compoſe the tail are raiſed up from it by the ſuperior denſity and weight of that atmoſphere, they muſt riſe into thoſe parts that the comet has left, and therefore at that time they may appear in a direction oppoſite to the ſun. But as ſoon as the comet comes near the ſun, and moves in a direction nearly at right angles with the direction of its tail, the vapours which then ariſe, partaking of the great velocity of the comet, and being ſpecifically lighter than the medium in which they move, and being vaſtly expanded through it, muſt neceſſarily ſuffer a reſiſtance immenſely greater than what the ſmall and denſe body of the comet meets with, and conſequently cannot poſſibly keep up with it, but muſt be left behind, or, as it were, driven backwards by the reſiſtance of that medium into a line directed towards the parts which the comet has left, and therefore can no longer appear in a direction oppoſite to the ſun. And, in like manner, when a comet paſſes its perihelion, and begins to aſcend from the ſun, it certainly ought to appear ever after with its tail behind it, or in a direction pointed towards the ſun ; for if the tail of the comet be ſpecifically lighter than the medium in which it moves with ſo great velocity, it muſt be juſt as impoſſible it ſhould move foremoſt, as it is that a torch moved ſwiftly thro' the air ſhould project its flame and ſmoke before it. Since therefore we find that the tail of a comet, even when it is aſcending from the ſun, moves foremoſt, and appears in a direction nearly oppoſite to the ſun, I think we muſt conclude that the comet and its tail do not move in a medium heavier and denſer than the matter of which the tail conſiſts, and conſequently that the conſtant aſcent of the tail from the ſun muſt be owing to ſome other cauſe. For that the ſolar atmoſphere ſhould have denſity and weight ſufficient to raiſe up the vapours of a comet from the ſun, and yet not be able to give any ſenſible reſiſtence to theſe vapours in their rapid progreſs through it, are two things inconſiſtent with each other : And therefore, ſince the tail of a comet is found to move as freely as the body does, we ought rather to conclude, that the celeſtial ſpaces are void of all reſiſting matter, than that they are filled with a ſolar atmoſphere, be it ever ſo rare.

"But there is, I think, a further conſideration, which will ſhow that the received opinion, as to the aſcent of comets tails, is not agreeable to the phenomena, and may at the ſame time lead us to ſome knowledge of the matter of which theſe tails conſiſt; which I ſuſpect is of a very different nature from what it has been hitherto ſuppoſed to be. Sir Iſaac ſays, the vapours, of which the tail of a comet conſiſts, grow hot by reflecting the rays of the ſun, and thereby warm and rarefy the medium which ſurrounds them ; which muſt therefore aſcend from the ſun, and carry with it the reflecting particles of which the tail is formed ; for he always ſpeaks of the tail as ſhining by reflected light. But one would rather imagine, from the phenomena, that the matter which forms a comet's tail has not the leaſt ſenſible power of reflecting the rays of light. For it appears from Sir Iſaac's obſervation, which I have quoted already, that the light of the ſmalleſt ſtars, coming to us through the immenſe thickneſs of a comet's tail, does not ſuffer the leaſt diminution. And yet, if the tail can reflect the light of the ſun ſo copiouſly as it muſt do if its great ſplendor be owing to ſuch reflection, it muſt undoubtedly have the ſame effect on the light of the ſtars ; that is, it muſt reflect back the light which comes from the ſtars behind it, and by ſo doing muſt intercept them from our ſight, conſidering its vaſt thickneſs, and how exceedingly ſlender a ray is that comes from a ſmall ſtar ; or if it did not intercept their whole light, it muſt at leaſt increaſe their twinkling. But we do not find that it has even this ſmall effect : for thoſe ſtars that appear through the tail are not obſerved to twinkle more than others

others in their neighbourhood. Since therefore this fact is ſupported by obſervations, what can be a plainer proof that the matter of a comet's tail has no power of reflecting the rays of light? and conſequently that it muſt be a ſelf-ſhining ſubſtance. But the ſame thing will further appear, from conſidering that bodies reflect and refract light by one and the ſame power; and therefore if comets tails want the power of refracting the rays of light, they muſt alſo want the power of reflecting them. Now, that they want this refracting power appears from hence: If that great column of tranſparent matter which forms a comet's tail, and moves either in a vacuum or in ſome medium of a different denſity from its own, had any power of refracting a ray of light coming through it from a ſtar to us, that ray muſt be turned far out of its way in paſſing over the great diſtance between the comet and the earth; and therefore we ſhould very ſenſibly perceive the ſmalleſt refraction that the light of the ſtars might ſuffer in paſſing through a comet's tail. The conſequence of ſuch a refraction muſt be very remarkable: the ſtars that lie near the tail would, in ſome caſes, appear double; for they would appear in their proper places by their direct rays, and we ſhould ſee their images behind the tail, by means of their rays which it might refract to our eyes; and thoſe ſtars that were really behind the tail would diſappear in ſome ſituations, their rays being turned aſide from us by refraction. In ſhort, it is eaſy to imagine what ſtrange alterations would be made in the apparent places of the fixed ſtars by the tails of comets, if they had a power of refracting their light, which could not fail to be taken notice of if any ſuch ever happened. But ſince aſtronomers have not mentioned any ſuch apparent changes of place among the ſtars, I take it for granted that the ſtars ſeen through all parts of a comet's tail appear in their proper places, and with their uſual colours; and conſequently I infer, that the rays of light ſuffer no refraction in paſſing through a comet's tail. And thence I conclude (as before), that the matter of a comet's tail has not the power of refracting or reflecting the rays of light, and muſt therefore be a lucid or ſelf-ſhining ſubſtance."

181
Sir Iſaac's account defended.

But whatever probability the Doctor's conjecture concerning the materials whereof the tails are formed may have in it, his criticiſm on Sir Iſaac Newton's account of them ſeems not to be juſt: for that great philoſopher ſuppoſes the comets to have an atmoſphere peculiar to themſelves; and conſequently, in their neareſt approaches to the ſun, both comet and atmoſphere are immerſed in the atmoſphere of that luminary. In this caſe, the atmoſphere of the comet being prodigiouſly heated on the ſide next to the ſun, and conſequently the equilibrium in it broken, the denſer parts will continually pour in from the regions fartheſt from the ſun; for the ſame reaſon, the more rarefied part which is before will continually fly off oppoſite to the ſun, being diſplaced by that which comes from behind; for tho' we muſt ſuppoſe the comet and its atmoſphere to be heated on all ſides to an extreme degree, yet ſtill that part which is fartheſt from the ſun will be leſs hot, and conſequently more denſe, than what is neareſt to his body. The conſequence of this is, that there muſt be a conſtant ſtream of denſe atmoſphere deſcending towards the ſun, and another ſtream of rarefied vapours and atmoſphere aſcending on the contrary ſide; juſt as, in a common fire, there is a conſtant ſtream of denſe air deſcending, which puſhes up another of rarefied air, flame, and ſmoke. The reſiſtance of the ſolar atmoſphere may indeed be very well ſuppoſed to occaſion the curvature obſervable in the tails of comets, and their being better defined in the fore part than behind; and this appearance we think Dr Hamilton's hypotheſis is incapable of ſolving. We grant, that there is the utmoſt probability that the tails of comets are ſtreams of electric matter; but they who advance a theory of any kind ought to ſolve every phenomenon, otherwiſe their theory is inſufficient. It was incumbent on Dr Hamilton, therefore, to have explained how this ſtream of electric matter comes to be bent into a curve; and alſo why it is better defined and brighter on the outer ſide of the arch than on the inner. This, indeed, he attempts in the following manner: "But that this curvature was not owing to any reſiſting matter appears from hence, that the tail muſt be bent into a curve though it met with no reſiſtance; for it could not be a right line, unleſs all its particles were projected in parallel directions, and with the ſame velocity, and unleſs the comet moved uniformly in a right line. But the comet moves in a curve, and each part of the tail is projected in a direction oppoſite to the ſun, and at the ſame time partakes of the motion of the comet; ſo that the different parts of the tail muſt move on in lines which diverge from each other; and a line drawn from the head of a comet to the extremity of the tail, will be parallel to a line drawn from the ſun to the place where the comet was when that part of the tail began to aſcend, as Sir Iſaac obſerves; and ſo all the chords or lines drawn from the head of the comet to the intermediate parts of the tail, will be reſpectively parallel to lines drawn from the ſun to the places where the comet was when theſe parts of the tail began to aſcend. And therefore, ſince theſe chords of the tail will be of different lengths, and parallel to different lines, they muſt make different angles, with a great circle paſſing through the ſun and comet, and conſequently a line paſſing through their extremities will be a curve.

182
Dr Hamilton's hypotheſis inſufficient.

"It is obſerved, that the convex ſide of the tail which is turned from the ſun is better defined, and ſhines a little brighter, than the concave ſide. Sir Iſaac accounts for this, by ſaying, that the vapour on the convex ſide is freſher (that is, has aſcended later) than that on the concave ſide; and yet I cannot ſee how the particles on the convex ſide can be thought to have aſcended later than thoſe on the concave ſide which may be nearer to the head of the comet. I think it rather looks as if the tail, in its rapid motion, met with ſome ſlight reſiſtance juſt ſufficient to cauſe a ſmall condenſation in that ſide of it which moves foremoſt, and which would occaſion it to appear a little brighter and better defined than the other ſide; which ſlight reſiſtance may ariſe from that ſubtile ether which is ſuppoſed to be diſperſed through the celeſtial regions, or from this very electric matter diſperſed in the ſame manner, if it be different from the ether."

On the laſt part of this obſervation we muſt remark, that though a ſlight reſiſtance in the etherial medium would have ſerved Sir Iſaac Newton's turn, it will by no means ſerve Dr Hamilton's; for though a ſtream of water

Concluſions from the foregoing Appearances.

water or air may be eaſily deſtroyed or broken by reſiſtance, yet a ſtream of electric matter ſeems to ſet every obſtacle at defiance. If a ſharp needle is placed on the conductor of an electric machine, and the machine ſet in motion, we will perceive a ſmall ſtream of electric matter iſſuing from the point; but though we blow againſt this ſtream of fire with the utmoſt violence, it is impoſſible either to move it, or to brighten it on the ſide againſt which we blow. If the celeſtial ſpaces then are full of a ſubtile ether capable of thus affecting a ſtream of electric matter, we may be ſure that it alſo will reſiſt very violently: and we are then as much difficulted to account for the projectile motion continuing amidſt ſuch violent reſiſtance; for if the ether reſiſts the tail of the comet, it is impoſſible to prove that it doth not reſiſt the head alſo.

183
Electric matter not always paſſive.

This objection may appear to ſome to be but weakly founded, as we perceive the electric fluid to be endowed with ſuch extreme ſubtility, and to yield to the impreſſion of ſolid bodies with ſuch facility, that we eaſily imagine it to be of a very paſſive nature in all caſes. But it is certain, that this fluid only ſhows itſelf paſſive where it paſſes from one body into another, which it ſeems very much inclined to do of itſelf. It will be alſo found, on proper examination of all the phenomena, that the only way we can manage the electric fluid at all is by allowing it to direct its own motions. In all caſes where we ourſelves attempt to aſſume the government of it, it ſhows itſelf the moſt untractable and ſtubborn being in nature. But theſe things come more properly under the article ELECTRICITY, where they are fully conſidered. Here it is ſufficient to obſerve, that a ſtream of electric matter reſiſts air, and from the phenomena of electric repulſion we are ſure that one ſtream of electric matter reſiſts another; from which we may be alſo certain, that if a ſtream of electric matter moves in an aerial fluid, ſuch fluid will reſiſt it: and we can only judge of the degree of reſiſtance it meets with in the heavens from what we obſerve on earth. Here we ſee the moſt violent blaſt of air has no effect upon a ſtream of electric fluid; in the celeſtial regions, either air or ſome other fluid has an effect upon it according to Dr Hamilton. The reſiſtance of that fluid, therefore, muſt be greater than that of the moſt violent blaſt of air we can imagine.

184
Prodigious velocity of a comet obſerved by Mr Brydone.

As to the Doctor's method of accounting for the curvature of the comet's tail, it might do very well on Sir Iſaac Newton's principles, but cannot do ſo on his. There is no compariſon between the celerity with which rarefied vapour aſcends in our atmoſphere, and that whereby the electric fluid is diſcharged. The velocity of the latter ſeems to equal that of light; of conſequence, ſuppoſing the velocity of the comet to be equal to that of the earth in its annual courſe, and its tail equal in length to the diſtance of the ſun from the earth, the curvature of the tail could only be to a ſtraight line as the velocity of the comet in its orbit is to the velocity of light, which, according to the calculations of Dr Bradley, is as 10,201 to 1. The apparent curvature of ſuch a comet's tail, therefore, would at this rate only be $\frac{1}{10201}$ part of its viſible length, and thus would always be imperceptible to us. The velocity of comets is indeed ſometimes inconceivably great. Mr Brydone obſerved one at Palermo, in July 1770, which in 24 hours deſcribed an arch in the heavens upwards of 50 degrees in length; according to which he ſuppoſes, that if it was as far diſtant as the ſun, it muſt have moved at the rate of upwards of 60 millions of miles in a day. But this comet was attended with no tail, ſo that we cannot be certain whether the curvature of the tails of theſe bodies correſponds with their velocity or not.

Concluſions from the foregoing Appearances.

185
Vehement heat of the comet of 1680.

The near approach of ſome comets to the ſun ſubjects them to intenſe and inconceivable degrees of heat. Newton calculated that the heat of the comet of 1680 muſt have been near 2000 times as great as that of red hot iron. The calculation is founded upon this principle, that the heat of the ſun falling upon any body at different diſtances is reciprocally as the ſquares of thoſe diſtances; but it may be obſerved, that the effect of the heat of the ſun upon all bodies near our earth depends very much on the conſtitution of thoſe bodies, and of the air that ſurrounds them. "The comet in queſtion (ſays Dr Long) certainly acquired a prodigious heat; but I cannot think it came up to what the calculation makes it: the effect of the ſtrongeſt burning-glaſs that has ever been made uſe of was the vitrification of moſt bodies placed in its focus. What would be the effect of a ſtill greater heat we can only conjecture; it would perhaps ſo diſunite the parts as to make them fly off every way in atoms. This comet, according to Halley, in paſſing thro' its ſouthern node, came within the length of the ſun's ſemidiameter of the orbit of the earth. Had the earth then been in the part of her orbit neareſt to that node, their mutual gravitation muſt have cauſed a change in the plane of the orbit of the earth, and in the length of our year: he adds, that if ſo large a body with ſo rapid a motion as that of this comet were to ſtrike againſt the earth, a thing by no means impoſſible, the ſhock might reduce this beautiful frame to its original chaos."

We muſt not conclude this account without obſerving, that Whiſton, who, from Flamſtead's meaſure of its apparent diameter, concluded the nucleus of the comet to be about ten times as big as the moon, or equal to a fourth part of the earth, attributes the univerſal deluge in the time of Noah to the near approach thereof. His opinion was, that the earth paſſing thro' the atmoſphere of the comet, attracted therefrom great part of the water of the flood; that the nearneſs of the comet raiſed a great tide in the ſubterraneous waters, ſo that the outer cruſt of the earth was changed from a ſpherical to an oval figure; that this could not be done without making fiſſures and cracks in it, thro' which the waters forced themſelves by the hollow of the earth being changed into a leſs capacious form; that along with the water thus ſqueezed up on the ſurface of the earth, much ſlime or mud would riſe; which, together with the groſſer part of the comet's atmoſphere, would after the ſubſiding of the water, partly into the fiſſures and partly into the lower parts of the earth to form the ſea, cover all over, to a conſiderable depth, the antediluvian earth. Thus he accounts for trees and bones of animals being found at very great depths in the earth. He alſo held that, before the fall, the earth revolved round the ſun in the plane of the ecliptic, keeping always the ſame points of its ſurface towards the ſame fixed ſtars. By this means, as every meridian would come to the ſun but once in every revolution, a day and a year were then the ſame: but that a comet ſtriking obliquely upon ſome part of the earth gave it the diurnal rotation; that the antediluvian year conſiſted of 360 days; but that the additional matter depoſited upon the earth from the atmoſphere of the comet at the flood ſo retarded the revolution thereof round the ſun, that it is not now performed in leſs than 365 days and about a quarter. The ſame comet he thought would probably, coming near the earth when heated in an immenſe degree in its perihelion, be the inſtrumental cauſe of that great cataſtrophe, the general conflagration, foretold in the ſacred writings and from ancient tradition.

186
Conjectures of Hevelius, &c. concerning the nature of comets.

Theſe conjectures lead us to ſpeak ſomewhat more particularly concerning the nature of the comets, and the purpoſes they may poſſibly anſwer in the creation. Hevelius, in order to account for the various appearances of the nucleus already related, ſuppoſed that they were compoſed of ſeveral maſſes compacted together with a tranſparent fluid interſperſed, but the apparent changes in the nucleus may be only on the ſurface: comets may be ſubject to ſpots as the planets are; and the vaſtly different degrees of heat they go through may occaſion great and ſudden changes, not only in their ſurfaces, but even in their internal frame and texture. Newton places all theſe apparent changes to the atmoſphere that environs them; which muſt be very denſe near the ſurface, and have clouds floating therein. It was his opinion, that the changes mentioned may all be in the clouds, not in the nucleus. This laſt indeed he looked upon to be a body of extreme ſolidity, in order to ſuſtain ſuch an intenſe heat as the comets are ſometimes deſtined to undergo; and that, notwithſtanding their running out into the immenſe regions of ſpace, where they were expoſed to the moſt intenſe degrees of cold, they would hardly be cooled again on their return to the ſun. Indeed, according to his calculation, the comet of 1680 muſt be for ever in a ſtate of violent ignition. He hath computed that a globe of red-hot iron of the ſame dimenſions with the earth, would ſcarce be cool in 50,000 years. If then the comet be ſuppoſed to cool 100 times faſter than red-hot-iron, as its heat was 2000 times greater, it muſt require upwards of a million of years to cool it. In the ſhort period of 575 years, therefore, its heat will be in a manner ſcarce diminiſhed; and, of conſequence, in its next and every ſucceeding revolution, it muſt acquire an increaſe of heat: ſo that, ſince the creation, having received a proportional addition in every ſucceeding revolution, it muſt now be in a ſtate of ignition very little inferior to that of the ſun itſelf. Sir Iſaac Newton hath farther concluded, that this comet muſt be conſiderably retarded in every ſucceeding revolution by the atmoſphere of the ſun within which it enters; and thus muſt continually come nearer and nearer his body, till at laſt it falls into it. This, he thinks, may be one uſe of the comets, to furniſh fuel for the ſun, which otherwiſe would be in danger of waſting from the continual emiſſion of its light.

He adds, that for the conſervation of the water and moiſture of the planets, comets ſeem abſolutely requiſite; from whoſe condenſed vapours and exhalation all the moiſture which is ſpent in vegetation and putrefaction, and turned into dry earth, &c. may be reſupplied and recruited; for all vegetables grow and increaſe wholly from fluids; and again, as to their greateſt part, turn by putrefaction into earth; an earthy ſlime being perpetually precipitated to the bottom of putrefying liquors. Hence the quantity of dry earth muſt continually increaſe, and the moiſture of the globe decreaſe, and be quite evaporated, if it have not a continual ſupply from ſome part or other of the univerſe. "And I ſuſpect (adds our great author), that the ſpirit, which makes the fineſt, ſubtileſt, and beſt part of our air, and which is abſolutely requiſite for the life and being of all things, comes principally from the comets."

187
Mr Brydone's conjectures concerning comets without tails.

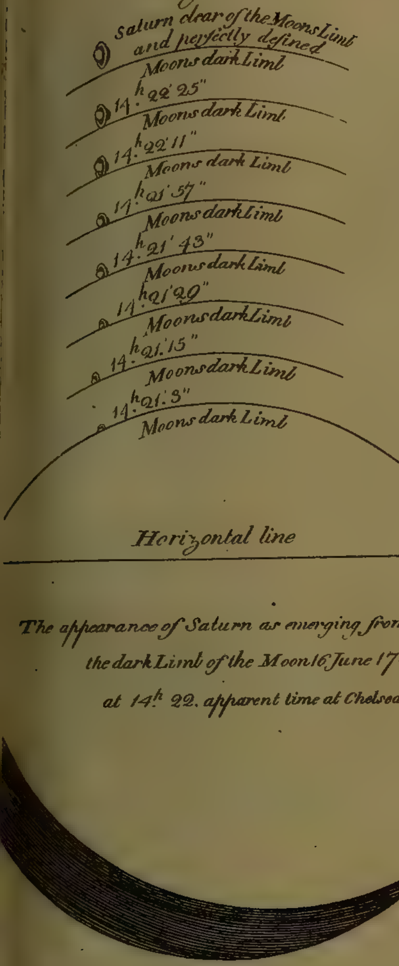
Mr Brydone obſerves, that the comets without tails ſeem to be of a very different ſpecies from thoſe which have tails: To the latter, he ſays, they appear to bear a much leſs reſemblance than they do even to planets. He tells us, that comets with tails have ſeldom been viſible but on their receſs from the ſun: that they are kindled up, and receive their alarming appearance, in their near approach to this glorious luminary; but that thoſe without tails are ſeldom or never ſeen but on their way to the ſun; and he does not recollect any whoſe return has been tolerably well aſcertained. "I remember indeed (ſays he), a few years ago, a ſmall one, that was ſaid to have been diſcovered by a teleſcope after it had paſſed the ſun, but never more became viſible to the naked eye. This aſſertion is eaſily made, and nobody can contradict it; but it does not at all appear probable that it ſhould have been ſo much leſs luminous after it had paſſed the ſun than before it approached him: and I will own to you, when I have heard that the return of theſe comets had eſcaped the eyes of the moſt acute aſtronomers, I have been tempted to think that they did not return at all, but were abſorbed in the body of the ſun, which their violent motion towards him ſeemed to indicate." He then attempts to account for the continual emiſſion of the ſun's light without waſte, by ſuppoſing that there are numberleſs bodies throughout the univerſe that are attracted into the body of the ſun, which ſerve to ſupply the waſte of light, and which for ſome time remain obſcure and occaſion ſpots on his ſurface, till at laſt they are perfectly diſſolved and become bright like the reſt. This hypotheſis may account for the dark ſpots becoming as bright, or even brighter, than the reſt of the diſk, but will by no means account for the brighter ſpots becoming dark. Of this comet too, Mr Brydone remarks, that it was evidently ſurrounded by an atmoſphere which refracted the light of the fixed ſtars, and ſeemed to cauſe them change their places as the comet came near them.

188
Mr Cole's hypotheſis.

A very ſtrange opinion we find ſet forth in a book entitled "Obſervations and Conjectures on the Nature and Properties of Light, and on the Theory of Comets, by William Cole." This gentleman ſuppoſes that the comets belong to no particular ſyſtem; but were originally projected in ſuch directions as would ſucceſſively expoſe them to the attraction of different centres, and thus they would deſcribe various curves of the parabolic and the hyperbolic kind. This treatiſe is written in anſwer to ſome objections thrown out in Mr Brydone's Tour, againſt the motions of the comets by means of the two forces of gravitation and projection, which

ASTRONOMY Plate LXIX

Fig. 88



The appearance of Saturn as emerging from behind the dark Limb of the Moon 16 June 1762 at 14h 22. apparent time at Chelsea

Fig. 90

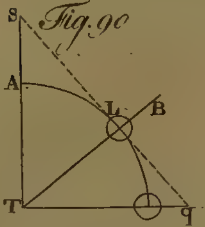


Fig. 89

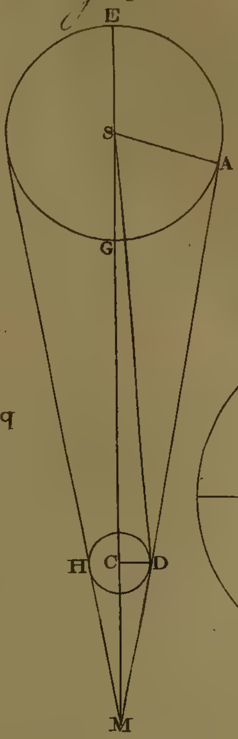


Fig. 92

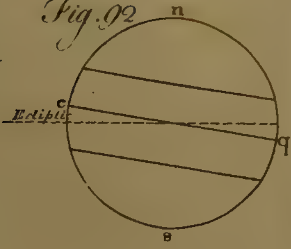


Fig. 93

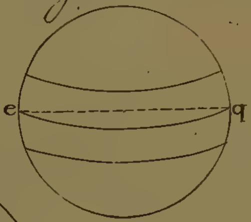


Fig. 96

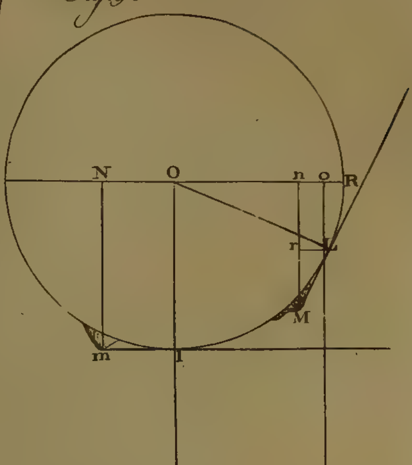


Fig. 94

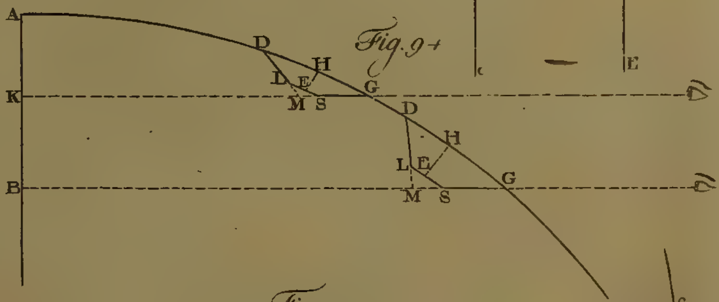


Fig. 95

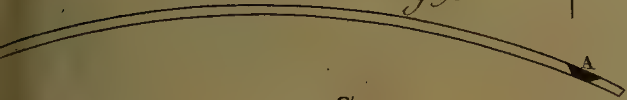


Fig. 91

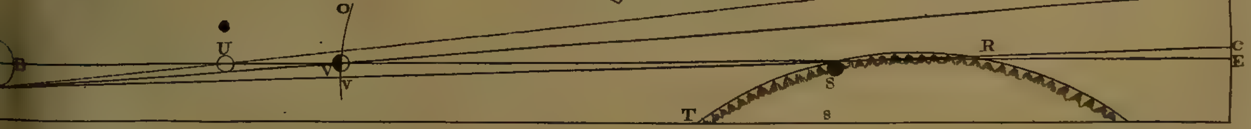


Fig. 98

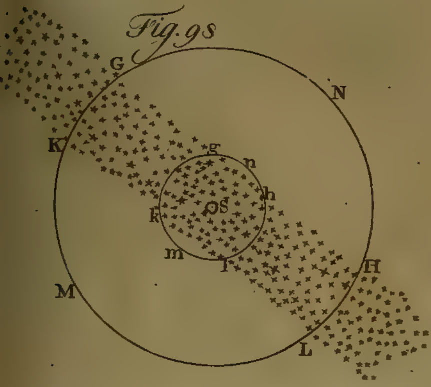


Fig. 97

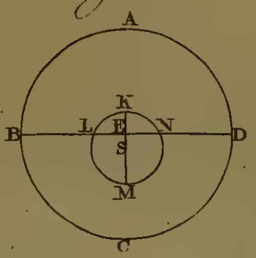
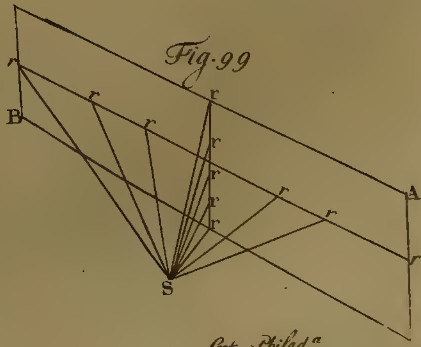


Fig. 99



Scot Philada

which were thought ſufficient for that purpoſe by Sir Iſaac Newton; of which we ſhall treat as fully as our limits will allow in the next ſection.

189
Of the periodical times, &c. of the comets.

The analogy between the periodical times of the planets and their diſtances from the ſun diſcovered by Kepler, takes place alſo in the comets. In conſequence of this, the mean diſtance of a comet from the ſun may be found by comparing its period with the time of the earth's revolution round the ſun. Thus the period of the comet that appeared in 1531, 1607, 1682, and 1759, being about 76 years, its mean diſtance from the ſun may be found by this proportion: As 1, the ſquare of one year, the earth's periodical time, is to 5776 the ſquare of 76, the comet's periodical time; ſo is 1,000,000, the cube of 100 the earth's mean diſtance from the ſun, to 5,776,000,000, the cube of the comet's mean diſtance. The cube root of this laſt number is 1794, the mean diſtance itſelf in ſuch parts as the mean diſtance of the earth from the ſun contains 100. If the perihelion diſtance of this comet, 58, be taken from 3588 double the mean diſtance, we ſhall have the aphelion diſtance, 3530, of ſuch parts as the diſtance of the earth contains 100; which is a little more than 35 times the diſtance of the earth from the ſun. By a like method, the aphelion diſtance of the comet of 1680 comes out 138 times the mean diſtance of the earth from the ſun, ſuppoſing its period to be 575 years; ſo that this comet in its aphelion, goes more than 14 times the diſtance from the ſun that Saturn does. Euler computes the orbit of this comet from three of Flamſtead's obſervations taken near together, compared with a fourth taken at ſome diſtance from the other three; and from thence concludes the period to be a little more than 170 years. "It ſeems ſomething ſurpriſing (ſays Dr Long), that, from the ſame obſervations which were uſed by Newton and Halley, he ſhould bring out a period ſo very different from what thoſe great men have determined: but it is the leſs to be wondered at, if we conſider how ſmall a portion of the comet's orbit lay between the moſt diſtant places uſed in this computation, or indeed that could be had for that purpoſe; ſo ſmall, that the form of the ellipſis cannot be found with preciſion by this method, except the comet's places were more exactly verified than is poſſible to be done: and that he does not pretend to confirm his determination of the period by pointing out and comparing together any former appearances of this comet; a method which Newton recommended as the only one whereby the periodical times and tranſverſe diameters of the orbits of the comets can be determined with accuracy."

The period of the comet in 1744 is much longer than even that of 1680. Mr Betts, in attempting to compute the tranſverſe axis of its orbit, found it come out ſo near infinite, that, though the orbit ſhowed itſelf in this manner to be a very long one, he found it impoſſible to calculate it without ſome obſervations made after its perihelion.

190
Dr Halley calculates the return of comets.

Halley, after he had finiſhed his table of comets, found ſuch a ſimilitude in the elements of thoſe of 1531, 1607, and 1682, that he was induced to believe them to be returns of the ſame comet in an elliptic orbit: but as there was ſuch a difference in their periodical times and inclinations of their orbits as ſeemed to make againſt this opinion; and as the obſervations of the firſt of them in 1531 by Apian, and the ſecond in 1607 by Kepler were not exact enough to determine ſo nice a point when he firſt publiſhed his ſynopſis in 1705; he only mentioned this as a thing probable, and recommended it to poſterity to watch for an appearance of the ſame in 1758. Afterwards, looking over the catalogue of ancient comets, and finding three others at equal intervals with thoſe now mentioned, he grew more poſitive in his opinion; and knowing a method of calculating with eaſe a motion in an elliptic orbit, how eccentric ſoever it might be, inſtead of the parabolic orbit which he had given for the comet of 1682, he ſet about adapting the plan of that orbit to an ellipſis of a given ſpace and magnitude, having the ſun in one of its foci, ſo as to tally with the obſervations of that comet made by Flamſtead with great accuracy, by the help of a very large ſextant. He likewiſe corrected the places of the comet of 1531 from Apian, and thoſe of the comet 1607 from Kepler and Longomontanus, by rectifying the places of the ſtars they had made uſe of, and found thoſe places agree as well with the motion in ſuch an ellipſis as could be expected from the manner of obſerving of theſe aſtronomers and the imperfections of their inſtruments. The greateſt objection to this theory was ſome difference in the inclination of the orbits, and that there was above a year's difference between the two periods.

191
Why the periodical return of comets may happen at unequal intervals.

The comet of 1531 was in its perihelion Auguſt 24.; that of 1607, October 16.; and that of 1682, September 4.: ſo that the firſt of theſe periods was more than 76, the latter not quite 75 years. To obviate this, he reminds his readers of an obſervation made by him of the periodical revolution of Saturn having at one time been about 13 days longer than at another time; occaſioned, as he ſuppoſed, by the near approach of Saturn and Jupiter, and the mutual attraction and gravitation of the two planets: and obſerves, that in the ſummer of the year 1681, the comet in its deſcent was for ſome time ſo near Jupiter, that its gravitation towards that planet was one-fiftieth part of its gravitation towards the ſun. This, he concluded, would cauſe a change in the inclination of its orbit, and alſo in the velocity of its motion: for by continuing longer near the planet Jupiter on the ſide moſt remote from the ſun, its velocity, would be more increaſed by the joint forces of both thoſe bodies, than it would be diminiſhed by them acting contrarywiſe, when on the ſide next to the ſun where its motion was ſwifteſt. The projectile motion being thus increaſed, its orbit would be enlarged, and its period lenghtened; ſo that he thought it probable it would not return till after a longer period than 76 years, about the end of the year 1758 or beginning of 1759.

As Halley expreſſed his opinon modeſtly, though clearly enough, that this comet would appear again about the end of 1758, or the beginning of the following year, M. de la Lande pretends he muſt have been at a loſs to know whether the period he foretold would have been of 75 or of 76 years; that he did not give a deciſive prediction, as if it had been the reſult of calculation; and that, by conſidering the affair in ſo looſe a manner as Halley did, there was a good deal of room for objecting to his reaſoning. After theſe reflections, he is very large in his commendation of the performance of Mr Clairault; who, he ſays, not

Conclusions from the foregoing Appearances.

only calculated ſtrictly the effect of the attraction of Jupiter in 1681 and 1683, when the comet was again near Jupiter, but did not neglect the attraction of that planet when the comet was moſt diſtant; that he conſidered the uninterrupted attractions of Jupiter and Saturn upon the ſun and upon the comet, but chiefly the attraction of Jupiter upon the ſun, whereby that luminary was a little diſplaced, and gave different elements to the orbit of the comet. By this method he found the comet would be in its perihelion about the middle of April: but that, on account of ſome ſmall quantities neceſſarily neglected in the method of approximation made uſe of by him, Mr. Clairault deſired to be indulged one month; and that the comet came juſt 30 days before the time he had fixed for its appearance.

That comets may have their motion diſturbed by the planets, eſpecially by the two largeſt, Jupiter and Saturn, appears by an inſtance juſt now mentioned. They may alſo affect one another by their mutual gravitation when out of the planetary regions; but of this we can take no account, nor can we eſtimate the reſiſtance of the ether through which they paſs; and yet both theſe cauſes may have ſome influence on the inclination of their orbits and the length of their periods.

192
Fixed ſtars ſuppoſed to be ſuns.

THUS much concerning the bodies of which our ſolar ſyſtem is compoſed. But the conjectures of aſtronomers have reached even beyond its boundaries: they have ſuppoſed every one of the innumerable multitude of fixed ſtars to be a ſun attended by planets and comets, each of which is an habitable world like our own; ſo that the univerſe may in ſome meaſure be repreſented by fig. 161. where ſeveral adjacent ſyſtems are marked. The ſtrongeſt argument for this hypotheſis is, that they cannot be magnified by a teleſcope on account of their extreme diſtance; whence we muſt conclude that they ſhine by their own light, and are therefore as many ſuns; each of which we may ſuppoſe to be equal, if not ſuperior, in luſtre and magnitude to our own. They are not ſuppoſed to be at equal diſtances from us, but to be more remote in proportion to their apparent ſmallneſs. This ſuppoſition is neceſſary to prevent any interference of their planets; and thus there may be as great a diſtance between a ſtar of the firſt magnitude and one of the ſecond apparently cloſe to it, as between the earth and the fixed ſtars firſt mentioned.

193
Oppoſed, from the variable nature of the ſtars.

Thoſe who take the contrary ſide of the queſtion affirm, that the diſappearance of ſome of the fixed ſtars is a demonſtration that they cannot be ſuns, as it would be to the higheſt degree abſurd to think that God would create a ſun which might diſappear of a ſudden, and leave its planets and their inhabitants in endleſs night.

194
Conjectures concerning new ſtars, &c.

Yet this opinion we find adopted by Dr Keill, who tells us, "It is no ways improbable that theſe ſtars loſt their brightneſs by a prodigious number of ſpots which entirely covered and overwhelmed them. In what diſmal condition muſt their planets remain, who have nothing but the dim and twinkling light of the fixed ſtars to enlighten them?" Others, however, have made ſuppoſitions more agreeable to our notions of the benevolent character of the Deity. Sir Iſaac Newton thinks that the ſudden blaze of ſome ſtars may have been occaſioned by the falling of a comet into them, by which means they would be enabled to emit a prodigious light for a little time, after which they would gradually return to their former ſtate. Others have thought that the variable ones, which diſappear for a time, were planets, which were only viſible during ſome part of their courſe. But this their apparent immobility, notwithſtanding their decreaſe of luſtre, will not allow us to think. Some have imagined, that one ſide of them might be naturally much darker than the other, and when by the revolution of the ſtar upon its axis the dark ſide was turned towards us, the ſtar became inviſible, and, for the ſame reaſon, after ſome interval, reſumed its former luſtre.

Conclusions from the foregoing Appearances.

195
Opinion of M. Maupertuis.

M. Maupertuis, in his diſſertation on the figures of the celeſtial bodies (p. 61—63.), is of opinion, that ſome ſtars, by their prodigious quick rotations on their axes, may not only aſſume the figures of oblate ſpheroids, but that, by the great centrifugal force ariſing from ſuch rotations, they may become of the figures of mill-ſtones; or be reduced to flat circular planes, ſo thin as to be quite inviſible when their edges are turned towards us; as Saturn's ring is in ſuch poſitions. But when very eccentric planets or comets go round any flat ſtar, in orbits much inclined to its equator, the attraction of the planets or comets in their perihelions muſt alter the inclination of the axis of that ſtar; on which account it will appear more or leſs large and luminous, as its broad ſide is more or leſs turned towards us. And thus he imagines we may account for the apparent changes of magnitude and luſtre in thoſe ſtars, and likewiſe for their appearing and diſappearing.

196
Mr Dunn's hypotheſis.

Laſtly, Mr Dunn (Phil. Tranſ. Vol. LII.) in a diſſertation concerning the apparent increaſe of magnitude in the heavenly bodies when they approach the horizon, conjectures that the interpoſition of ſome groſs atmoſphere may ſolve the phenomena both of nebulous and new ſtars. "The phenomena of nebulous and new ſtars (ſays he) have engaged the attention of curious aſtronomers; but none that I know of have given any reaſon for the appearance of nebulous ſtars. Poſſibly what has been before advanced may alſo be applicable for inveſtigating reaſons for thoſe ſtrange appearances in the remote parts of the univerſe. From many inſtances which might be produced concerning the nature and properties of lights and illuminations on the earth's ſurface, concerning the nature and properties of the earth's atmoſphere, and concerning the atmoſpheres and illuminations of comets, we may ſafely conclude, that the atmoſpheres of comets and of our earth are more groſs in their nature than the etherial medium which is generally diffuſed through the ſolar ſyſtem. Poſſibly a more aqueous vapour in the one than the other makes the difference. Now, as the atmoſpheres of comets and of planets in our ſolar ſyſtem are more groſs than the ether which is generally diffuſed through our ſolar ſyſtem, why may not the etherial medium diffuſed throughout thoſe other ſolar ſyſtems (whoſe centres are their reſpective fixed ſtars) be more groſs than the etherial medium diffuſed throughout our ſolar ſyſtem? This indeed is an hypotheſis, but ſuch an one as agrees exactly with nature. For theſe nebulous ſtars appear ſo much like comets, both to the naked eye and through teleſcopes, that the one cannot always, by any difference of their extraneous light, be known from the other. Such orbs of groſs ether reflecting

Concluſions from the foregoing Appearances.

flecting light more copiouſly, or like the atmoſpheres of comets, may help us to judge of the magnitudes of the orbs illuminated by thoſe remote ſuns, when all other means ſeem to fail. The appearance of new ſtars, and diſappearance of others, poſſibly may be occaſioned by the interpoſition of ſuch an etherial medium, within their reſpective orbs, as either admits light to paſs freely, or wholly abſorbs it at certain times, whilſt light is conſtantly purſuing its journey through the vaſt regions of ſpace."

197 Mr Michell's conjectures concerning the nature of the fixed ſtars.

198 In what caſes light may be ſuppoſed to return to the body that emits it.

In the Philoſophical Tranſactions for 1783, however, Mr Michell, in propoſing a method to determine the diſtance, magnitude, &c. of the fixed ſtars by the diminution of the velocity of their light, ſhould any ſuch thing be diſcovered, makes ſuch ſuppoſitions as ſeem totally inconſiſtent with what has been juſt now advanced. "The very great number of ſtars (ſays he) that have been diſcovered to be double, treble, &c. particularly by Mr Herſchel, if we apply the doctrine of chances, as I have heretofore done in my Inquiry into the probable parallax, &c. of the fixed ſtars, publiſhed in the Philoſophical Tranſactions for the year 1767, cannot leave a doubt with any one who is properly acquainted with the force of thoſe arguments, that by far the greateſt part, if not all of them, are ſyſtems of ſtars ſo near each other, as probably to be liable to be affected ſenſibly by their mutual gravitation; and it is therefore not unlikely, that the periods of the revolutions of ſome of theſe about their principals (the ſmaller ones being, upon this hypotheſis, to be conſidered as ſatellites to the others) may ſome time or other be diſcovered." Having then ſhown in what manner the magnitude of a fixed ſtar, if its denſity were known, would affect the velocity of its light, he concludes at laſt, that "if the ſemidiameter of a ſphere of the ſame denſity with the ſun were to exceed his in the proportion of 500 to 1, a body falling from an infinite height towards it (or moving in a parabolic curve at its ſurface) would have acquired a greater velocity than that of light; and conſequently, ſuppoſing light to be attracted by the ſame force in proportion to its *vis inertiæ* with other bodies, all light emitted from ſuch a body would be made to return towards it by its own proper gravity. But if the ſemidiameter of a ſphere, of the ſame denſity with the ſun, was of any other ſize leſs than 497 times that of the ſun, though the velocity of light emitted by ſuch a body would never be wholly deſtroyed, yet it would always ſuffer ſome diminution, more or leſs according to the magnitude of the ſphere. The ſame effects would likewiſe take place if the ſemidiameters were different from thoſe already mentioned, provided the denſity was greater or leſs in the duplicate ratio of thoſe ſemidiameters inverſely."

199 Comparative brightneſs of the ſun and fixed ſtars.

After proceeding in his calculations, in order to find the diameter and diſtance of any ſtar, he proceeds thus: "According to Mr Bouguer, the brightneſs of the ſun exceeds that of a wax candle in no leſs a proportion than that of 8000 to 1. If therefore the brightneſs of any of the fixed ſtars ſhould not exceed that of our common candles, which, as being ſomething leſs luminous than wax, we will ſuppoſe in round numbers to be only one ten thouſandth part as bright as the ſun, ſuch a ſtar would not be viſible at more than one hundredth part of the diſtance at which it would be ſeen if it were as bright as the ſun. Now, becauſe the ſun would ſtill, I apprehend, appear as bright and luminous as the ſtar Sirius, if removed to 400,000 times his preſent diſtance, ſuch a body, if no brighter than our common candles, would only appear equally luminous with that ſtar at 4000 times the diſtance of the ſun; and we might then be able, with the beſt teleſcopes, to diſtinguiſh ſome ſenſible apparent diameter of it: but the apparent diameters of the ſtars of leſſer magnitudes would ſtill be too ſmall to be diſtinguiſhable even with our beſt teleſcopes, unleſs they were yet a good deal leſs luminous; which may poſſibly, however, be the caſe with ſome of them: for though we have indeed very ſlight grounds to go upon with regard to the ſpecific brightneſs of the fixed ſtars, compared with that of the ſun at preſent, and can therefore form only very uncertain and random conjectures concerning it; yet from the infinite variety which we find in the works of the creation, it is not unreaſonable to ſuſpect, that very poſſibly ſome of the fixed ſtars may have ſo little natural brightneſs in proportion to their magnitude, as to admit of their diameters having ſome ſenſible apparent ſize when they ſhall come to be more carefully examined, and with larger and better teleſcopes than have been hitherto in common uſe.

Concluſions from the foregoing Appearances.

200 Luminous appearance of the ſun ſuppoſed to proceed from an atmoſphere

"With regard to the ſun, we know that his whole ſurface is extremely luminous, a very ſmall and temporary interruption ſometimes, from a few ſpots, excepted. This univerſal and exceſſive brightneſs of the whole ſurface is probably owing to an atmoſphere, which being luminous throughout, and in ſome meaſure alſo tranſparent, the light proceeding from a conſiderable depth of it all arrives at the eye, in the ſame manner as the light of a great number of candles would do if they were placed one behind another, and their flames were ſufficiently tranſparent to permit the light of the more diſtant ones to paſs through thoſe that were nearer without interruption.

201 Of the variable ſtars.

"How far the ſame conſtitution may take place in the fixed ſtars we do not know: probably, however, it may ſtill do ſo in many; but there are ſome appearances, with regard to a few of them, which ſeem to make it probable that it does not do ſo univerſally. Now, if I am right in ſuppoſing the light of the ſun to proceed from a luminous atmoſphere which muſt neceſſarily diffuſe itſelf equally over the whole ſurface, and I think there can be very little doubt that this is really the caſe, this conſtitution cannot well take place in thoſe ſtars which are in ſome degree periodically more and leſs luminous, ſuch as that in Collo Ceti, &c. It is alſo not very improbable, that there is ſome difference from that of the ſun in the conſtitution of thoſe ſtars which have ſometimes appeared and diſappeared, of which that in the conſtellation of Caſſiopeia is a notable inſtance. And if theſe conjectures are well founded, which have been formed by ſome philoſophers, concerning ſtars of this kind, that they are not wholly luminous, or at leaſt not conſtantly ſo, but that all, or by far the greateſt part of their ſurfaces, is ſubject to conſiderable changes, ſometimes becoming luminous, at others extinguiſhed; it is amongſt ſtars of this ſort that we are moſt likely to meet with inſtances of a ſenſible apparent diameter, their light being much more likely not to be ſo great in proportion as that of the ſun, which if removed to 400,000 times his preſent diſtance, would ſtill appear, I ap-

Concluſions from the foregoing Appearances.

I apprehend, as bright as Sirius, as I have obſerved above; whereas it is hardly to be expected, with any teleſcope whatſoever, that we ſhould ever be able to diſtinguiſh a well-defined diſk of any body of the ſame ſize with the ſun at much more than 10,000 times his preſent diſtance.

"Hence the greateſt diſtance at which it would be poſſible to diſtinguiſh any ſenſible apparent diameter of a body as denſe as the ſun, cannot well greatly exceed five hundred times ten thouſand; that is five million times the diſtance of the ſun; for if the diameter of ſuch a body was not leſs than 500 times that of the ſun, its light, as has been ſhown above, could never arrive at us."

202 Mr Herſchel's opinion concerning the conſtruction of the univerſe.

Mr Herſchel improving on Mr Michell's idea of the fixed ſtars being collected into groups, and aſſiſted by his own obſervations with the extraordinary teleſcopic powers already mentioned, has ſuggeſted a theory concerning the conſtruction of the univerſe entirely new and ſingular. It had been the opinion of former aſtronomers, that our ſun, beſides occupying the centre of the ſyſtem which properly belongs to him, occupied alſo the centre of the univerſe; but Mr Herſchel is of a very different opinion. "Hitherto (ſays he) the ſidereal heavens have, not inadequately for the purpoſe deſigned, been repreſented by the concave ſurface of a ſphere, in the centre of which the eye of the obſerver might be ſuppoſed to be placed. It is true, the various magnitudes of the fixed ſtars even then plainly ſuggeſted to us, and would have better ſuited the idea of an expanded firmament of three dimenſions; but the obſervations upon which I am now going to enter, ſtill farther illuſtrate and enforce the neceſſity of conſidering the heavens in this point of view. In future therefore we ſhall look upon thoſe regions into which we may now penetrate by means of ſuch large teleſcopes *, as a naturaliſt regards a rich extent of ground or chain of mountains, containing ſtrata variouſly inclined and directed, as well as conſiſting of very different materials. A ſurface of a globe or map therefore will but ill delineate the interior parts of the heavens."

203 His obſervations on the Via Lactea.

With the powerful teleſcope mentioned in the note, Mr Herſchel firſt began to ſurvey the Via Lactea, and found that it completely reſolved the whitiſh appearance into ſtars, which the teleſcopes he formerly uſed had not light enough to do. The portion he firſt obſerved was that about the hand and club of Orion; and found therein an aſtoniſhing multitude of ſtars, whoſe number he endeavoured to eſtimate by counting many fields †, and computing from a mean of theſe how many might be contained in a given portion of the milky way. In the moſt vacant place to be met with in that neighbourhood he found 63 ſtars; other ſix fields contained 110, 60, 70, 90, 70, and 74 ſtars; a mean of all which gave 79 for the number of ſtars to each field: and thus he found, that by allowing 15 minutes for the diameter of his field of view, a belt of 15 degrees long and two broad, which he had often ſeen paſs before his teleſcope in an hour's time, could not contain leſs than 50,000 ſtars, large enough to be diſtinctly numbered; beſides which, he ſuſpected twice as many more, which could be ſeen only now and then by faint glimpſes for want of ſufficient light.

Concluſions from the foregoing Appearances.

204 On the nebulæ.

The ſucceſs he had in the milky-way ſoon induced him to turn his teleſcope to the nebulous parts of the heavens, of which an accurate liſt had been publiſhed in the *Connoiſſance des Temps* for 1783 and 1784. Moſt of theſe yielded to a Newtonian reflector of 20 feet focal diſtance and 12 inches aperture; which plainly diſcovered them to be compoſed of ſtars, or at leaſt to contain ſtars, and to ſhow every other indication of conſiſting of them entirely. "The nebulæ (ſays he) are arranged into ſtrata, and run on to a great length; and ſome of them I have been able to purſue, and to gueſs pretty well at their form and direction. It is probable enough that they may ſurround the whole ſtarry ſphere of the heavens, not unlike the milky-way, which undoubtedly is nothing but a ſtratum of fixed ſtars: and as this latter immenſe ſtarry bed is not of equal breadth or luſtre in every part, nor runs on in one ſtraight direction, but is curved, and even divided into two ſtreams along a very conſiderable portion of it; we may likewiſe expect the greateſt variety in the ſtrata of the cluſters of ſtars and nebulæ. One of theſe nebulous beds is ſo rich, that in paſſing through a ſection of it in the time of only 36 minutes, I have detected no leſs than 31 nebulæ, all diſtinctly viſible upon a fine blue ſky. Their ſituation and ſhape, as well as condition, ſeem to denote the greateſt variety imaginable. In another ſtratum, or perhaps a different branch of the former, I have often ſeen double and treble nebulæ variouſly arranged; large ones with ſmall, ſeemingly attendants; narrow, but much extended lucid nebulæ or bright daſhes; ſome of the ſhape of a fan, reſembling an electric bruſh iſſuing from a lucid point; others of the cometic ſhape, with a ſeeming nucleus in the centre, or like cloudy ſtars ſurrounded with a nebulous atmoſphere: a different ſort again contain a nebuloſity of the milky kind, like that wonderful inexplicable phenomenon about θ Orionis; while others ſhine with a fainter mottled kind of light, which denotes their being reſolvable into ſtars.

205 They are arranged into ſtrata.

206 Variety of ſhapes aſſumed by them.

207 Why the milky-way appears to ſurround the heavens.

"It is very probable that the great ſtratum called the *milky-way*, is that in which the ſun is placed, though perhaps not in the very centre of its thickneſs. We gather this from the appearance of the galaxy, which ſeems to encompaſs the whole heavens, as it certainly muſt do if the ſun is within the ſame. For ſuppoſe a number of ſtars arranged between two parallel planes, indefinitely extended every way, but at a given conſiderable diſtance from one another, and calling this a ſidereal ſtratum, an eye placed ſomewhere within it will ſee all the ſtars in the direction of the planes of the ſtratum projected into a great circle, which will appear lucid on account of the accumulation of the ſtars, while the reſt of the heavens at the ſides will only ſeem to be ſcattered over with conſtellations, more or leſs

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* Mr Herſchel's obſervations, on which this theory is founded, were made with a Newtonian reflector of 20 feet focal length, and an aperture of 18 inches.

† By this word we are to underſtand the apparent ſpace in the heavens he could ſee at once through his teleſcope.

ASTRONOMY

Plate LXX

Fig. 100.

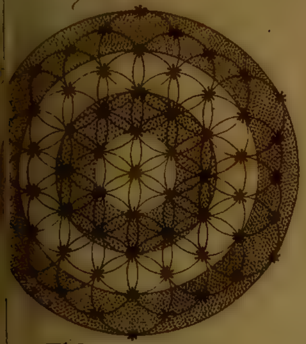


Fig. 102.

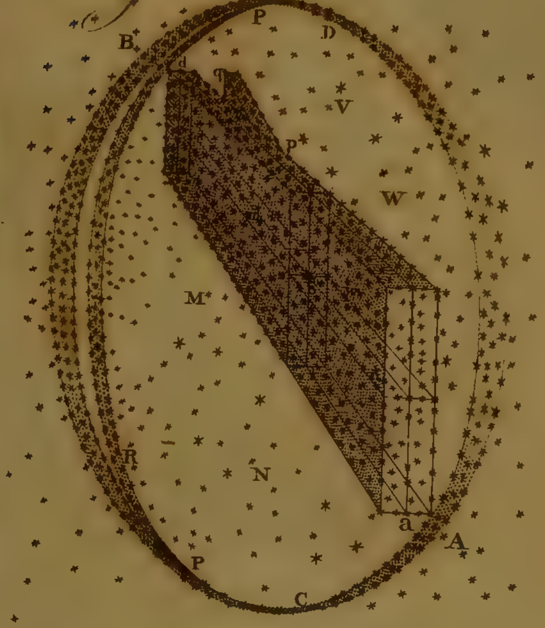


Fig. 101.

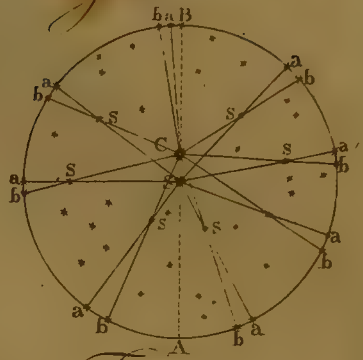


Fig. 103.

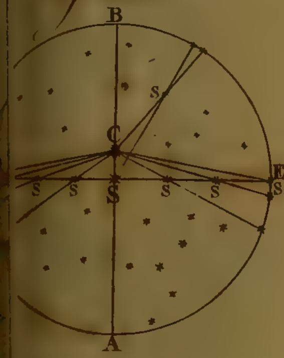


Fig. 104.

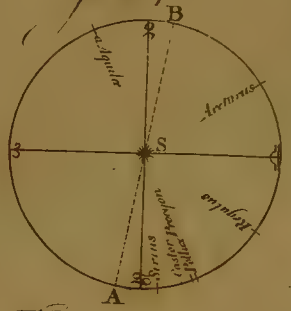


Fig. 106.

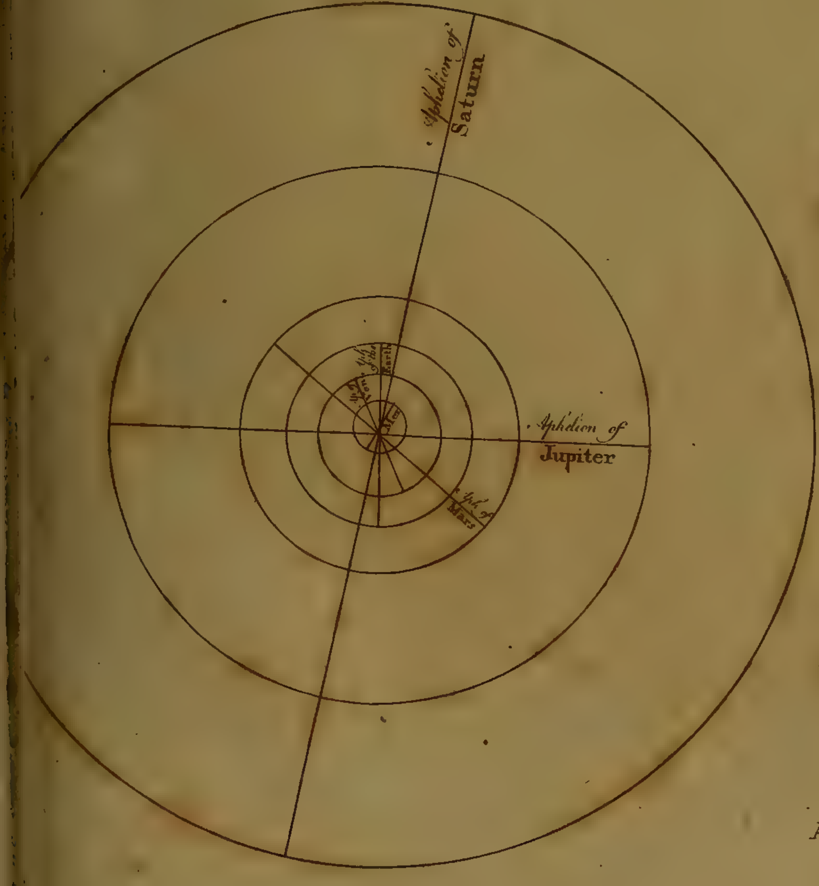


Fig. 105.

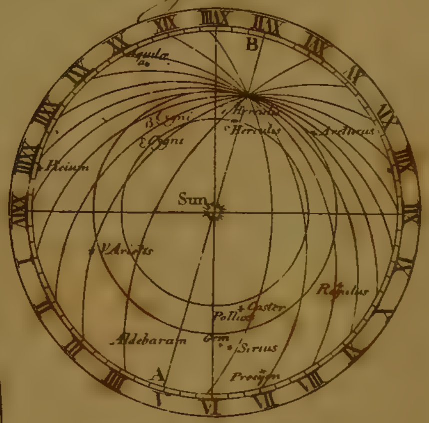
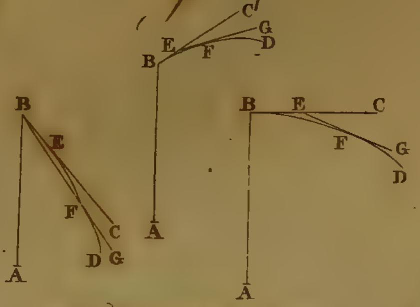


Fig. 107.



Thackara & Vallance sculp^t.

Concluſions from the foregoing Appearances.

leſs crowded according to the diſtance of the planes or number of ſtars contained in the thickneſs or ſides of the ſtratum.

“ Thus in fig. 102. an eye at S within the ſtratum *ab*, will ſee the ſtars in the direction of its length *ab*, or height *ed*, with all thoſe in the intermediate ſituation, projected into the lucid circle ABCD; while thoſe in the ſides *me*, *nw*, will be ſeen ſcattered over the remaining part of the heavens at MVNW.

208 Celeſtial appearances ſolved on Mr Herſchel's hypotheſis.

“ If the eye were placed ſomewhere without the ſtratum, at no very great diſtance, the appearance of the ſtars within it would aſſume the form of one of the leſſer circles of the ſphere, which would be more or leſs contracted to the diſtance of the eye: and if this diſtance were exceedingly increaſed, the whole ſtratum might at laſt be drawn together into a lucid ſpot of any ſhape, according to the poſition, length, and height of the ſtratum.

“ Let us now ſuppoſe, that a branch or ſmaller ſtratum ſhould run out from the former in a certain direction, and let it alſo be contained between two parallel planes extended indefinitely onwards, but ſo that the eye may be placed in the great ſtratum ſomewhere before the ſeparation, and not far from the place where the ſtrata are ſtill united; then will this ſecond ſtratum not be projected into a bright circle like the former, but will be ſeen as a lucid branch proceeding from the firſt, and returning to it again at a certain diſtance leſs than a ſemicircle. Thus, in the ſame figure, the ſtars in the ſmall ſtratum *p g* will be projected into a bright arch at PRRP, which, after its ſeparation from the circle CBD, unites with it again at P.

“ What has been inſtanced in parallel planes may eaſily be applied to ſtrata irregularly bounded, and running in various directions; for their projection will of conſequence vary according to the quantities of the variations in the ſtrata and the diſtance of the eye from the ſame. And thus any kind of curvatures, as well as various degrees of brightneſs, may be produced in the projections.

209 Of the ſun's place in the univerſe.

“ From appearances, then, as I obſerved before, we may infer, that the ſun is moſt likely placed in one of the great ſtrata of the fixed ſtars, and very probably not far from the place where ſome ſmaller ſtratum branches out from it. Such a ſuppoſition will ſatisfactorily, and with great ſimplicity, account for all the phenomena of the milky way; which according to this hypotheſis, is no other than the appearance of the projection of the ſtars contained in this ſtratum and its ſecondary branch. As a farther inducement to look on the galaxy in this point of view, let it be conſidered, that we can no longer doubt of its whitiſh appearance ariſing from the mixed luſtre of the numberleſs ſtars that compoſe it. Now, ſhould we ſuppoſe it to be an irregular ring of ſtars, in the centre nearly of which we muſt then ſuppoſe the ſun to be placed, it will appear not a little extraordinary, that the ſun, being a fixed ſtar like thoſe which compoſe this imagined ring, ſhould juſt be in the centre of ſuch a multitude of celeſtial bodies, without any apparent reaſon for this ſingular diſtinction; whereas, on our ſuppoſition, every ſtar in this ſtratum, not very near the termination of its length or height, will be ſo placed as alſo to have its own galaxy, with only ſuch variations in the form and luſtre of it as may ariſe from the particular ſituation of each ſtar.

Concluſions from the foregoing Appearances.

210 Herſchel's method of gauging the heavens.

“ Various methods may be taken to come to a knowledge of the ſun's place in the ſidereal ſtratum, one of which I have already begun to put in practice. I call it *gauging the heavens*, or the *ſtar-gauge*. It conſiſts in repeatedly taking the number of ſtars in ten fields of view of my reflector very near each other; and by adding their ſums, and cutting off one decimal on the right, a mean of the contents of the heavens in all the parts which are thus gauged are obtained. Thus it appears, that the number of ſtars increaſes very much as we approach the milky way; for in the parallel from 92 to 24 degrees north polar diſtance, and right aſcenſion 15 h. 10′, the ſtar-gauge runs up from 9.4 ſtars in the field to 18.6 in about an hour and an half; whereas in the parallel from 78 to 80 degrees north polar diſtance, and R. A. 11, 12, 13, and 14 hours, it very ſeldom riſes above 4. We are, however, to remember, that, with different inſtruments, the account of the gauges will be very different, eſpecially on our ſuppoſition of the ſun in a ſtratum of ſtars. For let *ab*, fig. 98. be the ſtratum, and ſuppoſe the ſmall circle *g h l k* to repreſent the ſpace into which, by the light and power of a given teleſcope, we are enabled to penetrate, and let GHLK be the extent of another portion which we are enabled to viſit by means of a larger aperture and power; it is evident, that the gauges with the latter inſtrument will differ very much in their account of ſtars contained at MN and at KG or LH, when with the former they will hardly be affected with the change from *mn* to *kg* or *lk*.

211 How to find the place of the ſun in the ſidereal ſtratum.

“ The ſituation of the ſun in the ſidereal ſtratum will be found by conſidering in what manner the ſtar-gauge agrees with the length of a ray revolving in ſeveral directions about an aſſumed point, and cut off by the bounds of the ſtratum. Thus, in fig. 99. let S be the place of an obſerver; S r r r, *S r r r*, lines in the plane r S r, *r S r*, drawn from S within the ſtratum to one of the boundaries here repreſented by the plane AB. Then, ſince neither the ſituation of S nor the form of the limiting ſurface AB is known, we are to aſſume a point, and apply to it lines proportional to the ſeveral gauges that have been obtained, and at ſuch angles from each other as they may point out; then will the termination of theſe lines delineate the boundary of the ſtratum, and conſequently manifeſt the ſituation of the ſun within the ſame.

212 Obſervations on nebulæ.

“ In my late obſervations on nebulæ, I ſoon found, that I generally detected them in certain directions rather than in others: that the ſpaces preceding them were generally quite deprived of their ſtars, ſo as often to afford many fields without a ſingle ſtar in it: that the nebulæ generally appeared ſome time after among ſtars of a certain conſiderable ſize, and but ſeldom among very ſmall ſtars: that when I came to one nebula, I generally found ſeveral more in the neighbourhood: that afterwards a conſiderable time paſſed before I came to another parcel. Theſe events being often repeated in different altitudes of my inſtrument, and ſome of them at conſiderable diſtances from each other, it occurred to me that the intermediate ſpaces between the ſweeps might alſo contain nebulæ; and finding this to hold good more than once, I ventured to give

Concluſions from the foregoing Appearances.

213 Direction of ſome of the principal ſtrata of ſtars.

notice to my aſſiſtant at the clock, that 'I found myſelf on nebulous ground.' But how far theſe circumſtances of vacant places preceding and following the nebulous ſtrata, and their being as it were contained in a bed of ſtars ſparingly ſcattered between them, may hold good in more diſtant portions of the heavens, and which I have not yet been able to viſit in any regular manner, I ought by no means to hazard a conjecture. I may venture, however, to add a few particulars about the direction of ſome of the capital ſtrata, or their branches. The well-known nebula of Cancer, viſible to the naked eye, is probably one belonging to a certain ſtratum, in which I ſuppoſe it to be ſo placed as to lie neareſt to us. This ſtratum I ſhall call that of Cancer. It runs from ε Cancri towards the ſouth, over the 67th nebula of the *Connoiſſance des Temps*, which is a very beautiful and pretty much compreſſed cluſter of ſtars, eaſily to be ſeen by any good teleſcope; and in which I have obſerved above 200 ſtars at once in the field of view of my great reflector with a power of 157. This cluſter appearing ſo plainly with any good common teleſcope, and being ſo near to the one which may be ſeen with the naked eye, denotes it to be probably the next in diſtance to that within the quartile formed by γ, δ, η, θ. From the 67th nebula, the ſtratum of Cancer proceeds towards the head of Hydra; but I have not yet had time to trace it farther than the equator.

" Another ſtratum, which perhaps approaches nearer to the ſolar ſyſtem than any of the reſt, and whoſe ſituation is nearly at rectangles with the great ſidereal ſtratum in which the ſun is placed, is that of Coma Berenices, as I ſhall call it. I ſuppoſe the Coma itſelf to be one of the cluſters in it, and that on account of its nearneſs it appears to be ſo ſcattered. It has many capital nebulæ very near it; and in all probability this ſtratum runs out a very conſiderable way. It may perhaps even make the circuit of the heavens, though very likely not in one of the great circles of the ſphere; for unleſs it ſhould chance to interſect the great ſidereal ſtratum of the milky way before mentioned in the very place in which the ſun is ſtationed, ſuch an appearance would hardly be produced. However, if the ſtratum of Coma Berenices ſhould extend ſo far as I apprehend it may, the direction of it towards the north lies probably, with ſome windings, through the Great Bear onwards to Caſſiopeia, thence through the Girdle of Andromeda and the Northern Fiſh, proceeding towards Cetus; while towards the ſouth it paſſes through the Virgin, probably on to the tail of Hydra and Centaurus."

* *Philoſ. Tranſ.* vol. 75.

214 Of the interior conſtruction of the heavens.

By a continued ſeries of obſervations, Mr Herſchel became confirmed in his notions; and in a ſucceeding paper has given a ſketch of his opinions concerning the interior conſtruction of the heavens.—" That the milky way (ſays he) is a moſt extenſive ſtratum of ſtars of various ſizes, admits no longer of the leaſt doubt; and that our ſun is one of the heavenly bodies belonging to it, is as evident. I have now viewed and gauged this ſhining zone in almoſt every direction, and find it compoſed of ſhining ſtars, whoſe number, by the account of thoſe gauges, conſtantly increaſes and decreaſes in proportion to its apparent brightneſs to the naked eye. But in order to develope the ideas of the univerſe that have been ſuggeſted by my late obſervations, it will be beſt to take the ſubject from a point of view at a conſiderable diſtance both of ſpace and time.

Concluſions from the foregoing Appearances.

215 Conſequences of the laws of attraction acting among the ſtars.

" Let us then ſuppoſe numberleſs ſtars of various ſizes ſcattered over an indefinite portion of ſpace, in ſuch a manner as to be almoſt equally diſtributed thro' the whole. The laws of attraction which no doubt extend to the remoteſt regions of the fixed ſtars, will operate in ſuch a manner as moſt probably to produce the following remarkable effects.

216 Nebulæ how formed.

" I. It will frequently happen, that a ſtar, being conſiderably larger than its neighbouring ones, will attract them more than they will be attracted by others that are immediately around them; by which means they will be in time, as it were, condenſed about a centre; or, in other words, form themſelves into a cluſter of ſtars of almoſt a globular figure, more or leſs regularly ſo according to the ſize and original diſtance of the ſurrounding ſtars. The perturbations of theſe mutual attractions muſt undoubtedly be very intricate, as we may eaſily comprehend by conſidering what Sir Iſaac Newton has ſaid, *Princip.* lib. i. prob. 38, *et ſeq.*: but in order to apply this great author's reaſoning of bodies moving in ellipſis to ſuch as are here for a while ſuppoſed to have no other motion than what their mutual gravity has imparted to them, we muſt ſuppoſe the conjugate axes of theſe ellipſes indefinitely diminiſhed, whereby the ellipſes will become ſtraight lines.

" II. The next caſe, which will happen almoſt as frequently as the former, is where a few ſtars, though not ſuperior in ſize to the reſt, may chance to be rather nearer each other than the ſurrounding ones; for here alſo will be formed a prevailing attraction in the combined centre of gravity of them all, which will occaſion the neighbouring ſtars to draw together; not, indeed, ſo as to form a regular globular figure, but, however, in ſuch a manner as to be condenſed towards the common centre of gravity of the whole irregular cluſter. And this conſtruction admits of the utmoſt variety of ſhapes, according to the number and ſituation of the ſtars which firſt gave riſe to the condenſation of the reſt.

" III. From the compoſition and repeated conjunction of both the foregoing forms, a third may be derived, when many large ſtars, or combined ſmall ones, are ſituated in long extended regular or crooked rows, hooks, or branches; for they will alſo draw the ſurrounding ones ſo as to produce figures of condenſed ſtars coarſely ſimilar to the former, which gave riſe to theſe condenſations.

" IV. We may likewiſe admit of ſtill more extenſive combinations; when at the ſame time that a cluſter of ſtars is forming in one part of ſpace, there may be another collecting in a different, but perhaps not far diſtant quarter, which may occaſion a mutual approach towards their common centre of gravity.

217 Vacancies how they are occaſioned in the heavens.

" V. In the laſt place, as a natural conſequence of the former caſes, there will be great cavities or vacancies formed by the retreat of the ſtars towards the various centres which attract them; ſo that, upon the whole, there is evidently a field of the greateſt variety for the mutual and combined attractions of the heavenly bodies to exert themſelves in.

" From this theoretical view of the heavens, which has

Concluſions from the foregoing Appearances.

218 How the ſtars muſt appear to us according to this hypotheſis.

has been taken from a point not leſs diſtant in time than in ſpace, we will now retreat to our own retired ſtation, in one of the planets attending a ſtar in its great combination with numberleſs others: and in order to inveſtigate what will be the appearances from this contracted ſituation, let us begin with the naked eye. The ſtars of the firſt magnitude, being in all probability the neareſt, will furniſh us with a ſtep to begin our ſcale. Setting off, therefore, with the diſtance of Sirius or Arcturus, for inſtance, as unity, we will at preſent ſuppoſe, that thoſe of the ſecond magnitude are at double, thoſe of the third at treble, the diſtance, &c. Taking it for granted, then, that a ſtar of the ſeventh magnitude (the ſmalleſt ſuppoſed viſible with the naked eye) is about ſeven times as far as one of the firſt, it follows, that an obſerver who is incloſed in a globular cluſter of ſtars, and not far from the centre, will never be able with the naked eye to ſee to the end of it; for ſince, according to the above eſtimations, he can only extend his view to about ſeven times the diſtance of Sirius, it cannot be expected that his eyes ſhould reach the borders of a cluſter which has perhaps not leſs than 50 ſtars in depth every where around him. The whole univerſe to him, therefore, will be compriſed in a ſet of conſtellations richly ornamented with ſcattered ſtars of all ſizes. Or if the united brightneſs of a neighbouring cluſter of ſtars ſhould, in a remarkable clear night, reach his ſight, it will put on the appearance of a ſmall, faint, whitiſh, nebulous cloud, not to be perceived without the greateſt attention. Let us ſuppoſe him placed in a much extended ſtratum, or branching cluſter of millions of ſtars, ſuch as may fall under the third form of nebulæ already conſidered. Here alſo the heavens will not only be richly ſcattered over with brilliant conſtellations, but a ſhining zone or milky way will be perceived to ſurround the whole ſphere of the heavens, owing to the combined light of thoſe ſtars which are too ſmall, that is, too remote to be ſeen. Our obſerver's ſight will be ſo confined, that he will imagine this ſingle collection of ſtars, though he does not even perceive the thouſandth part of them, to be the whole contents of the heavens. Allowing him now the uſe of a common teleſcope, he begins to ſuſpect that all the milkineſs of the bright path which ſurrounds the ſphere may be owing to ſtars. He perceives a few cluſters of them in various parts of the heavens, and finds alſo that there are a kind of nebulous patches: but ſtill his views are not extended to reach ſo far as to the end of the ſtratum in which he is ſituated; ſo that he looks upon theſe patches as belonging to that ſyſtem which to him ſeems to comprehend every celeſtial object. He now increaſes his power of viſion; and, applying himſelf to a cloſe obſervation, finds that the milky way is indeed no other than a collection of very ſmall ſtars. He perceives, that thoſe objects which had been called *nebulæ*, are evidently nothing but cluſters of ſtars. Their number increaſes upon him; and when he reſolves one nebula into ſtars, he diſcovers ten new ones which he cannot reſolve. He then forms the idea of immenſe ſtrata of fixed ſtars, of cluſters of ſtars and of nebulæ; till, going on with ſuch intereſting obſervations, he now perceives, that all theſe appearances muſt naturally ariſe from the confined ſituation in which we are placed. *Confined* it may juſtly be called, though in no leſs a ſpace than what appeared before to be the whole region of the fixed ſtars, but which now has aſſumed the ſhape of a crookedly branching nebula; not indeed one of the leaſt, but perhaps very far from being the moſt conſiderable, of thoſe numberleſs cluſters that enter into the conſtruction of the heavens."

219 Arguments in favour of the foregoing theory from obſervations on nebulæ.

Our author now proceeds to ſhow that this theoretical view of the heavens is perfectly conſiſtent with facts, and ſeems to be confirmed by a ſeries of obſervations. Many hundreds of nebulæ of the firſt and ſecond forms are to be ſeen in the heavens; and their places, he ſays, will hereafter be pointed out; many of the third form deſcribed, and inſtances of the fourth related; a few of the cavities mentioned in the fifth particulariſed, though many more have been already obſerved: ſo that, "upon the whole (ſays he), I believe it will be found, that the forgoing theoretical view, with all its conſequential appearances, as ſeen by an eye incloſed in one of the nebulæ, is no other than a drawing from nature, wherein the features of the original have been cloſely copied: and I hope the reſemblance will not be called a bad one, when it ſhall be conſidered how very limited muſt be the pencil of an inhabitant of ſo ſmall and retired a portion of an indefinite ſyſtem in attempting the picture of ſo unbounded an extent."

220 Method of meaſuring the dimenſions of the heavens.

Mr Herſchel next preſent us with a long table of ſtar-gauges, or accounts of the number of ſtars at once in the field of his teleſcope, which go as high as 588; after which he propoſes the following

PROBLEM.

"The ſtars being ſuppoſed nearly equally ſcattered, and their number, in a field of view of a known angular diameter, being given, to determine the length of the viſual ray.

"Here, the arrangement of the ſtars not being fixed upon, we muſt endeavour to find which way they may be placed ſo as to fill a given ſpace moſt equally. Suppoſe a rectangular cone cut into fruſtula by many equidiſtant planes perpendicular to the axis; then, if one ſtar be placed at the vertex and another in the axis at the firſt interſection, ſix ſtars may be ſet around it ſo as to be equally diſtant from one another and from the central ſtar. Theſe poſitions being carried on in the ſame manner, we ſhall have every ſtar within the cone ſurrounded by eight others at an equal diſtance from that ſtar taken at a centre. Fig. 100 contains four ſections of ſuch a cone diſtinguiſhed by alternate ſhades; which will be ſufficient to explain what ſort of arrangements I would point out.

"The ſeries of the number of ſtars contained in the ſeveral ſections will be 1, 7, 19, 37, 61, 91, &c. which, continued to n terms, the ſum of it, by the differential method, will be $na+n.\frac{n-1}{2}d'+n.\frac{n-1}{2}.\frac{n-2}{3}d''$,&c. where a is the firſt term, d', d'', d''', &c. the firſt, ſecond, and third differences. Then, ſince $a=1$, $d'=6$, $d''=6$, $d'''=0$, the ſum of the ſeries will be n^3. Let S be the given number of ſtars; 1 the diameter of the baſe of the field of view; and B the diameter of the great rectangular cone; and by trigonometry we ſhall

Concluſions from the foregoing Appearances.

have $B = \frac{\text{Radius}}{\text{Tang. } \frac{1}{2} \text{ field}}$. Now, ſince the field of view of a teleſcope is a cone, we ſhall have its ſolidity to that of the great cone of the ſtars formed by the above conſtruction, as the ſquare of the diameter of the baſe of the field of view to the ſquare of the diameter of the great cone, the height of both being the ſame; and the ſtars in each cone being in the ratio of the ſolidity, as being equally ſcattered, we have $n = \sqrt[3]{B^2 S}$; and the length of the viſual ray $= n - 1$, which was to be determined." Another ſolution of this problem, on the ſuppoſition of another arrangement of ſtars, is given; but Mr Herſchel prefers the former.

221 Proofs of our ſidereal ſyſtem being a nebula.

From the data now laid down, Mr Herſchel next endeavours to prove that the earth is 'the planet of a ſtar belonging to a compound nebula of the third form.' "I ſhall now (ſays he) proceed to ſhow, that the ſtupendous ſidereal ſyſtem we inhabit, this extenſive ſtratum, and its ſecondary branch, conſiſting of many millions of ſtars, is in all probability *a detached nebula.* In order to go upon grounds that ſeem to me to be capable of great certainty, they being no leſs than an actual ſurvey of the boundaries of our ſidereal ſyſtem, which I have plainly perceived as far as I have yet gone round it, every where terminated, and in moſt places very narrowly too, it will be proper to ſhow the length of my ſounding line, if I may ſo call it, that it may appear whether it was ſufficiently long for the purpoſe.

222 Length of the line by which Mr Herſchel meaſures the heavens

"In the moſt crowded parts of the milky-way, I have had fields of view that contained no fewer than 588 ſtars, and theſe were continued for many minutes; ſo that in one quarter of an hour's time there paſſed no leſs than 116,000 ſtars through the field of view of my teleſcope. Now, if we compute the length of the viſual ray, by putting $S = 588$, and the diameter of the field of view 15 minutes, we ſhall find $n = \sqrt[3]{B^2 S} = 498$; ſo that it appears the length of what I have called my Sounding Line, or $n - 1$, was not probably leſs than 497 times the diſtance of Sirius from the ſun.

"It may ſeem inaccurate that we ſhould found an argument on the ſtars being equally ſcattered, when, in all probability, there may not be any two of them in the heavens whoſe mutual diſtance ſhall be equal to that of any other two given ſtars: but it ſhould be conſidered, that when we take all the ſtars collectively, there will be a mean diſtance which may be aſſumed as the general one; and an argument founded on ſuch a ſuppoſition will have in its favour the greateſt probability of not being far ſhort of truth. And here I muſt obſerve, that the difference between a crowded place and a cluſter (none of the latter being put into the gauge table), may eaſily be perceived by the arrangement as well as the ſize and mutual diſtance of the ſtars: for in a cluſter they are generally not only reſembling each other pretty nearly in ſize, but a certain uniformity of diſtance alſo takes place: they are more and more accumulated towards the centre, and put on all the appearances which we ſhould naturally expect from a number of them collected into a group at a certain diſtance from us. On the other hand, the rich parts of the milky-way, as well as thoſe in the diſtant broad parts of the ſtratum, conſiſt of a mixture of ſtars of all poſſible ſizes, that are ſeemingly placed without any particular apparent order. Perhaps we might recollect, that a greater condenſation towards the centre of our ſyſtem than towards the borders of it ſhould be taken into conſideration; but with a nebula of the third form, containing ſuch various and extenſive combinations as I have found to take place in ours, this circumſtance, which in one of the firſt form would be of conſiderable moment, may, I think, be ſafely neglected.

223 Cluſter of ſtars defined.

Concluſions from the foregoing Appearances.

"If ſome other high gauge be ſelected from the table, ſuch as 472 or 344, the length of the viſual ray will be found 461 and 415. And although in conſequence of what has been ſaid, a certain degree of doubt may be left about the arrangement and ſcattering of the ſtars, yet when it is recollected, that in thoſe parts of the milky-way, where theſe high gauges were taken, the ſtars were neither ſo ſmall nor ſo crowded as they muſt have been, on a ſuppoſition of a much farther continuance of them, when certainly a milky or nebulous appearance muſt have come on, I need not fear to have over-rated the extent of my viſual ray; and indeed every thing that can be ſaid to ſhorten it will only contract the limits of our nebulæ, as it has in moſt places been of ſufficient length to go far beyond the bounds of it. Thus in the ſides of our ſtratum, oppoſite to our ſituation in it, where the gauges often run below 5, our nebulæ cannot extend to 100 times the diſtance of Sirius; and the ſame teleſcope which could ſhow 588 ſtars in a field of view of 15 minutes, muſt certainly have preſented me alſo with the ſtars in theſe ſituations, had they been there. If we ſhould anſwer this by obſerving, that they might be at too great a diſtance to be perceived, it will be allowing that there muſt at leaſt be a vacancy amounting to the length of a viſual ray, not ſhort of 400 times the diſtance of Sirius: and this is amply ſufficient to make our nebulæ a detached one. It is true, that it would not be conſiſtent confidently to affirm that we were on an iſland, unleſs we had found ourſelves every where bounded by the ocean; and therefore I ſhall go no farther than the gauges will authoriſe: but conſidering the little depth of the ſtratum in all thoſe places which have been actually gauged, to which muſt be added all the intermediate parts that have been viewed and found to be much like the reſt, there is but little room to expect a connection between our nebula and any of the neighbouring ones. A teleſcope, with a much larger aperture than my preſent one, graſping together a greater quantity of light, and thereby enabling us to ſee farther into ſpace, will be the ſureſt means of completing and eſtabliſhing the arguments that have been uſed: for if our nebula is not abſolutely a detached one, I am firmly perſuaded that an inſtrument may be made large enough to diſcover the places where the ſtars continue onwards. A very bright milky nebuloſity muſt there undoubtedly come on, ſince the ſtars in a field of view will increaſe in the ratio of n^3 greater than that of the cube of the viſual ray. Thus, if 588 ſtars in a given field of view are to be ſeen by a ray of 497 times the diſtance of Sirius, when this is lengthened to 1000, which is but little more than double the former, the number of ſtars in the ſame field of view will

224 Extent of our nebula.

will be no leſs than 4774: for when the viſual ray *r* is given, the number of ſtars S will be $=\frac{n^3}{B^2}$; where $n=r+1$; and a teleſcope with a threefold power of extending into ſpace, or with a ray of 1500, which I think may eaſily be conſtructed, will give us 16,096 ſtars. Nor would theſe be ſo cloſe, but that a good power applied to ſuch an inſtrument might eaſily diſtinguiſh them; for they need not, if arranged in regular ſquares, approach nearer to each other than 6″.27: but the milky nebuloſity I have mentioned, would be produced by the numberleſs ſtars beyond them, which, in one reſpect, the viſual ray might alſo be ſaid to reach. To make this appear, we muſt return to the naked eye; which, as we have before eſtimated, can only ſee the ſtars of the ſeventh magnitude ſo as to diſtinguiſh them: but it is nevertheleſs very evident, that the united luſtre of millions of ſtars, ſuch as I ſuppoſe the nebula in Andromeda to be, will reach our ſight in the ſhape of a very ſmall faint nebuloſity; ſince the nebula of which I ſpeak may eaſily be ſeen in a fine evening. In the ſame manner, my preſent teleſcope, as I have argued, has not only a viſual ray that will reach the ſtars at 497 times the diſtance of Sirius, ſo as to diſtinguiſh them, and probably much farther, but alſo a power of ſhowing the united luſtre of the accumulated ſtars that compoſe a milky nebuloſity at a diſtance far exceeding the former limits; ſo that from theſe conſiderations it appears again highly probable, that my preſent teleſcope not ſhowing ſuch a nebuloſity in the milky-way, goes already far beyond its extent: and conſequently much more would an inſtrument, ſuch as I have mentioned, remove all doubt on the ſubject, both by ſhowing the ſtars in the continuation of the ſtratum, and by expoſing a very ſtrong milky nebuloſity beyond them, that could no longer be miſtaken for the dark ground of the heavens.

225
Analogical arguments in favour of his doctrine.

"To theſe arguments, which reſt on the firm baſis of a ſeries of obſervation, we may add the following conſiderations drawn from analogy. Among the great number of nebulæ which I have now already ſeen, amounting to more than 900, there are many which in all probability are equally extenſive with that which we inhabit; and yet they are all ſeparated from each other by very conſiderable intervals. Some, indeed, there are that ſeem to be double and treble; and though with moſt of theſe it may be that they are at a very great diſtance from each other, yet we allow that ſome ſuch conjunctions really are to be found; nor is this what we mean to exclude. But then theſe compound, or double nebulæ, which are thoſe of the third and fourth forms, ſtill make a detached link in the great chain. It is alſo to be ſuppoſed, that there may be ſome thinly ſcattered ſolitary ſtars between the large interſtices of nebulæ; which being ſituated ſo as to be nearly equally attracted by the ſeveral cluſters when they were forming, remain unaſſociated: and though we cannot expect to ſee thoſe ſtars on account of their vaſt diſtance, yet we may well preſume that their number cannot be very conſiderable in compariſon to thoſe that are already drawn into ſyſtems: which conjecture is alſo abundantly confirmed in ſituations where the nebulæ are near enough to have their ſtars viſible; for they are all inſulated, and generally to be ſeen upon a very clear and pure ground, without any ſtar near them that might be thought to belong to them. And though I have often ſeen them in beds of ſtars, yet from the ſize of theſe latter we may be certain, that they were much nearer to us than thoſe nebulæ, and belonged undoubtedly to our own ſyſtem.

226
How the figure of our nebula may be delineated.

Having thus determined that the viſible ſyſtem of nature, by us called the *univerſe*, conſiſting of all the celeſtial bodies and many more than can be ſeen by the naked eye, is only a group of ſtars or ſuns with their planets, conſtituting one of thoſe patches called a *nebula*, and perhaps not one ten thouſandth part of what is really the univerſe, Mr Herſchel goes on to delineate the figure of this vaſt nebula, which he is of opinion may now be done; and for this purpoſe he gives a table, calculating the diſtance of the ſtars which form its extreme boundaries, or the length of the viſual ray in different parts, by the number of ſtars contained in the field of his teleſcope at different times, according to the principles already laid down. He does not, however, as yet attempt the whole nebula, but of a particular ſection, repreſented fig. 160. "I have taken one (ſays he) which paſſes through the poles of our ſyſtem, and is at rectangles to the conjunction of the branches, which I have called its *length*. The name of *poles* ſeemed to me not improperly applied to thoſe points which are 90 degrees diſtant from a circle paſſing along the milky way; and the north pole is here ſuppoſed to be ſituated in right aſcenſion 186°, and polar diſtance (that is from the pole commonly ſo called) 58°. The ſection is one which makes and angle of 35 degrees with our equator, croſſing it in 124½ and 304½ degrees. A celeſtial globe, adjuſted to the latitude of 55° north, and having σ Ceti near the meridian, will have the plane of this ſection pointed out by the horizon. The viſual rays are to be projected on the plane of the horizon of the latitude juſt mentioned, which may be done accurately enough by a globe adjuſted in the manner directed. The ſtars in the border, which are marked larger than the reſt, are thoſe pointed out by the gauges. The intermediate parts are filled up by ſmaller ſtars, arranged in ſtraight lines between the gauged ones. From this figure, which I hope is not a very inaccurate one, we may ſee that our nebula, as we obſerved before, is of the third form; that is, a very extenſive, branching, compound congeries of many millions of ſtars, which moſt probably owes its origin to many remarkably large, as well as pretty cloſely ſcattered ſmall ſtars, that may have drawn together the reſt. Now to have ſome idea of the wonderful extent of this ſyſtem, I muſt obſerve, that this ſection of it is drawn upon a ſcale where the diſtance of Sirius is no more than the 80th part of an inch; ſo that probably all the ſtars, which in the fineſt nights we are able to diſtinguiſh with the naked eye, may be comprehended within a ſphere drawn round the large ſtar near the middle, repreſenting our ſituation in the nebula of leſs than half a quarter of an inch radius."

Mr Herſchel now proceeds to offer ſome further thoughts on the origin of the nebulous ſtrata of the heavens; in doing which he gives ſome hints concerning the antiquity of them. "If it were poſſible (ſays he) to diſtinguiſh between the parts of an indefinitely extended whole, the nebula we inhabit might be ſaid to

Concluſions from the foregoing Appearances.

to be one that has fewer marks of antiquity than any of the reſt. To explain this idea perhaps more clearly, we ſhould recollect, that the condenſation of cluſters of ſtars has been aſcribed to a gradual approach; and whoever reflects on the number of ages that muſt have paſſed before ſome of the cluſters that are to be found in my intended catalogue of them could be ſo far condenſed as we find them at preſent, will not wonder if I aſcribe a certain air of youth and vigour to many very regularly ſcattered regions of our ſidereal ſtratum.

227
Of the decay and recompoſition of nebulæ.

There are, moreover, many places in it in which, if we may judge from appearances, there is the greateſt reaſon to believe that the ſtars are drawing towards ſecondary centres, and will in time ſeparate into cluſters, ſo as to occaſion many ſubdiviſions. Hence we may ſurmiſe, that when a nebulous ſtratum conſiſts chiefly of nebulæ of the firſt and ſecond forms, it probably owes its origin to what may be called the decay of a great compound nebula of the third form; and that the ſubdiviſions which happened to it in length of time, occaſioned all the ſmall nebulæ which ſprung from it to lie in a certain range, according as they were detached from the primary one. In like manner, our ſyſtem, after numbers of ages, may very poſſibly become divided ſo as to give riſe to a ſtratum of two or three hundred nebulæ; for it would not be difficult to point out ſo many beginning or gathering cluſters in it. This throws a conſiderable light upon that remarkable collection of many hundreds of nebulæ which are to be ſeen in what I have called the *nebulous ſtratum* in Coma Berenices. It appears from the extended and branching figure of our nebula, that there is room for the decompoſed ſmall nebulæ of a large reduced former great one to approach nearer to us in the ſides than in any other parts. Nay, poſſibly there might originally be another very large joining branch, which in time became ſeparated by the condenſation of the ſtars: and this may be the reaſon of the little remaining breadth of our ſyſtem in that very place; for the nebulæ of the ſtratum of the Coma are brighteſt and moſt crowded juſt oppoſite to our ſituation, or in the pole of our ſyſtem. As ſoon as this idea was ſuggeſted, I tried alſo the oppoſite pole; where accordingly I have met with a great number of nebulæ, though under a much more ſcattered form.

"Some parts of our ſyſtem indeed ſeem already to have ſuſtained greater ravages of time than others: for inſtance, in the body of the Scorpion is an opening or hole, which is probably owing to this cauſe. It is at leaſt four degrees broad; but its height I have not yet aſcertained. It is remarkable, that the 80 *Nebuleuſe ſans Etoiles* of the *Connoiſſance des Temps*, which is one of the richeſt and moſt compreſſed cluſters of ſmall ſtars I remember to have ſeen, is ſituated juſt on the weſt border of it, and would almoſt authoriſe a ſuſpicion that the ſtars of which it is compoſed were collected from that place, and had left the vacancy. What adds not a little to this ſurmiſe is, that the ſame phenomenon is once more repeated with the fourth cluſter of the *Connoiſſance des Temps*; which is alſo on the weſtern border of another vacancy, and has moreover a ſmall miniature cluſter, or eaſily reſolvable nebula, of about 2¼ minutes in diameter north, following it at no very great diſtance.

"There is a remarkable purity or clearneſs in the heavens when we look out of our ſtratum at the ſides; that is, towards Leo, Virgo, and Coma Berencies on one hand, and towards Cetus on the other; whereas the ground of the heavens becomes troubled as we approach towards the length or height of it. Theſe troubled appearances are eaſily to be explained by aſcribing them to ſome of the diſtant ſtraggling ſtars that yield hardly light enough to be diſtinguiſhed. And I have indeed often experienced this to be the cauſe, by examining theſe troubled ſpots for a long while together, when at laſt I generally perceived the ſtars which occaſioned them. But when we look towards the poles of our ſyſtem, where the viſual ray does not graze along the ſide, the ſtraggling ſtars will of courſe be very few in number: and therefore the ground of the heavens will aſſume that purity which I have always obſerved to take place in thoſe regions."

228
Univerſe compoſed of nebulæ.

Thus, then, according Mr Herſchel, the univerſe conſiſts of *nebulæ*, or innumerable collections of innumerable ſtars, each individual of which is a ſun not only equal, but much ſuperior to ours: at leaſt if the words of Mr Nicholſon have any weight; for he tells us, that "each individual ſun is deſtined to give light to *hundreds* of worlds that revolve about it, but which can no more be ſeen by us, on account of their great diſtance, than the ſolar planets can be ſeen from the fixed ſtars." "Yet (continues he), as in this unexplored, and perhaps unexplorable, abyſs of ſpace, it is no neceſſary condition that the planets ſhould be of the ſame magnitudes as thoſe belonging to our ſyſtem, it is not impoſſible but that planetary bodies may be diſcovered among the double and treble ſtars."

Nat. Phil. 165, 166. *Philad. Edit.*

Though in the above extracts from Mr Herſchel's papers, the words *condenſation*, *cluſters*, &c. of ſtars frequently occur, we are by no means from thence to imagine that any of the celeſtial bodies in our nebulæ are nearer to one another than we are to Sirius, whoſe diſtance is ſuppoſed not to be leſs than 400,000 times that of the ſun from us, or 38 millions of millions of miles. The whole extent of the nebula being in ſome places near 500 times as great, muſt be ſuch, that the light of a ſtar placed at its extreme boundary, ſuppoſing it to fly with the velocity of 12 millions of miles every minute, muſt have taken near 3000 years to reach us. Mr Herſchel, however, is by no means of opinion, that our nebula is the moſt conſiderable in the univerſe. "As we are uſed (ſays he to call the appearance of the heavens, where it is ſurrounded with a bright zone, the *milky-way*, it may not be amiſs to point out ſome other very remarkable nebulæ, which cannot well be leſs, but are probably much larger, than our own ſyſtem; and being alſo extended, the inhabitants of the planets that attend the ſtars which compoſe them, muſt likewiſe perceive the ſame phenomena: for which reaſon they may alſo be called *milky ways*, by way of diſtinction.

229
Of the ſize and diſtance of nebulæ.

"My opinion of their ſize is grounded on the following obſervations: There are many round nebulæ of the firſt form, of about five or ſix minutes in diameter, the ſtars of which I can ſee very diſtinctly; and on comparing them with the viſual ray calculated from ſome of my long guages, I ſuppoſe by the appearance of the ſmall ſtars in thoſe guages, that the centres of theſe round nebulæ may be 600 times the diſtance of Sirius

Concluſions from the foregoing Appearances.

Sirius from us."—He then goes on to tell us, that the ſtars in ſuch nebulæ are probably twice as much condenſed as thoſe of our ſyſtem; otherwiſe the centre of it would not be leſs than 6000 times the diſtance of Sirius from us; and that it is probably much underrated by ſuppoſing it only 600 times the diſtance of that ſtar.

"Some of theſe round nebulæ (ſays Mr Herſchel), have others near them, perfectly ſimilar in form, colour, and the diſtribution of ſtars, but of only half the diameter: and the ſtars in them ſeem to be doubly crowded, and only at about half the diſtance from each other. They are indeed ſo ſmall, as not to be viſible without the utmoſt attention. I ſuppoſe theſe miniature nebulæ to be at double the diſtance of the firſt. An inſtance equally remarkable and inſtructive is a caſe where, in the neighbourhood of two ſuch nebulæ as have been mentioned, I met with a third ſimilar, reſolvable, but much ſmaller and fainter nebula. The ſtars of it are no longer to be perceived; but a reſemblance of colour with the former two, and its diminiſhed ſize and light, may well permit us to place it at full twice the diſtance of the ſecond, or about four or five times the diſtance of the firſt. And yet the nebuloſity is not of the milky kind; nor is it ſo much as difficultly reſolvable or colourleſs. Now in a few of the extended nebulæ, the light changes gradually, ſo as from the reſolvable to approach to the milky kind; which appears to me an indication, that the milky light of nebulæ is owing to their much greater diſtance. A nebula, therefore, whoſe light is perfectly milky, cannot well be ſuppoſed to be at leſs than ſix or eight thouſand times the diſtance of Sirius; and though the numbers here aſſumed are not to be taken otherwiſe than as very coarſe eſtimates, yet an extended nebula, which in an oblique ſituation, where it is poſſibly foreſhortened by one-half, two-thirds, or three-fourths of its length, ſubtends a degree or more in diameter, cannot be otherwiſe than of a wonderful magnitude, and may well out-vie our milky-way in grandeur."

Mr Herſchel next proceeds to give an account of ſeveral remarkable nebulæ, and then concludes thus.

230
Vaſt length of time requiſite to form the nebulæ.

"Now, what great length of time muſt be required to produce theſe effects (the formation of nebulæ) may eaſily be conceived, when, in all probablility, our whole ſyſtem, of about 800 ſtars in diameter, if it were ſeen at ſuch a diſtance that one end of it might aſſume the reſolvable nebuloſity, would not, at the other end, preſent us with the irreſolvable, much leſs with the colourleſs and milky, ſort of nebuloſities." Great indeed muſt be the length of time requiſite for ſuch diſtant bodies to form combinations by the laws of attraction, ſince, according to the diſtances he has aſſumed, the light of ſome of his nebulæ muſt be thirty-ſix or forty-eight thouſand years in arriving from them to us. It would be worth while then to inquire, whether *attraction* is a virtue propagated in time or not; or whether it moves quicker or ſlower than light?

231
Why the ſtars do not fall upon one another

In the courſe of Mr Herſchel's obſervations and inquiries concerning the ſtructure of the heavens, an objection occurred, that if the different ſyſtems were formed by the mutual attractions of the ſtars, the whole would be in danger of deſtruction by the falling of them one upon another. A ſufficient anſwer to this, he thinks, is, that if we can really prove the ſyſtem of the univerſe to be what he has ſaid, there is no doubt but that the great Author of it has amply provided for the preſervation of the whole, though it ſhould not appear to us in what manner this is effected. Several circumſtances, however, he is of opinion, manifeſtly tend to a general preſervation; as, in the firſt place, the indefinite extent of the ſidereal heavens; which muſt produce a balance that will effectually ſecure all the great parts of the whole from approaching to each other. "There remains then (ſays he) only to ſee how the particular ſtars belonging to ſeparate cluſters are prevented from ruſhing on to their centres of attraction." This he ſuppoſes may be done by projectile forces; "the admiſſion of which will prove ſuch a barrier againſt the ſeeming deſtructive power of attraction, as to ſecure from it all the ſtars belonging to a cluſter, if not for ever, at leaſt for millions of ages. Beſides, we ought perhaps to look upon ſuch cluſters, and the deſtruction of a ſtar now and then in ſome thouſands of ages, as the very means by which the whole is preſerved and renewed. Theſe cluſters may be the *laboratories* of the univerſe, wherein the moſt ſalutary remedies for the decay of the whole are prepared."

232
Of the planetary nebulæ.

In ſpeaking of the planetary nebulæ, by which name he diſtinguiſhes thoſe ſpots that are all over equally luminous, he ſays, "if we ſhould ſuppoſe them to be ſingle ſtars with large diameters, we ſhall find it difficult to account for their not being brighter, unleſs we ſhould admit that the intrinſic light of ſome ſtars may be very much inferior to that of the generality; which, however, can hardly be imagined to extend to ſuch a degree. We might ſuppoſe them to be comets about their aphelion, if the brightneſs, as well as magnitude of their diameters, did not oppoſe this idea: ſo that, after all, we can hardly find any hypotheſis ſo probable as that of their being nebulæ; but then they muſt conſiſt of ſtars that are compreſſed and accumulated in the higheſt degree. If it were not perhaps too hazardous to purſue a former ſurmiſe of a renewal in what I figuratively called the *Laboratories of the Univerſe*, the ſtars forming theſe extraordinary nebulæ, by ſome decay or waſte of nature being no longer fit for their former purpoſes, and having their projectile forces, if any ſuch they had, retarded in each others atmoſphere, may ruſh at laſt together; and, either in ſucceſſion, or by one general tremendous ſhock, unite into a new body. Perhaps the extraordinary and ſudden blaze of a new ſtar in Caſſiopeia's chair, in 1572, might poſſibly be of ſuch a nature. If a little attention to theſe bodies ſhould prove that, having no annual parallax, they belong moſt probably to the claſs of nebulæ, they may then be expected to keep their ſtation better than any one of the ſtars belonging to our ſyſtem, on account of their being probably at a very great diſtance."

233
Motion of the fixed ſtars and ſolar ſyſtem.

Having thus at length got through the conjectures and theories concerning the nature and ſituations of the heavenly bodies, we muſt now proceed to conſider thoſe projectile forces which are ſuppoſed neceſſary to the preſervation of the ſyſtem of Nature, and to prevent the ſtars from falling upon one another more frequently than they do. It was firſt ſuſpected by Dr Halley, that many of the ſtars which we call *fixed*, are really in motion, though that motion is either ſo ſlow in

Concluſions from the foregoing Appearances.

in itſelf, or their diſtance is ſo great, that it can ſcarce be perceptible in half a century. It is, however, now confirmed by aſtronomical obſervations, that Arcturus, Sirius, Aldebaran, Procyon, Caſtor, Rigel, Altair, and many others, are actually in motion: which conſideration, with the length of time neceſſary to ſhow any change of place in bodies at ſuch extreme diſtance, with the lateneſs of any obſervations on this head, "would lead us (ſays Mr Herſchel) to ſuppoſe that there is not one fixed ſtar in the heavens: but "many other reaſons (adds he) will render this ſo obvious, that there can hardly remain a doubt of the general motion of all the ſtarry ſyſtems, and conſequently of the ſolar one among the reſt.

234 Attraction prevents the ſtars from remaining at abſolute reſt.

"I might begin with principles drawn from the theory of attraction, which evidently oppoſe every idea of abſolute reſt in any one of the ſtars, when once it is known that ſome of them are in motion, for the change that muſt ariſe by ſuch motion, in the value of a power which acts inverſely as the ſquares of the diſtances, muſt be felt in all the neighbouring ſtars; and if theſe be influenced by the motion of the former, they will again affect thoſe that are next to them, and ſo on, till all are in motion. Now, as we know ſeveral ſtars in divers parts of the heavens do actually change their place, it will follow, that the motion of our ſolar ſyſtem is not a mere hypotheſis. And what will give additional weight to this conſideration is, that we have the greateſt reaſon to ſuppoſe moſt of thoſe very ſtars which have been obſerved to move, to be ſuch as are neareſt to us; and therefore their influence on our ſituation would alone prove a powerful argument in favor of the proper motion of the ſun had it been originally at reſt."

235 Conjectures concerning the appearance of new ſtars.

After enumerating a great many changes, which, from his own obſervation, have happened among the fixed ſtars, and of which we have already given an account, "Does it not ſeem natural (ſays he), that theſe obſervations ſhould cauſe a ſtrong ſuſpicion that moſt probably every ſtar in the heaven is more or leſs in motion? And though we have no reaſon to think that the diſappearance of ſome ſtars, or new appearance of others, nor indeed that the frequent changes in the magnitude of ſo many of them, are owing to their change of diſtance from us by proper motions, which could not occaſion theſe phenomena without being inconceivably quick; yet we may well ſuppoſe, that motion is ſome way or other concerned in producing theſe effects. A ſlow motion, for inſtance, in an orbit round ſome large opaque body, where the ſtar which is loſt or diminiſhed in magnitude might undergo occaſional occultations, would account for ſome of thoſe changes; while others might perhaps be owing to the periodical return of ſome large ſpots on that ſide of the ſurface which is alternately turned towards us by the rotatory motion of the ſtar. The idea, alſo, of a body much flattened by a quick rotation, and having a motion ſimilar to the moon's orbit by a change of the place of its nodes, whereby more of the luminous ſurface would one time be expoſed to us than another, tends to the ſame end: for we cannot help thinking with M. de la Lande (Mem. 1776), that the ſame force which gave ſuch rotations, would probably alſo produce motions of a different kind by a tranſlation of the centre. Now, if the proper motion of the ſtars in general be once admitted, who can refuſe to allow that our ſun, with all its planets and comets, that is, the ſolar ſyſtem, is no leſs liable to ſuch a general agitation as we find to obtain among the reſt of the celeſtial bodies?

236 How to diſcover the proper motion of the ſun.

"Admitting this for granted, the greateſt difficulty will be, how to diſcern the proper motion of the ſun among ſo many other and variouſly compounded motions of the ſtars. This is an arduous taſk indeed; but I ſhall point out a method of detecting the direction and quantity of the ſuppoſed proper motion of the ſun by a few geometrical deductions; and at the ſame time ſhow, by an application of them to ſome known facts, that we have already ſome reaſon to gueſs which way the ſolar ſyſtem is probably tending its courſe.

"Suppoſe the ſun to be at S. fig. 101, the fixed ſtars to be diſperſed in all poſſible directions and diſtances around, at *s*, *s*, *s*, *s*, &c. Now, ſetting aſide the proper motion of the ſtars, let us firſt conſider what will be the conſequence of a proper motion in the ſun, and let it move in a direction from A towards B. Suppoſe it now arrived at C: here, by a mere inſpection of the figure, it will be evident, that the ſtars *s*, *s*, *s*, which were before ſeen at *a a a*, will now, by the motion of the ſun from S to C, appear to have gone in a contrary direction, and be ſeen at *b b b*; that is to ſay, every ſtar will appear more or leſs to have receded from the point B, in the order of the letters *ab*, *ab*, *ab*. The converſe of this propoſition is equally true; for if the ſtars ſhould all appear to have had a retrograde motion with reſpect to the point B, it is plain, on a ſuppoſition of their being at reſt, the ſun muſt have a direct motion towards the point B, to occaſion all theſe appearances. From a due conſideration of what has been ſaid, we may draw the following inferences:

"1. The greateſt, or total ſyſtematical parallax of the fixed ſtars (fig. 103), will fall upon thoſe that are in the line D E, at rectangles to the direction A B of the ſun's motion.

"2. The partial ſyſtematical parallax of every other ſtar *s*, *s*, *s*, not in the line D E, will be to the total parallax as the ſine of the angle BS*a*, being the ſtar's diſtance from that point towards which the ſun moves, to radius.

"3. The parallax of ſtars at different diſtances will be inverſely as theſe diſtances; that is, one half at double the diſtance, one third at three times, and ſo on; for the ſubtenſe SC remaining the ſame, and the parallactic angle being very ſmall, we may admit the angle S*s*C to be inverſely as the ſide S*s*, which is the ſtar's diſtance.

"4. Every ſtar at reſt, to a ſyſtem in motion, will appear to move in a direction contrary to that which the ſyſtem has. Hence it follows, that if the ſolar ſyſtem be carried towards any ſtar ſituated in the ecliptic, every ſtar, whoſe angular diſtance in *antecedentia* (reckoned upon the ecliptic from the ſtar towards which the ſyſtem moves) is leſs than 180 degrees, will decreaſe in longitude; and that, on the contrary, every ſtar, whoſe diſtance from the ſame ſtar (reckoned upon the ecliptic, but *in conſequentia*) is leſs than 180 degrees, will increaſe in longitude in both caſes, without alteration of latitude.

The immenſe regions of the fixed ſtars may be conſidered as an infinitely expanded globe, having the ſo-

ASTRONOMY

Plate LXXI

ig. 108

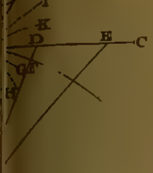


Fig 109

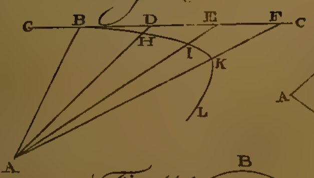


Fig. 110

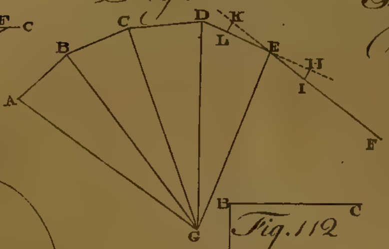


Fig. 111

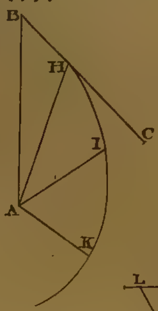


Fig. 115

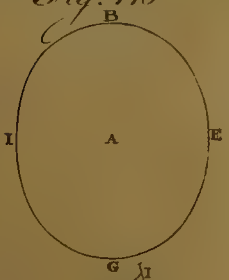


Fig. 114

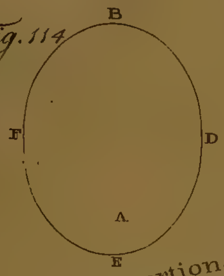


Fig. 112

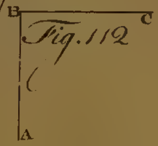


Fig. 113

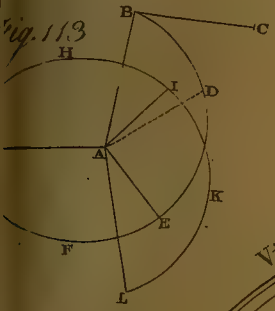


Fig. 116

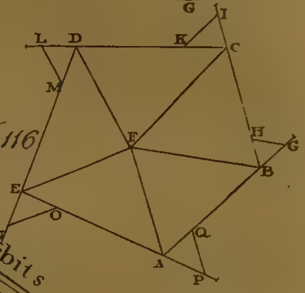
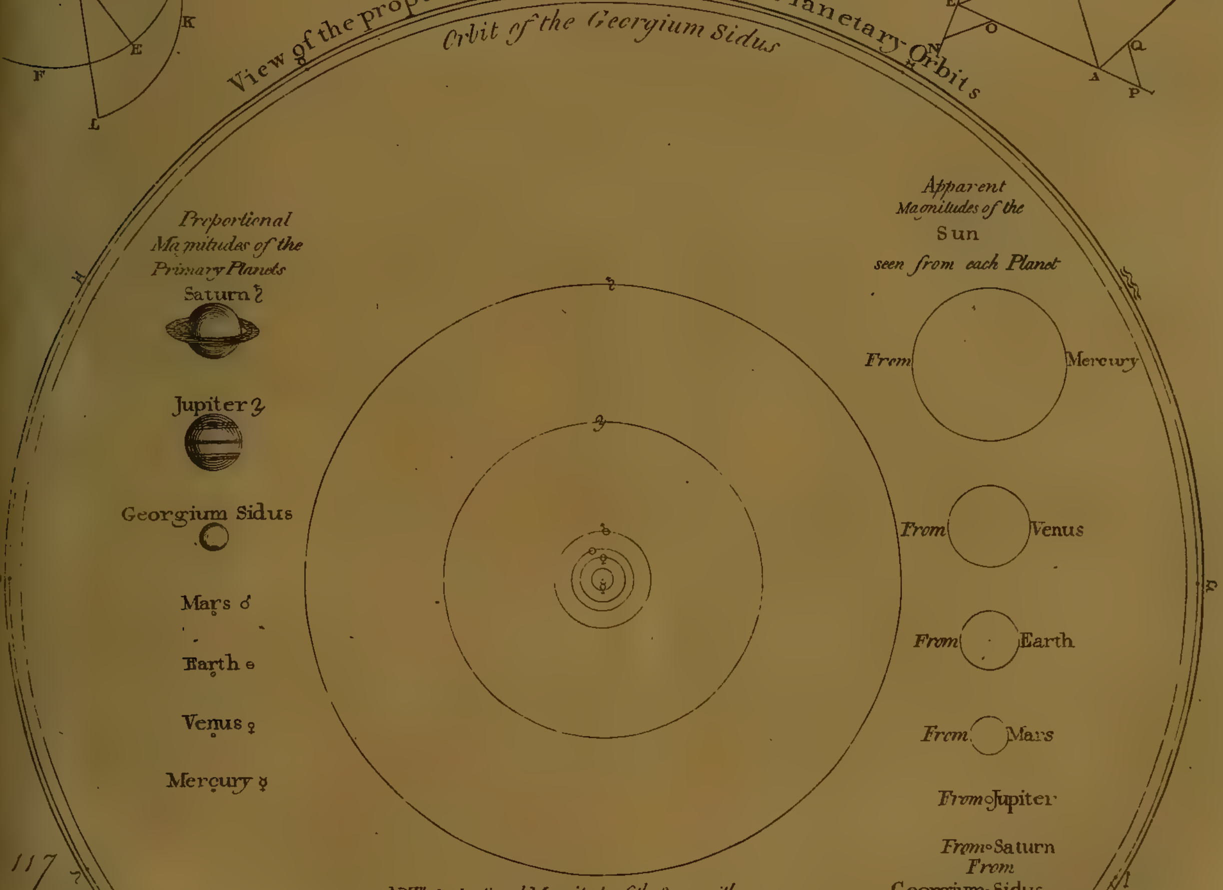


Fig. 119

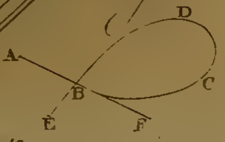
View of the proportional Magnitudes of the Planetary Orbits



NB The proportional Magnitude of the Sun, with respect to the figures of the Planets here given, is represented by the Circle of Saturns Orbit marked ♄

ig. 117

Fig. 118



Scot Philada

Conclusions from the foregoing Appearances.

ſolar ſyſtem for its centre. The moſt proper method therefore of finding out the direction of the motion of the ſun is, to divide our obſervations on the ſyſtematical parallax of the fixed ſtars into three principal zones. Theſe, for the convenience of fixed inſtruments, may be aſſumed ſo as to let them paſs around the equator and the ſolſtitial colures, every one being at rectangles to the other two, according to the three dimenſions of ſolids." Our author, then, having informed us that obſervations on double ſtars are moſt proper for aſcertaining this point, gives an account of three zones he has marked out for this purpoſe; the equatorial zone, containing 150 double ſtars; that of the equinoctial colure, extending 10 degrees of a great circle on each ſide, as far as it is viſible on our hemiſphere, which will contain about 70 double ſtars; and that of the ſolſtitial colure, including 120, beſides a zone of the ecliptic containing a great many double ſtars which may undergo occultations by the moon. It is of the ſame extent, and includes about 120 double ſtars.

To apply this theory, it is neceſſary, in the firſt place to obſerve, that the rules of philoſophiſing direct us to refer all phenomena to as few and ſimple principles as are ſufficient to explain them. Aſtronomers, therefore, having already obſerved what they call a proper motion in ſeveral of the fixed ſtars, and which may be ſuppoſed common to them all, ought to reſolve it, as far as poſſible, into a ſingle and real motion of the ſolar ſyſtem, as far as that will anſwer the known facts, and only to attribute to the proper motion of each particular ſtar the deviations from the general law which the ſtars ſeem to follow.

237
Proper motions of ſome of the ſtars.

Dr Maſkelyne informs us, that the proper motions in right aſcenſion of Sirius, Caſtor, Procyon, Pollux, Regulus, Arcturus, and α Aquilæ, are as follow.— 0″.63;— 0″.28; 0″.80—0″.93;— 0″.41;— 1″.40, and + 0″.57. Two of them, Sirius and Arcturus, have alſo a change of declination; viz. 1′.20 and 2″.01; both ſouthward. Let now fig. 104. repreſent an equatorial zone with the abovementioned ſtars referred to it, according to their reſpective right aſcenſions, having the ſolar ſyſtem in its centre. Aſſume the direction AB from a point ſomewhere not far from the 77th degree of right aſcenſion to its oppoſite 257th degree, and ſuppoſe the ſun to move in that direction from S towards B, then will that one motion anſwer that of all the ſtars together; for if the ſuppoſition be true, Arcturus, Regulus, Pollux, Procyon, Caſtor, and Sirius, ſhould appear to decreaſe in right aſcenſion, while α Aquilæ, on the contrary, ſhould appear to increaſe. Moreover, ſuppoſe the ſun to aſcend at the ſame time, in the ſame direction, towards ſome point in the northern hemiſphere, for inſtance towards the conſtellation Hercules; then will alſo the obſerved change of declination of Sirius and Arcturus be reſolved into the ſingle motion of the ſyſtem. Many difficulties indeed yet remain; ſuch as the correſpondence of the exact quantity of motion obſerved in each ſtar, with what will be aſſigned to it by this hypotheſis. But it is to be remembered, that the very different and ſtill unknown diſtances of the fixed ſtars muſt, for a good while yet, leave us in the dark as to the ſtrict application of the theory; and that any deviation from it may eaſily be accounted for from the ſtill unknown *real* proper motion of the ſtars; for if the ſolar ſyſtem have in reality the motion now aſcribed to it, then what aſtronomers have already obſerved concerning the change of place of the ſtars, and have called their proper motion, will become only an *apparent* motion; and future obſervations muſt ſtill point out, by the deviations from the general law, which the ſtars will follow in thoſe apparent motions, what may be their real proper motions, as well as relative diſtances. "But (ſays Mr Herſchel) leſt I ſhould be cenſured for admitting ſo new and capital a motion upon too ſlight a foundation, I muſt obſerve that the concurrence of thoſe ſeven principal ſtars cannot but give ſome value to an hypotheſis that will ſimplify the celeſtial motions in general. We know that the ſun, at the diſtance of a fixed ſtar, would appear like one of them; and from analogy we conclude the fixed ſtars to be ſuns. Now, ſince the apparent motions of thoſe ſeven ſtars may be accounted for, either by ſuppoſing them to move in the manner they appear to do, or elſe by ſuppoſing the ſun alone to have a motion in a direction ſome how not far from that which I have aſſigned to it, I think we are no more authoriſed to ſuppoſe the ſun at reſt than we ſhould be to deny the diurnal motion of the earth; excepting in this reſpect, that the proofs of the latter are very numerous, whereas the former reſt only on a few, though capital teſtimonies."

238
Change of right aſcenſion and declination of twelve ſtars.

The following table, taken from De la Lande, of the change of right aſcenſion and declination of twelve ſtars, is brought as an additional proof of this doctrine.

Names of Stars.	Change of R. A.	Change of Declin.
Arcturus	— 1′ 11″	— 1′ 55″
Sirius	— 37	— 52
β Cygni	— 3	+ 49
Procyon	— 33	— 47
ε Cygni	+ 20	+ 34
γ Arietis	— 14	— 29
γ Gemini	— 8	— 24
Aldebaran	+ 3	— 18
β Gemini	— 48	— 16
γ Piſcium	+ 53	+ 7
α Aquilæ	+ 32	— 4
α Gemini	— 24	— 1

Fig. 105. repreſents them projected on the plane of the equator. They are all in the northern hemiſphere except Sirius, which muſt be ſuppoſed to be viewed in the concave part of the oppoſite half of the globe, while the reſt are drawn on the convex ſurface. Regulus being added to that number, and Caſtor being double, we have 14 ſtars; and every ſtar's motion, except Regulus, being aſſigned in declination as well as right aſcenſion, we have no fewer than 27 given motions to account for.

239
Motions of the ſtars accounted for.

Now, by aſſuming a point ſomewhere near λ Herculis, and ſuppoſing the ſun to have a proper motion towards that part of the heavens, we ſhall account for 22 of theſe motions. For β Cygni, α Aquilæ, ε Cygni, γ Piſcium, γ Arietis, and Aldebaran, ought, upon the ſuppoſed motion of the ſun, to have an apparent progreſſion according to the hour-circle XVIII, XIX, XX, &c. or to increaſe in right aſcenſion; while Arcturus, Regulus, the two ſtars of α Geminorum, Pollux, Procyon, Sirius, and γ Geminorum, ſhould apparently go back in the order XVI, XV, XIV, &c. of the hour-circle, ſo as to decreaſe in right aſcenſion. But according to De la Lande's table, excepting β Cygni and γ Arietis, all theſe motions

Concluſions from the foregoing Appearances.

tions really take place. With regard to the change of declination, every ſtar in the table ſhould go towards the ſouth; and here we find but three exceptions, in β and ε Cygni and γ Piſcium. So that, upon the whole, we have but five deviations out of 27 known motions, which this hypotheſis will not account for; and theſe exceptions muſt be reſolved into the real proper motion of the ſtars.

240 Of the velocity of the ſtars.

Some circumſtances in the quantity of theſe motions alſo deſerve our notice. In the firſt place, Arcturus and Sirius being the largeſt of the ſtars, and therefore probably the neareſt, ought to have the greateſt apparent motion, both in right aſcenſion and declination; which is agreeable to obſervation, as appears from the table. 2. With regard to the right aſcenſion only, Arcturus being better ſituated to ſhow its motion, ought to have it much greater; as we find it actually has. Aldebaran, both badly ſituated and conſiderably ſmaller, ought, according to the ſame rule, to ſhow but little motion, &c.; all of which is conformable to the table. A very ſtriking agreement with the hypotheſis may be alſo obſerved in Caſtor and Pollux, both of which are pretty well ſituated; and accordingly we find that Pollux, for the ſize of the ſtar, ſhows as much motion in right aſcenſion as we could expect; though it is remarkable that Caſtor, though equally well placed, ſhows no more than half the motion by the table. This is ſeemingly contrary to the hypotheſis: but it muſt be remembered, that Caſtor is a double ſtar, and the two of which it conſiſts are nearly equal to each other in luſtre; ſo that, as we can allow only half the light to each, there is a ſtrong preſumption of their being at twice the diſtance of Pollux, which agrees very well with obſervation. It might alſo be obſerved, that we ſhould be involved in great difficulty by ſuppoſing the motion of Caſtor really to be in the ſtar: for how extraordinary muſt be the concurrence, that two ſtars, viz. thoſe that make up this apparently ſingle one, ſhould both have a proper motion ſo exactly alike, that in all our obſervations hitherto, we have not found them diſagree a ſingle ſecond either in right aſcenſion or in declination for 50 years together?

241 Arguments from the obſervations of Mr Mayer in favour of Herſchel's hypotheſis

In a poſtſcript to this paper on the motion of the ſolar ſyſtem, Mr Herſchel brings ſeveral additional confirmations of his hypotheſis from the works of Mr Mayer. Theſe contain a catalogue of the places of 80 ſtars obſerved by Mr Mayer in 1756, and whoſe places he compared with thoſe of the ſame ſtars given by Roemer in 1706. From the goodneſs of the inſtrument with which Mr Roemer made his obſervations, Mr Mayer gives it as his opinion, that where the diſagreement in the place of a ſtar is but ſmall, it may be attributed to the imperfection of the inſtrument; but that when it amounts to 10″ or 15″, it is a very probable indication of motion in ſuch a ſtar; and he adds, that when the diſagreement is ſo much as in ſome ſtars which he names (among which is *Fomahand*, where the difference is 21″ in 50 years), he has not the leaſt doubt of a proper motion.

242 Tables of moving ſtars.

The following tables are extracted from Mr Mayer's work; one contains the ſtars whoſe motion agrees with Mr Herſchel's hypotheſis; the other thoſe that diſagree with it, and whoſe phenomena muſt therefore be either aſcribed to a proper motion of the ſtars themſelves, or to ſome other more hidden cauſe.

Concluſions from the foregoing Appearances.

TABLE I.

Names of Stars.	Motion in R. A.	Motion in Declin.
β Ceti	+ 32	- -
α Arietis	+ 10	- -
δ Ceti	+ 15	- -
α Ceti	+ 16	- -
α Perſei	+ 16	- -
η Pleiadum	- -	— 16
γ Eridani	+ 14	- -
ε Tauri	- -	— 11
α Aurigæ	+ 11	— 11
β Orionis	inſenſ.	inſenſ.
β Tauri	— 11	— 13
ζ Hydræ	— 23	- -
γ Leporis	- -	— 10
ε Urſæ Majoris	— 33	+ 10
α Serpentis	inſenſ.	- -
γ Draconis	+ 12	- -
α Lyræ	inſenſ.	+ 14
γ Aquilæ	- -	— 20
γ Capricorn	+ 19	- -
ε Pegaſi	- -	— 28
δ Capricorn	+ 24	— 17
α Aquar.	+ 13	- -
α Orionis	inſenſ.	— 11
μ Geminorum	— 16	- -
ρ Navis	— 13	— 11
β Cancri	- -	— 14
ι Urſa Majoris	— 54	- -
ζ Pegaſi	- -	— 13
Fomahand	+ 21	- -
β Pegaſi	+ 12	- -
α Androm.	- -	— 21
β Caſſiopeiæ	+ 34	- -

TABLE II.

Names of Stars.	Motion in R. A.	Motion in Declin.
Polaris	- -	+ 13
γ Ceti	— 14	- -
β Perſei	— 10	- -
α Leporis	- -	+ 11
μ Geminor.	- -	+ 15
ε Canis Major	- -	+ 10
ζ Hydræ	- -	+ 24
α Hydræ	- -	+ 13
β Herculis	+ 14	- -
γ Cygni	— 13	- -
ε Pegaſi	— 14	- -
ζ Pegaſi	— 20	- -

"From the firſt table, (ſays Mr Herſchel), we gather that the principal ſtars, Lucida, Lyræ, Capella, α Orionis, Rigel, Fomahand, α Serpentarii, α Aquarii, α Arietis, α Perſei, α Andromedæ, α Tauri, α Ceti, and 20 more of the moſt diſtinguiſhed of the ſecond and third rank of the ſtars, agree with our propoſed ſolar motion, when, on the contrary, the ſecond table contains but a few ſtars, and not a ſingle one of the firſt magnitude among them to oppoſe it. It is alſo remarkable, that many ſtars of the firſt table agree both in right aſcenſion and declination with the ſuppoſition of a ſolar motion; whereas there is not one among thoſe of the ſecond table which oppoſes it in both directions. This ſeems to indicate, that the ſolar motion, in ſome

of

Concluſions from the foregoing Appearances.

of them at leaſt, has counteracted and thereby deſtroyed, the effect of their own proper motion in one direction, ſo as to render it inſenſible; otherwiſe it would appear improbable, that eight ſtars out of twelve, contained in the latter table ſhould only have a motion at rectangles, or in oppoſition to any one given direction. The ſame may alſo be ſaid of 19 ſtars of the former table, that only agree with the ſolar motion one way, and are as to ſenſe at reſt in the other direction; but theſe ſingularities will not be near ſo remarkable when we have the motion of the ſun to compound with their own proper motions.

The motions of α Lyræ and ε Urſæ Majoris towards the north, are placed in the firſt table: to underſtand the reaſon of which, it will be neceſſary to point out the general law by which the apparent declinations of the ſtars at preſent under conſideration are governed.

243 To delineate the apparent motions of the ſtars.

Let an arch of 90° be applied to a ſphere repreſenting the fixed ſtars, ſo as always to paſs through the apex of the ſolar motion: then, while one end of it is drawn along the equator, the other will deſcribe on the ſpherical ſurface a curve which will paſs through the pole of the equator, and return into itſelf at the apex.

244 Spherical conchoid deſcribed.

This curve, not taken notice of by other authors, Mr Herſchel calls a *ſpherical conchoid*, from the manner in which it is generated. The law then is, that all the ſtars in the northern hemiſphere, ſituated within the nodated part of the conchoid, will ſeem to go to the north by the motion of the ſolar ſyſtem towards its apex, the reſt will appear to go ſouthwards. A ſimilar curve is to be delineated in the ſouthern hemiſphere. Mr Herſchel then ſhows a method of finding whether any ſtar, whoſe place in the heavens is known, will fall without or within the conchoid; after which he accounts for the want of ſenſible motion in α Lyræ and α Orionis in right aſcenſion, and of Rigel both in right aſcenſion and declination, in the following manner: "Theſe ſtars are ſo bright, that we may reaſonably ſuppoſe them to be among thoſe that are neareſt to us; and if they had any conſiderable motion, it would moſt likely have been diſcovered, ſince the variations of Sirius, Arcturus, Procyon, Caſtor, and Pollux, &c. have not eſcaped our notice. Now, from the ſame principle of the motion of the ſolar ſyſtem, by which we have accounted for the apparent *motion* of the latter ſtars, we may account for the apparent *reſt* of the former. Thoſe two bright ſtars, α Lyræ and α Orionis, are placed ſo near the direction of the aſſigned ſolar motion, that from the application of the ſecond theorem (n° 236), their motion ought to be inſenſible in right aſcenſion, and not very conſiderable in declination; all which is confirmed by obſervations. With reſpect to Rigel and α Serpentarii, admitting them both as ſtars large enough to have ſhown a proper motion, were their ſituation otherwiſe than it is, we find that they alſo ſhould be apparently at reſt in right aſcenſion; and Rigel, having ſouthern declination, and being a leſs conſiderable ſtar than α Orionis, which ſhows but 11″ motion towards the ſouth in 50 years, its apparent motion in declination may on that account be alſo too ſmall to become viſible." Our author concludes with a remarkable paſſage from Mayer, to the following purpoſe, viz. "if it be poſſible that the ſun has any proper motion of his own, the ſtars in that part of the heavens towards which he moves, muſt appear to open and recede from each other, while on the other hand, thoſe on the oppoſite ſide will ſeem to contract their diſtances, and come nearer each other." "Now (ſays Mr Herſchel), if we recollect what has been ſaid of the motion of the ſtars, we find that thoſe towards which I ſuppoſe the ſolar ſyſtem to move, do really recede from each other: for inſtance, Arcturus from α Lyræ, α Aquilæ and α Aquarii from α Serpentarii and ε Urſæ Majoris; and, on the contrary, thoſe in the oppoſite part of the heavens do really come nearer each other, as Sirius to Aldebaran, Procyon to α Arietis, Caſtor, Pollux, Regulus, &c. to α Ceti, α Perſei, α Andromedæ, &c. It muſt be added however, that we cannot expect immediately to perceive any effects of this motion, excepting in ſuch ſtars as are neareſt to us. But as we have at preſent no other method of judging of the relative diſtance of the fixed ſtars than from their apparent brightneſs, thoſe that are moſt likely on that account to be affected by a parallax ariſing from the motion of the ſolar ſyſtem, are the very ſtars which have been pointed out from Mayer's own table."

245 Velocity of the ſolar ſyſtem.

With regard to the quantity of motion in the ſolar ſyſtem, or the velocity with which the ſun and planets change their places in abſolute ſpace, Mr Herſchel propoſes only a few diſtant hints. "From the annual parallax of the fixed ſtars (ſays he), which from my own obſervations I find much leſs than it has hitherto been thought to be, we may certainly admit that the diameter of the earth's orbit, at the diſtance of Sirius or Arcturus, would not nearly ſubtend an angle of one ſecond; but the apparent motion of Arcturus, if owing to a tranſlation of the ſolar ſyſtem, amounts to no leſs 2″.7 a-year, as will appear if we compound the two motions of 1′ 11″ in right aſcenſion, and 1′ 55″ in declination into one ſingle motion, and reduce it into an annual quantity. Hence we may, in a general way eſtimate, that the ſolar motion can certainly not be leſs than that which the earth has in her annual orbit."

SECT. IV. *Of the different Syſtems by which the Celeſtial Phenomena have been accounted for.*

In treating of the various ſyſtems which have been invented in different ages, we do not mean to give an account of the various abſurdities that have been broached by individuals on this ſubject; but ſhall confine ourſelves to thoſe ſyſtems which have been of conſiderable note, and been generally followed for a number of years. Concerning the opinions of the very firſt aſtronomers about the ſyſtem of nature, we are neceſſarily as ignorant as we are of thoſe aſtronomers themſelves. Whatever opinions are handed down to us, muſt be of a vaſtly later date than the introduction of aſtronomy among mankind. If we may hazard a conjecture, however, we are inclined to think that the firſt opinions on this ſubject were much more juſt than thoſe that were held afterwards for many ages.

246 Pythagorean ſyſtem.

We are told that Pythagoras maintained the motion of the earth, which is now univerſally believed, but at that time appears to have been the opinion of only a few detached individuals of Greece. As the Greeks borrowed many things from the Egyptians, and Pythagoras had travelled into Egypt and Phenice, it is probable he might receive an account of this hypotheſis from thence; but whether he did ſo or not, we have

Of the different ſyſtems by which the Celeſtial Phenomena have been accounted for.

247 Suppreſſed by the Ptolemaic.

now no means of knowing, neither is it of any importance whether he did or not. Certain it is, however, that this opinion did not prevail in his days, nor for many ages after. In the 2d century after Chriſt, the very name of the Pythagorean hypotheſis was ſuppreſſed by a ſyſtem erected by the famous geographer and aſtronomer Claudius Ptolemæus. This ſyſtem, which commonly goes by the name of the *Ptolemaic*, he ſeems not to have originally invented, but adopted as the prevailing one of that age; and perhaps made it ſomewhat more conſiſtent than it was before. He ſuppoſed the earth at reſt in the centre of the univerſe. Round the earth, and the neareſt to it of all the heavenly bodies, the moon performed its monthly revolutions. Next to the moon was placed the planet Mercury; then Venus; and above that the Sun, Mars, Jupiter, and Saturn, in their proper orbits; then the ſphere of the fixed ſtars; above theſe, two ſpheres of what he called *chryſtalline* heavens; above theſe was the primum mobile, which, by turning round once in 24 hours, by ſome unaccountable means or other, carried all the reſt along with it. This primum mobile was encompaſſed by the empyrean heaven, which was of a cubic form, and the ſeat of angels and bleſſed ſpirits. Beſides the motions of all the heavens round the earth once in 24 hours, each planet was ſuppoſed to have a particular motion of its own; the moon, for inſtance, once in a month, performed an additional revolution, the ſun in a year, &c. See Fig. 150.

248 Ptolemy's ſyſtem inſufficient.

It is eaſy to ſee, that, on this ſuppoſition, the confuſed motions of the planets already deſcribed could never be accounted for. Had they circulated uniformly round the earth, their apparent motion ought always to have been equal and uniform, without appearing either ſtationary or retrograde in any part of their courſes. In conſequence of this objection Ptolemy was obliged to invent a great number of circles, interfering with each other, which he called *epicycles* and *eccentrics*. Theſe proved a ready and effectual ſalvo for all the defects of his ſyſtem; as whenever a planet was deviating from the courſe it ought on his plan to have followed, it was then only moving in an epicycle or an eccentric, and would in due time fall into its proper path. As to the natural cauſes by which the planets were directed to move in theſe epicycles and eccentrics, it is no wonder that he found himſelf much at a loſs, and was obliged to have recourſe to divine power for an explanation, or, in other words, to own that his ſyſtem was unintelligible.

249 Pythagorean ſyſtem revived by Copernicus

This ſyſtem continued to be in vogue till the beginning of the 16th century, when Nicolaus Copernicus, a native of Thorn (a city of regal Pruſſia), and a man of great abilities, began to try whether a more ſatisfactory manner of accounting for the apparent motions of the heavenly bodies could not be obtained than was afforded by the Ptolemaic hypotheſis. He had recourſe to every author upon the ſubject, to ſee whether any had been more conſiſtent in explaining the irregular motions of the ſtars than the mathematical ſchools: but he received no ſatisfaction, till he found firſt from Cicero, that Nicetas the Syracuſan had maintained the motion of the earth; and next from Plutarch, that others of the ancients had been of the ſame opinion. From the ſmall hints he could obtain from the ancients, Copernicus then deduced a moſt complete ſyſtem, capable of ſolving every phenomenon in a ſatisfactory manner. From him this ſyſtem hath ever afterwards been called the *Copernican*, and repreſented fig. 152. Here the ſun is ſuppoſed to be in the centre; next him revolves the planet Mercury, then Venus; next, the Earth, with the Moon; beyond theſe, Mars, Jupiter, and Saturn; and far beyond the orbit of Saturn, he ſuppoſed the fixed ſtars to be placed, which formed the boundaries of the viſible creation.

Of the different ſyſtems by which the Celeſtial Phenomena have been accounted for.

250 Tychonic ſyſtem.

Fig. 151.

Though this hypotheſis afforded the only natural and ſatisfactory ſolution of the phenomena which ſo much perplexed Ptolemy's ſyſtem, it met with great oppoſition at firſt; which is not to be wondered at, conſidering the age in which he lived. Even the famous aſtronomer Tycho Brache could never aſſent to the earth's motion, which was the foundation of Copernicus's ſcheme. He therefore invented another ſyſtem, whereby he avoided the aſcribing of motion to the earth, and at the ſame time got clear of the difficulties with which Ptolemy was embarraſſed. In this ſyſtem, the earth was ſuppoſed the centre of the orbits of the ſun and moon; but the ſun was ſuppoſed to be the centre of the orbits of the five planets; ſo that the ſun with all the planets were by Tycho Brache ſuppoſed to turn round the earth in order to ſave the motion of the earth round its axis once in 24 hours. This ſyſtem was never much followed, the ſuperiority of the Copernican ſcheme being evident at firſt ſight.

251 Inquiries concerning the cauſes of the planetary motions.

The ſyſtem of Copernicus coming ſoon into univerſal credit, philoſophers began to inquire into the cauſes of the planetary motions; and here, without entering upon what has been advanced by detached individuals, we ſhall content ourſelves with giving an account of the three famous ſyſtems, the Carteſian, the Newtonian, and what is ſometimes called the *Mechanical* ſyſtem.

252 Carteſian ſyſtem.

Des Cartes, the founder of that ſyſtem which ſince his time has been called the *Carteſian*, flouriſhed about the beginning of the 17th century. His ſyſtem ſeems to have been borrowed from the philoſophers Democritus and Epicurus; who held, that every thing was formed by a particular motion of very minute bodies called *atoms*, which could not be divided into ſmaller parts. But though the philoſophy of Des Cartes reſembled that of the Corpuſcularians, in accounting for all the phenomena of nature merely from matter and motion; he differed from them in ſuppoſing the original parts of matter capable of being broken. To this property his *Materia Subtilis* owes its origin. To each of his atoms, or rather ſmall maſſes of matter, Des Cartes attributed a motion on its axis, and likewiſe maintained that there was a general motion of the whole matter of the univerſe round like a vortex or whirlpool. From this complicated motion, thoſe particles which were of an angular form, would have their angles broke off, and the fragments which were broke off being ſmaller than the particles from which they were abraded, behoved to form a matter of a more ſubtile kind than that made of large particles; and as there was no end of the abraſion, different kinds of matter of all degrees of fineneſs would be produced. The fineſt ſorts, he thought, would naturally ſeparate themſelves from the reſt, and be accumulated in particular places. The fineſt of all would therefore be collected in the ſun which was the centre of the univerſe, whoſe vortex was the whole etherial matter in the creation.

Fig. 120.

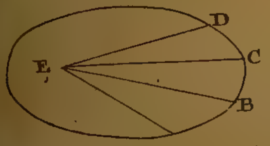


Fig. 123.

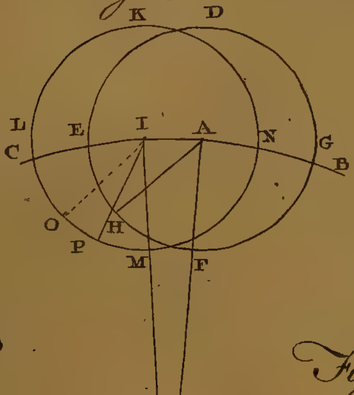


Fig. 124.

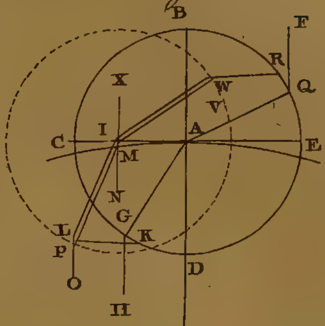


Fig. 125.

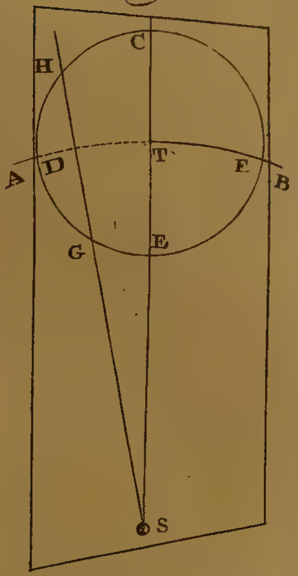


Fig. 121.

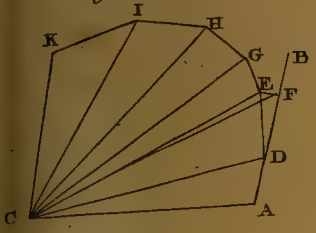


Fig. 126.

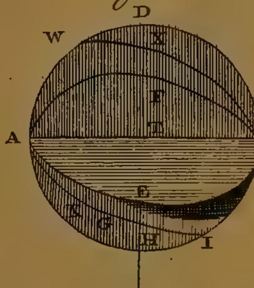


Fig. 122.

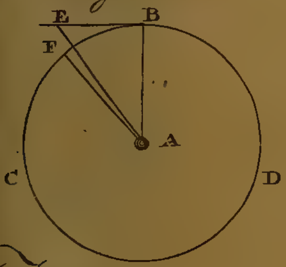


Fig. 132.

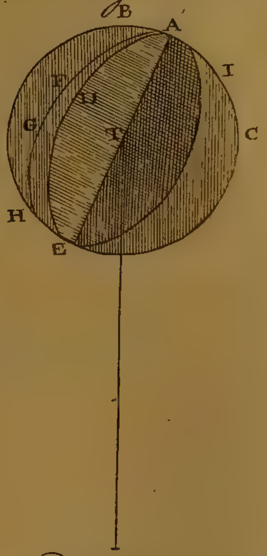


Fig. 127.

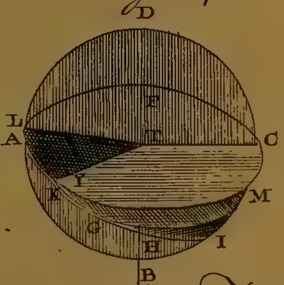


Fig. 131.

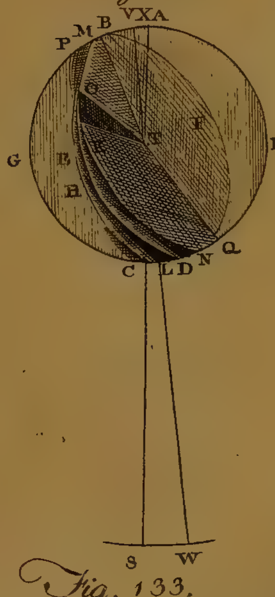


Fig. 128.

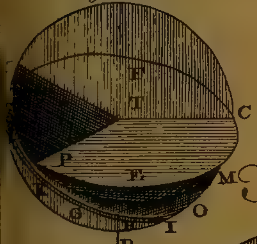


Fig. 129.

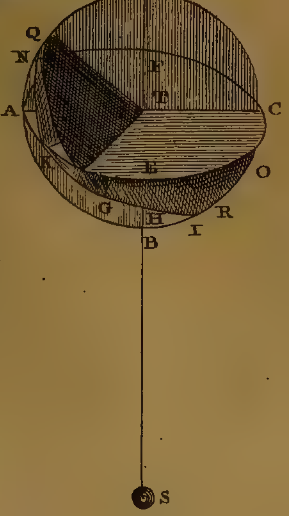


Fig. 130.

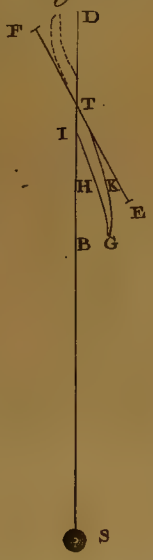


Fig. 134.

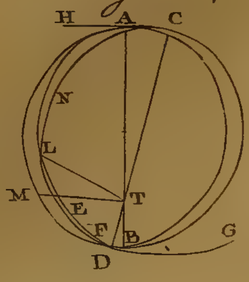
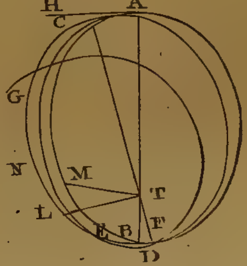


Fig. 133.



Of the different ſyſtems by which the Celeſtial Phenomena have been accounted for.

ation. As all the planets were immerſed in this vortex, they behoved to be carried round by it, in different times, proportioned to their diſtances; thoſe which were neareſt the ſun circulating the moſt quickly; and thoſe fartheſt off more ſlowly; as thoſe parts of a vortex which are fartheſt removed from the centre are obſerved to circulate more ſlowly than thoſe which are neareſt. Beſides this general vortex of the ſun, each of the planets had a particular vortex of their own by which their ſecondary planets were carried round, and any other body that happened to come within reach of it would likewiſe be carried away.

It is eaſy to ſee, from this ſhort account of Des Cartes's ſyſtem, that the whole of it was mere *petitio principii*: for had he been required to prove the exiſtence of his materia ſubtilis, he muſt undoubtedly have failed in the attempt; and hence, though his hypotheſis was for ſome time followed for want of a better, yet it gave way to that of Newton almoſt as ſoon as it was propoſed.

253
Sir Iſaac Newton's ſyſtem, (fig. 119.)

The general view of the ſolar ſyſtem given by this celebrated philoſopher is not different from what has been laid down in the foregoing ſections. The ſun is placed in or near the centre; about whom the ſix planets, to which a ſeventh, the *Georgium Sidus*, is now added, continually move with different degrees of velocity, and at different diſtances. The firſt and neareſt to the ſun is Mercury, next Venus, then the Earth and Moon: beyond theſe is Mars; after him, Jupiter; then Saturn; and laſt of all, at leaſt as far as diſcoveries have hitherto reached, the *Georgium Sidus*. Four of theſe primary planets, as they are called, are attended by moons or ſatellites, as well as the earth. Theſe are, Venus* Jupiter, Saturn, and the Georgium Sidus: of whom the firſt has only one; the ſecond, four; the third, five; and the fourth two, though probably there may be more yet undiſcovered by reaſon of their ſmallneſs or diſtance.

* See n° 74.

254
Orbits of the planets elliptical, &c.

Though theſe planets uniformly and at all times reſpect the ſun as the centre of their motion, yet they do not always preſerve the ſame diſtance from him; neither do they all move in the ſame plane, though every one of them revolves in an orbit whoſe plane if extended would paſs through the ſun's centre. The line in which the planes of any of the planetary orbits croſſes the orbit of the earth is called the *line* of its nodes, and the points of interſection are the *nodes* themſelves. Each of them moves in an orbit ſomewhat elliptical; and thus ſometimes approaches nearer, and at others recedes farther from, the ſun than before. This deviation from a circle is called the *eccentricity* of the orbit; the point where it is fartheſt diſtant from the ſun is called its *aphelion*; and where neareſt, the *perihelion*. The eccentricities of the different planets, however, are very different. In Saturn the proportion of the greateſt diſtance to the leaſt is ſomething leſs than 9 to 8, but much nearer to this than 10 to 9; in Jupiter, it is ſomething greater than that of 11 to 10; in Mars, it exceeds the proportion of 6 to 5; in the earth, it is only in the proportion of about 30 to 29; in Venus ſtill leſs, being only as 70 to 69; but in Mercury it is much greater than in any of the reſt, being little leſs than that of 3 to 2. The aphelia of all the planets are not ſituated on the ſame ſide of the ſun, but in the poſitions ſhown fig. 106. though theſe poſitions are alſo variable, as ſhall be afterwards more fully explained. The eccentricity of the Georgium Sidus is not yet determined, though it is ſuppoſed to be leſs than that of the reſt. All of them revolve from weſt to eaſt; and the moſt remote is the longeſt of finiſhing its courſe round the ſun.

255
Eccentricities, aphelia, &c. of the different planets.

Of Centripetal Powers.

256
They deſcribe equal ſpaces in equal times round the ſun.

Each of the planets moves in its orbit round the ſun in ſuch a manner, that the line drawn from the ſun to the planet, by accompanying the planet in its motion, will deſcribe about the ſun equal ſpaces in equal times. There is alſo a certain relation between the greater axes of theſe ellipſes and the times in which the planets perform their revolutions through them, which may be expreſſed in the following manner: Let the period of one planet be expreſſed by the letter A, the greater axis of its orbit by D; let the period of another planet be denoted by B, and the greater axis of this planet's orbit by E. Then if C be taken to bear the ſame proportion to B as B bears to A; likewiſe if F be taken to bear the ſame proportion to E as E bears to D, and G taken to bear the ſame proportion likewiſe to F as E bears to D; then A ſhall bear the the ſame proportion to C as D bears to G.

A	D
B	E
C	F
	G

§ 1. *Of Centripetal Powers in general.*

257
Sir Iſaac's doctrine of centripetal powers.

Before we attempt to give any particular explanation of the cauſes producing the planetary motions, it will be neceſſary to premiſe ſomething of Sir Iſaac Newton's doctrine of centripetal forces, as upon that depends his doctrine of gravitation, and of the whole celeſtial ſyſtem. The firſt effect of theſe powers is, to cauſe any body projected in a ſtraight line deviate from it, and deſcribe an incurvated one, which ſhall always be bent towards the centre to which the body is ſuppoſed to have a tendency. It is not, however, neceſſary that the moving body ſhould approach the centre; it may even recede farther from it notwithſtanding its being drawn by it; but this property uniformly belongs to it, that the line in which it moves will be continually concave towards the centre to which the power is directed.

Let A (fig. 107.) be the centre of the force. Let a body in B be moving in the direction of the ſtraight line BC, in which line it would continue to move if undiſturbed; but being attracted by the centripetal force towards A, the body muſt neceſſarily depart from this line BC; and being drawn into the curve line BD, muſt paſs between the lines AB and BC. It is evident, therefore, that the body in B being gradually turned off from the ſtraight line BC, it will at firſt be convex towards that line and concave towards A. And that the curve will always continue to have this concavity towards A, may thus appear: In the line BC, near to B, take any point, as E, from which the line EFG may be ſo drawn as to touch the curve line BD in ſome point, as F. Now, when the body is come to E, if the centripetal power were immediately to be ſuſpended, the body would no longer continue to move in a curve line, but, being left to itſelf, would forthwith reaſſume a ſtraight courſe, and that ſtraight courſe would be in the line FG; for that line is in the direction of the body's motion of the point F. But the centripetal force continuing its energy, the body will be gradually drawn from this line FG ſo as to keep in the line FD, and make that line, near the point F, to be concave towards the point A; and in this manner the body may be followed in its courſe throughout the line BD, and every part of that line be ſhown to be concave towards the point A.

Again, the point A (fig. 108.) being the centre of a centripetal force, let a body at B ſet out in the direction of the ſtraight line BC perpendicular to the line AB. It will be eaſily conceived, that there is no other point in the line BC ſo near to A as the point B; that AB is the ſhorteſt of all the lines which can be drawn from A to any part of the line BC; all others, as AD or AE, being longer than AB. Hence it follows, that the body ſetting out from it, if it moved in the line BC, it would recede more and more from the point A. Now, as the operation of a centripetal force is to draw a body towards the centre of that force, if ſuch a force act upon a reſting body, it muſt neceſſarily put that body ſo into motion as to cauſe it move towards the centre of the force: if the body were of itſelf moving towards that centre, it would accelerate that motion, and cauſe it to move faſter down; but if the body were in ſuch a motion that it would of itſelf recede from the centre, it is not neceſſary that the action of a centripetal power ſhould make it immediately approach the centre from which it would otherwiſe have receded; the centripetal force is not without effect if it cauſe the body to recede more ſlowly from that centre than otherwiſe it would have done. Thus, the ſmalleſt centripetal power, if it act on the body, will force it out of the line BC, and cauſe it to paſs in a bent line between BC and the point A, as has been already explained. When the body, for inſtance, has advanced to the line AD, the effect of the centripetal force diſcovers itſelf by having removed the body out of the line BC, and brought it to croſs the line AD ſomewhere between A and D, ſuppoſe at F. Now, AD being longer than AB, AF may alſo be longer than AB. The centripetal power may indeed be ſo ſtrong, that AF ſhall be ſhorter than AB; or it may be ſo evenly balanced with the progreſſive motion of the body that AF and AB ſhall be juſt equal; in which caſe the body would deſcribe a circle about the centre A; this centre of the force being alſo the centre of the circle.

If now the body, inſtead of ſetting out in the line BC perpendicular to AB, had ſet out in another line BG more inclined towards the line AB, moving in the curve line BH; then, as the body, if it were to continue its motion in the line BG, would for ſome time approach the centre A, the centripetal force would cauſe it to make greater advances toward that centre: But if the body were to ſet out in the line BI, reclined the other way from the perpendicular BC, and were to be drawn by the centripetal force into the curve line BK; the body, notwithſtanding any centripetal force, would for ſome time recede from the centre; ſince ſome part at leaſt of the curve line BK lies between the line BI and the perpendicular BC.

Let us next ſuppoſe a centripetal power directed toward the point A (Fig. 109.), to act on a body in B, which is moving in the direction of the ſtraight line BC, the line BC reclining off from AB. If from A the ſtraight lines AD, AE, AF, are drawn to the line CB, prolonged beyond B to G, it appears that AD is inclined to the line GC more obliquely than AB, AE more obliquely than AD, and AF than AE; or, to ſpeak more correctly, the angle under ADG is leſs than that under ABG, that under AEG is leſs than ADG, and AFG leſs than AEG. Now ſuppoſe the body to move in the curve line BHIK, it is likewiſe evident that the line BHIK being concave towards A and convex towards BC, it is more and more turned off from that line: ſo that in the point H, the line AK will be more obliquely inclined to the curve line BHIK than the ſame line AHD is inclined to BC at the point D; at the point I the inclination of the line AI to the curve line will be more different from the inclination of the ſame line AIE to the line BC at the point IE; and in the points K and F the difference of inclination will be ſtill greater; and in both, the inclination at the curve will be leſs oblique than at the ſtraight line BC. But the ſtraight line AB is leſs obliquely inclined to BG than AD is inclined towards DG: therefore, although the line AH be leſs obliquely inclined towards the curve HB than the ſame line AHD is inclined towards DG, yet it is poſſible, that the inclination at H may be more oblique than the inclination at B. The inclination at H may indeed be leſs oblique than the other, or they may be both the ſame. This depends upon the degree of ſtrength wherewith the centripetal force exerts itſelf during the paſſage of the body from B to H; and in like manner the inclinations at I and K depend entirely on the degree of ſtrength wherewith the centripetal force acts on the body in its paſſage from H to K: if the centripetal force be weak enough, the lines AH and AI drawn from the centre A to the body at H and at I, ſhall be more obliquely inclined to the curve than the line AB is inclined towards BG. The centripetal force may be of ſuch a ſtrength as to render all theſe inclinations equal; or if ſtronger, the inclinations at I and K will be leſs oblique than at B; and Sir Iſaac Newton has particularly ſhown, that if the centripetal power decreaſes after a certain manner without the increaſe of diſtance, a body may deſcribe ſuch a curve line, that all the lines drawn from the centre to the body ſhall be equally inclined to that curve line.

258 Revolution of a body round a centre explained.

We muſt farther remark, that if the centripetal power, while the body increaſes its diſtance from the centre, retain ſufficient ſtrength to make the lines drawn from the centre to the body to become at length leſs oblique to the curve; then, if this diminution of the obliquity continue, till at laſt the line drawn from the centre to the body ſhall ceaſe to be obliquely inclined to the curve, and become perpendicular thereto; from this inſtant the body ſhall no longer recede from the centre, but in its following motion ſhall again deſcend, and deſcribe a curve in all reſpects like that which it has deſcribed already, provided the centripetal power, every where at the ſame diſtance from the body, acts with the ſame ſtrength. This return of the body may be proved by the following propoſition: That if the body in any place, ſuppoſe at I, were to be ſtopped, and thrown directly backward with the velocity wherewith it was moving forward in that point I, then the body, by the action of the centripetal force upon it, would move back again over the path IHB, in which it had before advanced

Of Centripetal Powers.

vanced forward, and would arrive again at the point B in the ſame ſpace of time as was taken up in its paſſage from B to I; the velocity of the body at its return from the point B being the ſame as that wherewith it firſt ſet out from that point.

The truth of this propoſition may be illuſtrated in the following manner. Suppoſe, in fig. 110, that a body were carried after the following manner through the bent figure ABCDEF, compoſed of the ſtraight lines AB, BC, CD, DE, EF, let the body then firſt be ſuppoſed to receive an impulſe to ſome point within the concavity of the figure, as G. Now, as this body, when once moving in the ſtraight line AB, will continue to move on in this line as long as it ſhall be left to itſelf; but being diſturbed at the point B by the impulſe given it, it will be turned out of this line AB into ſome other ſtraight line, wherein it will afterwards continue to move as long as it ſhall be left to itſelf: therefore, let this impulſe have ſtrength ſufficient to turn the body into the line BC; then let the body move on undiſturbed from B to C: but at C let it receive another impulſe pointed alſo towards G, and of ſufficient ſtrength to turn the body into the line CD; at D let a third impulſe turn it into the line DE; and at E let another turn it into EF. Now, if the body, while moving on in the line EF, be ſtopped and turned back again with the ſame velocity with which it was moving forward, then by the repetition of the former impulſe at E, the body will be turned in the line ED, and move in it from E to D with the ſame velocity as that wherewith it was moving forward in this line; then by a repetition of the impulſe at D, when the body ſhall have returned to that point, it will be turned into the line DC; and by the repetition of the former impulſes at C and at B, the body will be brought back again into the line BA, with the velocity wherewith it firſt moved in that line.

To illuſtrate this ſtill further, let DE and FE be continued beyond E. In DE thus continued, take at pleaſure the length EH, and let HI be ſo drawn as to be equidiſtant from the line GE; then, from the ſecond law of motion, it follows, that after the impulſe on the body on E, it will move through the ſpace EI in the ſame time it would have employed in moving from E to H with the velocity it had in the line DE. In FE prolonged, take EK equal to EI, and draw KL equidiſtant from GE. Then becauſe the body is thrown back in the line FE with the ſame velocity with which it went forward in that line, if, when the body was returned to E, it were permitted to go ſtraight on, it would paſs through EK in the ſame time as it took up in paſſing through EI, when it went forward in the line EF. But if, at the body's return to the point E, ſuch an impulſe directed toward the point D were to be given it as was ſufficient to turn it into the line DE, it is plain that this impulſe muſt be equal to that which originally turned the body out of the line DE into EF; and that the velocity with which the body will return into the line ED is the ſame as that wherewith it moved before through this line from D to E. Becauſe EK is equal to EI, and KL and HI being each equidiſtant from GE, are by conſequence equidiſtant from each other; it follows, that the two triangular figures IEH and KEL are altogether like and equal to each other. EK therefore being equal to EI, and EL equal to KH, and KL equal to HL, it is plain, that the body, after its return to E, being turned out of the line FE into ED by an impulſe acting upon it in E after the manner abovementioned, it will receive ſuch a velocity by this impulſe as will carry it through EL in the ſame time it would have taken to go through EK, if it had paſſed through it undiſturbed. It has already been obſerved, that the time in which the body would paſs over EK, with the velocity wherewith it returns, is equal to the time it took up in going forward from E to I; that is, to the time in which it would have gone through EH with the velocity wherewith it moved from D to E: therefore the time in which the body will paſs from E to L, after its return into the line ED, is the ſame as would have been taken up by the body in paſſing through the line EH with the velocity wherewith it firſt moved in the line DE. Since, therefore EL and EH are equal, the body returns into the line DE with the velocity which it had before in that line.—Again, we may affirm, that the ſecond impulſe in E is equal to the firſt; for as the impulſe in E, whereby the body was turned out of the line DE into the line EF, is of ſuch ſtrength, that if the body had been at reſt when this impulſe had acted upon it, it would have communicated as much motion to it as would have been ſufficient to carry it through a length equal to HI, in the time wherein the body would have paſſed from E to H, or in the time wherein it paſſed from E to I. In the ſame manner on the return of the body, the impulſe in E, whereby it is turned out of the line FE into ED, is of ſuch ſtrength, that if it had acted on the body at reſt, it would have cauſed it move through a length equal to KL in the ſame time as the body would employ in paſſing through EK with the velocity wherewith it returns in the line FE: therefore the ſecond impulſe, had it acted on the body at reſt, would have cauſed it to move through a length equal to KL in the ſame ſpace of time as would have been taken up by the body in paſſing through a length equal to HI were the firſt impuſe to act on the body while at reſt. That is, the effects of the firſt and ſecond impuſe on the body when at reſt would be the ſame: for KL and HI are equal; conſequently the ſecond impuſe is equal to the firſt. Thus, if the body be returned through FE with the velocity wherewith it moved forward, it has been ſhown how, by the repetition of the impulſe which acted on it in E, the body will return again into the line DE with the velocity which it had before in that line. By the ſame method of reaſoning it may be proved, that when the body is returned back to D, the impulſe which before acted on that point will throw the body into the line DC with the velocity which it firſt had in that line; and the other impulſes being ſucceſſively repeated, the body will at length be brought back again into the line BA with the velocity wherewith it ſet out in that line.—Thus theſe impulſes, by acting over again in an inverted order all their operations on the body, bring it back again through the path in which it had proceeded forward; and this obtains equally whatever be the number of ſtraight lines whereof this curve figure is compoſed. Now, by a method of reaſoning of which Sir Iſaac Newton made much uſe, and which he introduced into geometry.

Of Centripetal Powers.

metry, thereby greatly enriching that ſcience, we might make a tranſition from this figure, compoſed of a number ſtraight lines, to a figure of one continued curvature, and from a number of ſeparate impuſes repeated at diſtinct intervals to a continued centripetal force, and ſhow, that becauſe what has been here advanced holds univerſally true whatever be the number of ſtraight lines whereof the curve figure ACF is compoſed, and however frequently the impulſes at the angles of this figure are repeated; therefore the ſame will ſtill remain true although this figure ſhould be converted into one of a continued curvature; and theſe diſtinct impulſes ſhould be changed into a continual centripetal force.

This being allowed, ſuppoſe the body in K to have the line AK no longer obliquely inclined to its motion. In this caſe, if the body be turned back in the manner we have been conſidering, it muſt be directed back perpendicularly to AK; but if it had proceeded forward, it would likewiſe have moved in a direction perpendicular to AK: conſequently, whether it move from this point K backward or forward, it muſt deſcribe the ſame kind of courſe. Therefore, ſince by being turned back it will go over again the line KIHB, if it be permitted to go forward, the line KL, which it ſhall deſcribe, will be altogether ſimilar to the line KHB.

In like manner we may determine the nature of the motion, if the line wherein the body ſets out be inclined, as in fig. 111. down toward the line BA drawn between the body and the centre. If the centripetal power ſo much increaſes in ſtrength as the body approaches, that it can bend the path in which the body moves to that degree as to cauſe all the lines, AH, AI, AK, to remain no leſs oblique to the motion of the body than AB is oblique to BC, the body ſhall continually more and more approach the centre: But if the centripetal power increaſes in ſo much leſs a degree as to permit the line drawn from the centre to the body, as it accompanies the body in its motion, at length to become more and more erect to the curve wherein the body moves, and in the end, ſuppoſe at K, to become perpendicular to it; from that time the body ſhall riſe again. This is evident from what has been ſaid above; becauſe, for the very ſame reaſon, here alſo the body will proceed from the point K to deſcribe a line altogether ſimilar to that in which it has moved from B to K. Thus it happens as in the pendulum, which, all the time it approaches a perpendicular poſition towards the horizon, deſcends more and more; but as ſoon as it is come into that ſituation, it immediately riſes again by the ſame degrees as it deſcended before: ſo here the body more and more approaches the centre all the time it is moving from B to K; but thenceforward it riſes from the centre again by the ſame degrees as it approached before.

If, as in fig. 112. the line BC be perpendicular to AB; then as has already been obſerved, the centripetal power may be ſo balanced with the progreſſive motion of the body, that it may keep moving round the centre A conſtantly at the ſame diſtance, as the body does when whirled about any point to which it is tied by a ſtring. If the centripetal power be too weak to produce this effect, the motion of the body will preſently become oblique to the line drawn from itſelf to the centre; but if it be ſtronger, the body muſt conſtantly keep moving in a curve to which a line drawn from it to the body is perpendicular.

If the centripetal power change with the change of diſtance, in ſuch a manner that the body, after its motion has become oblique to the line drawn from itſelf to the centre, ſhall again become perpendicular thereto; then the body ſhall, in its ſubſequent motion, return again to the diſtance of AB, and from that diſtance take a courſe ſimilar to the former: and thus, if the body move in a ſpace void of all reſiſtance, which has been all along ſuppoſed, it will continue in a perpetual motion about the centre, deſcending and aſcending from it alternately. If the body, ſetting out from B (fig. 113.) in the line BC perpendicular to AB, deſcribe the line BDE, which in D ſhall be oblique to the line AD; but in E ſhall again become erect to AE, drawn from the body in E to the centre A; then from this point E the body ſhall deſcribe the line EFG entirely ſimilar to BDE, and at G ſhall be at the ſame diſtance as it was at B; and the line AG ſhall be erect to the body's motion. Therefore the body ſhall proceed to deſcribe from G the line GHI altogether ſimilar to the line GFE, and at I it will have the ſame diſtance from the centre as it had at E; and alſo have the line AI erect to its motion: ſo that its ſubſequent motion muſt be in the line IKL ſimilar to IKG, and the diſtance AL equal to AG. Thus the body will go on in a perpetual round without ceaſing, alternately enlarging and contracting its diſtance from the centre.

If it ſo happen that the point E fall upon the line BA, continued beyond A; then the point G will fall upon B, I on E, and L alſo on B; ſo that the body will in this caſe deſcribe a ſimple curve line round the centre A, like the line BDEF in fig. 114. in which it will revolve from B to E, and from E to B, without end. If AE in fig. 113. ſhould happen to be perpendicular to AB, in this caſe alſo a ſimple line will be deſcribed; for the point G will fall on the line BA prolonged beyond A; the point I on the line AE prolonged beyond A, and the point L on B; ſo that the body will deſcribe a line like the curve line BEGI in fig. 115. in which the oppoſite points B and G are equally diſtant from A; and the oppoſite points E and L are alſo equally diſtant from the ſame point A. In other caſes the body will have a courſe of a more complicated nature.

Thus it muſt be apparent how a body, while it is conſtantly attracted towards a centre, may notwithſtanding by its progreſſive motion keep itſelf from falling down to the centre, deſcribing about it an endleſs circuit, ſometimes approaching and ſometimes receding from it. Hitherto, however, we have ſuppoſed, that the centripetal power is every where of equal ſtrength at the ſame diſtance from the centre: and this is indeed the caſe with that power which keeps the planets in their orbits; but a body may be kept on in a perpetual circuit round the centre, although the centripetal power be kept moving in any curve line whatever, that ſhall have its concavity turned every where towards the centre of the force. To illuſtrate this, we ſhall in the firſt place propoſe the caſe of a body moving the incurvated figure ABCDE (fig. 116.), which is compoſed of the ſtraight lines AB, BC, CD, DE, and EA; the motion being carried on in the following manner. Let the body firſt move in the line AB with any uniform velocity. When it is arrived at the point B, let it receive an impulſe directed towards any point F taken within the figure; and let the impulſe be of ſuch a ſtrength as to turn the body out of the line AB into the line BC: The body after this impulſe, while left to itſelf, will continue moving in the line BC. At C let the body receive another impulſe directed towards the ſame point F, of ſuch a ſtrength as to turn it from the line BC into CD. At D, let the body, by another impulſe, directed likewiſe to the point F, be turned out of the line CD into DE. At E let another impulſe, directed likewiſe toward the point F, turn the body from the line DE into AE: and thus the body will, by means of theſe impulſes, be carried thro' the whole figure ABCDE.

Again, when the body is come to the point A, if it there receive another impulſe directed like the reſt to the point F, and of ſuch a degree of ſtrength as to turn it into the line AB, wherein it firſt moved; the body will then return into this line with the ſame velocity it had originally. To underſtand this, let AB be prolonged beyond B at pleaſure, ſuppoſe to G; and from G let GH be drawn; which, if produced, ſhould always continue equidiſtant from BF, i. e. let GH be drawn parallel to BF, in the time, then, in which the body would have moved from B to G, had it not received a new impulſe in B; by the means of that impulſe it will have acquired a velocity which will carry it from B to H. After the ſame manner, if CI be taken equal to BH, and IK be drawn parallel to CF, the body will have moved from C to K, with the velocity which it has in the line CD, in the ſame time it would have employed in moving from C to I with the velocity it had in the line BC. Therefore, ſince CI and BH are equal, the body will move through CK in the ſame time as it would have taken up in moving from B to G with the velocity wherewith it moved through the line AB. Again, DL being taken equal to CK, and LM drawn parallel to DF, the body will, for the ſame reaſon as before, move through DM with the velocity which it has in the line DE, in the ſame time it would employ in moving through BG with its original velocity. Laſtly, if EN be taken equal to DM, and NO be drawn parallel to EF; likewiſe, if AP be taken equal to EO, and PQ be drawn parallel to AF; then the body, with the velocity wherewith it returns into the line AB, will paſs thro' AQ in the time it would have employed in paſſing through BG with its original velocity. Now as all this follows directly from what has been delivered concerning oblique impulſes impreſſed upon bodies in motion; ſo we muſt here obſerve farther, that it can be proved by geometry, that AQ will always be equal to BG; which being granted, it follows, that the body has returned into the line AB with the ſame velocity which it had when it firſt moved in that line; for the velocity with which it returns into the line AB, will carry it over the line AQ in the ſame time as would have been taken up in its paſſing over an equal line BG with the original velocity.

259
A body may be moved in any curvilinear direction by means of centripetal force.

The concluſion naturally deduced from the above reaſoning is, that by means of a centripetal and projectile force, a body may be carried round any fixed point in a curve figure which ſhall be concave towards it, as that marked ABC, fig. 117. and when it is returned to that point from whence it ſet out, it ſhall recover again the velocity with which it departed from that point. It is not indeed always neceſſary that it ſhould return again into its firſt courſe, for the curve line may have ſome ſuch figure as ABCDBE in fig. 118. In this curve line, if the body ſet out from B in the direction BF, and moved through the line BCD till it returned to B; here the body would not enter again into the line BCD, becauſe the two parts BD and BC of the curve line make an angle at the point B: ſo that the centripetal power, which at the point B would turn the body from the line BF into the curve, will not be able to turn it into the line BC from the direction in which it returns to the point B. A forcible impulſe muſt be given the body in the point B to produce that effect. If, at the point B, whence the body ſets out, the curve line return into itſelf, as in fig. 117. then the body, upon its arrival again at B, may return into its former courſe, and thus make an endleſs circuit about the centre.

260
Calculation of the force requiſite to carry a body in any curve line.

The force requiſite to carry a body in any curve line propoſed, is to be deduced from the curvature which the figure has in any part of it. Sir Iſaac Newton has laid down the following propoſition as a foundation for diſcovering this, viz. that if a line be drawn from ſome fixed point to the body, and remaining by one extreme united to that point, it be carried round along with the body; then if the power whereby the body is kept in its courſe be always pointed to this fixed point as a centre, this line will move over equal ſpaces in equal portions of time. Suppoſe a body were moving through the curve line ABCD (fig. 120), and paſſed over the arches AB, BC, CD in equal portions of time; then if a point, as E, can be found, from whence the line EA being drawn to the body in accompanying it in its motion, it ſhall make the ſpaces EAB, EBC, and ECD, over which it paſſes, equal where the times are equal; then is the body kept in this line by a power always pointed to E as a centre. To prove this, ſuppoſe a body ſet out from the point A, fig. 121. to move in the ſtraight line AB; and after it had moved for ſome time in that line, it were to receive an impulſe directed to ſome point, as C. Let it receive that impulſe at D, and thereby be turned into the line DE; and let the body, after this impulſe, take the ſame time in paſſing from D to E that is employed in paſſing from A to D. Then the ſtraight lines CA, CD, and CE being drawn, the triangular ſpaces CAD and CDE are proved to be equal in the following manner. Let EF be drawn parallel to CD. Then, it follows, from the ſecond law of motion, that ſince the body was moving in the line AB when it received the impulſe in the direction DC, it will have moved after the impulſe through the line DE in the ſame time as it would have moved through DF, provided it had received no diſturbance in D. But the time of the body's moving from D to E is ſuppoſed to be equal to the time of its moving through AD; therefore the time which the body would have employed in moving through DF, had it not been diſturbed in D, is equal to the time wherein it moved through AD; conſequently DF is equal in length to AD; for if the body had gone on to move through the line AB without interruption, it would have moved through all the parts of it with the ſame velocity, and have paſſed over equal parts of that line in equal portions of time. Now CF being drawn, ſince AD and DF are equal, the triangular ſpace CDF is equal to the triangular ſpace CAD. Farther, the line EF being parallel to CD, it follows from the 37th propoſition of Euclid's firſt book, that the triangle CED is equal to the triangle CFD: therefore the triangle CED is equal to the triangle CAD.

In like manner, if the body receive at E another impulſe directed toward the point C, and be turned by that impulſe into the line EG; if it move afterwards from E to G in the ſame ſpace of time as was taken up by its motion from D to E, or from A to D; then CG being drawn, the triangle CEG is equal to CDE. A third impulſe at G, directed as the two former to C, whereby the body ſhall be turned into the line GH, will have alſo the like effect with the reſt. If the body move over GH in the ſame time as it took up in moving over EG, the triangle CGH will be equal to the triangle CEG. Laſtly, if the body at H be turned by a freſh impulſe directed toward C into the line HI, and at I by another impulſe directed alſo to C be turned into the line IK; and if the body move over each of the lines HI and IK in the ſame time as it employed in moving over each of the preceding lines AD, DE, EG, and GH: then each of the triangles CHI and CIK will be equal to each of the preceding. Likewiſe, as the time in which the body moves over ADE is equal to the time of its moving over EGH, and to the time of its moving over HIK; the ſpace CADE will be equal to the ſpace CEGH and to the ſpace CHIK. In the ſame manner, as the time in which the body moved over ADEG is equal to the time of its moving over GHIK, ſo the ſpace CADEG will be equal to the ſpace CGHIK. From this principle Sir Iſaac Newton demonſtrates the above-mentioned propoſition, by making the tranſition from this incurvated figure compoſed of ſtraight lines, to a figure of continued curvation; and by ſhowing, that ſince equal ſpaces are deſcribed in equal times, in this preſent figure compoſed of ſtraight lines, the ſame relation between the ſpaces deſcribed and the times of their deſcription will alſo have place in a figure of one continued curvature. He alſo deduces from this propoſition the reverſe of it; and proves, that whenever equal ſpaces are continually deſcribed, the body is acted upon by a centripetal force directed to the centre at which the ſpaces terminate.

Having thus endeavoured to illuſtrate the fundamental principle of the Newtonian philoſophy, at leaſt as far as it regards the motion of the planets and heavenly bodies, we ſhall now proceed to the more particular application of it. The firſt thing undertaken by Sir Iſaac in order to explain thoſe motions, is to demonſtrate, that in the celeſtial ſpaces there is no ſenſible matter. That the heavenly bodies ſuffer no ſenſible reſiſtance from any matter of this kind, is evident from the agreement betwixt aſtronomical obſervations in all ages with regard to the time in which the planets have been found to perform their revolutions. Des Cartes, however, was of opinion, that the planets might be kept in their courſes by means of a fluid matter, which continually circulating round, ſhould carry the planets along with it; and there is one appearance which ſeems to favour this opinion, viz. that the ſun turns round his axis the ſame way the planets move; the earth alſo turns round its axis the ſame way as the moon turns round the earth, and the planet Jupiter turns round his axis the ſame way that his ſatellites revolve round him. It might therefore be ſuppoſed, that if the whole planetary region were filled with a fluid matter, the ſun, by turning round on his own axis, might communicate motion firſt to that part of the fluid which was contiguous, and by degrees propagate the like motion to the parts more remote. After the ſame manner the earth might communicate motion to this fluid to a degree ſufficient to carry round the moon; and Jupiter might communicate the like to the diſtance of its ſatellites. This ſyſtem has been particularly examined by Sir Iſaac Newton; who finds, that the velocities with which the parts of this fluid ſhould move in different diſtances from the centre of motion will not agree with the motions obſerved in the different planets; for inſtance, that the time of one entire circulation of the fluid wherein Jupiter ſhould ſwim, would bear a greater proportion to the time of one entire circulation of the fluid where the earth is, than the period of Jupiter bears to that of the earth. He proves alſo, that the planet cannot circulate in ſuch a fluid, ſo as to keep long in the ſame courſe, unleſs the planet and the contiguous fluid are of the ſame denſity, and the planet be carried along with the ſame velocity as the fluid. There is alſo another remark made on this motion by Sir Iſaac, viz. that ſome vivifying force will be continually neceſſary at the centre of the motion. The ſun, in particular, by communicating motion to the ambient fluid, will loſe from itſelf as much motion as it communicates to the fluid, unleſs ſome acting principle reſide in the ſun to renew its motion continually. If the fluid were infinite, this gradual loſs of motion would continue till the whole ſhould ſtop; and if the fluid were limited, this loſs of motion would continue till there would remain no ſwifter a revolution in the ſun than in the outermoſt part of the fluid, ſo that the whole would turn together about the axis of the ſun like one ſolid globe. We muſt likewiſe obſerve, that as the planets do not move in perfect circles round the ſun, there is a greater diſtance between their orbits in ſome places than others. For inſtance, the diſtance between the orbit of Mars and Venus is near half as great again in ſome part of their courſe as in others. Now here the fluid in which the earth ſhould ſwim, muſt move with a leſs rapid motion where there is this greater interval between the contiguous orbits; but, on the contrary, where the ſpace is ſtraiteſt, the earth moves more ſlowly than where it is wideſt.

261
No ſenſible matter in the celeſtial ſpaces.

Again, if our globe of earth ſwam in a fluid of equal denſity with the earth itſelf, that is, in a fluid more denſe than water, all bodies put in motion here upon the earth's ſurface muſt ſuffer a great reſiſtance by it; whereas Sir Iſaac Newton has made it evident, by experiments, that bodies, falling perpendicularly through the air, ſuffer only about one hundred and ſixtieth part of the reſiſtance from it that they meet with in water.

These

262 Objections to a plenum.

Theſe expetiments are applied by Sir Iſaac yet farther to the general queſtion concerning the abſolute plenitude of ſpace. He objects againſt the filling of all ſpace with a ſubtile fluid, after the manner of Des Cartes, That all bodies muſt be immeaſurably reſiſted by it. And leſt it ſhould be thought that this objection might be evaded by aſcribing to this fluid ſuch very minute and ſmooth parts as might remove all adheſion or friction between them, whereby all reſiſtance would be loſt, Sir Iſaac proves, that fluids muſt reſiſt from the inactivity of their particles, and that water and the air reſiſt almoſt entirely on this account; ſo that in this ſubtile fluid, however ſmooth and lubricated the particles might be, yet if the whole were as denſe as water, it would reſiſt very near as much as water does: And whereas ſuch a fluid, whoſe parts are abſolutely cloſe together without any intervening ſpaces, muſt be a great deal more denſe than water, it muſt alſo reſiſt more in proportion to its denſity, unleſs we ſuppoſe the matter of which this fluid is compoſed not to be endowed with the ſame degree of inactivity with other matter: But if you deprive any ſubſtance of the property ſo univerſally belonging to all other matter, without impropriety of ſpeech it can ſcarce be called by this name. Sir Iſaac alſo made an experiment to try in particular, whether the internal parts of bodies ſuffered any reſiſtance; and the reſult did indeed appear to favour ſome ſmall degree of reſiſtance, but ſo very little as to leave it doubtful whether the effect did not ariſe from ſome other latent cauſe.

§ 2. *Of the Motions of the Primary Planets.*

263 Planetry motions particularly explained.

264 Reciprocal duplicate proportion explained.

SINCE the planets thus move in a ſpace void of all reſiſtance, they would, if once ſet in motion, continue to move on for ever on a ſtraight line. We have, however, already obſerved, that the primary planets move about the ſun in ſuch a manner that a line extended from the ſun to the planet would deſcribe equal ſpaces in equal times; and this ſingle property in the planetary motions proves, that they are continually acted upon by a power directed towards the ſun as the centre. It has alſo been obſerved, that if the ſtrength of the centripetal power were ſuitably accommodated every where to the motion of any body round a centre, the body might be carried in any bent line whatever, whoſe concavity ſhould be every where turned towards the centre of that force; and likewiſe that the ſtrength of the centripetal force in each place was to be collected from the nature of the line wherein the body moved. Now ſince each of the planets moves in an ellipſis, having the ſun in one of its foci, Sir Iſaac Newton demonſtrates, that the ſtrength of this power is reciprocally in the duplicate proportion of the diſtance from the ſun. This proportion may be explained in the following manner: Suppoſe ſeveral diſtances to bear to each other the proportions of the numbers 1, 2, 3, 4, 5; that is, let the ſecond diſtance be double the firſt, the third three times, the fourth four times, and the fifth five times as great as the firſt; multiply each of theſe numbers by itſelf, and 1 multiplied by 1 produces ſtill 1, 2 multiplied by 2 produces 4, 3 by 3 produces 9, 4 by 4 produces 16, and 5 by 5 produces 25; this being done, the fractions $\frac{1}{4}$, $\frac{1}{9}$, $\frac{1}{16}$, and $\frac{1}{25}$, will reſpectively expreſs the proportion which the centripetal power in each of the following diſtances bears to the power at the firſt diſtance: for in the ſecond diſtance, which is double the firſt, the centripetal power will be one-fourth part only of the power at the firſt diſtance; at the third diſtance, the power will only be one-ninth part of the firſt power; at the fourth diſtance, the power will be only one-ſixteenth; and at the fifth diſtance only one twenty-fifth, of the firſt power. Thus is found the proportion in which the centripetal power decreaſes, as the diſtance from the ſun increaſes within the compaſs of one planet's motion. How it comes to paſs that the planet can be carried about the ſun by this centripetal power in a continual round, ſometimes riſing from the ſun, then deſcending again as low, appears from what has been already ſaid concerning centripetal forces.

265 Centripetal power proved to extend throughout the ſyſtem.

266 Centripetal power defined.

In order to know whether this centripetal power extends in the ſame proportion throughout the ſyſtem, and conſequently whether all the planets are influenced by it, Sir Iſaac inquires what relation there ought to be between the periods of the different planets, provided they were acted upon by the ſame power, decreaſing throughout in the proportion abovementioned; and he finds, that the period of each, in this caſe, would have that very proportion to the greater axis of its orbit which has been already related: which puts it beyond a doubt, that the different planets are preſſed towards the ſun in the ſame proportion to the diſtances as one planet is in its ſeveral diſtances; whence it is juſtly concluded, that there is ſuch a power acting towards the ſun in the foreſaid proportion at all diſtances from it. This power, when refered to the earth, Sir Iſaac calls *gravity*; when to the ſun, *attraction*; and to the planets, *centripetal* force. By theſe means, however, he deſigns only to ſignify a power endowed with the properties abovementioned; but by no means would have it underſtood as if theſe names referred any way to the cauſe of it.

View of Sir Iſaac Newton's Philoſophy, p. 175.

267 Minute variations in the planetary motions accounted for.

268 Motion of the aphelion accounted for.

“ But now (ſays Mr Pemberton) in theſe demonſtrations, ſome very minute inequalities in the motion of the planets are neglected; which is done with a great deal of judgment: for whatever be their cauſe, the effects are very inconſiderable, they being ſo exceedingly ſmall, that ſome aſtronomers have thought fit wholly to paſs them by. However, the excellency of this philoſophy, when in the hands of ſo great a geometer as our author (Sir Iſaac Newton), is ſuch, that it is able to trace the leaſt variations of things up to their cauſes. The only inequalities which have been obſerved common to all the planets are, the motion of the aphelion and the nodes. The tranſverſe axis of each orbit does not remain always fixed, but moves about the ſun with a very ſlow progreſſive motion; nor do the planets keep conſtantly in the ſame planes, but changes them and the lines by which theſe planes interſect each other by inſenſible degrees. The firſt of theſe inequalities, which is the motion of the aphelion, may be accounted for, by ſuppoſing the gravitation of the planets towards the ſun to differ a little farther from the forementioned reciprocal duplicate proportion of the diſtances: but the ſecond, which is the motion of the nodes, cannot be accounted for by any power directed towards the ſun; for no ſuch power can give it any lateral impulſe to divert it from the plane of its motion into any new plane, but of neceſſity muſt be derived from ſome other centre. Where that power is lodged, remains to be diſcovered. Now it is proved, as ſhall be afterwards explained, that the three primary planets, Saturn, Jupiter, and the Earth, which have ſatellites revolving about them, are endowed with a power of cauſing bodies, in particular thoſe ſatellites, to gravitate towards them with a force which is reciprocally in the duplicate proportion of their diſtances; and the planets are, in all reſpects in which they come under our conſideration, ſo ſimilar and alike, that there is no reaſon to queſtion but that they have all the ſame property, though it be ſufficient for the preſent purpoſe to have it proved of Jupiter and Saturn only; for theſe planets contain much greater quantities of matter than the reſt, and proportionally exceed the others in power. But the influence of theſe two planets being allowed, it is evident how the planets come to ſhift their places continually: for each of the planets moving in a different plane, the action of Jupiter and Saturn upon the reſt will be oblique to the planes of their motion, and therefore will gradually draw them into new ones. The ſame action of theſe two planets upon the reſt will likewiſe cauſe a progreſſive motion; and therefore will gradually draw them into new ones. The ſame action of theſe two planets upon the reſt will likewiſe cauſe a progreſſive motion of the aphelion; ſo that there will be no neceſſity for having recourſe to the other cauſe for this motion, which was before hinted at, viz, the gravitation of the planets towards the ſun differing from the exact duplicate proportion of their diſtances. And in the laſt place, the action of Jupiter and Saturn upon each other will produce in their motions the ſame inequalities as their joint action produces upon the reſt. All this is effected in the ſame manner as the ſun produces the ſame kind of inequalities and many others in the motion of the moon and other ſecondary planets; and therefore will be beſt apprehended by what is ſaid afterwards. Thoſe other irregularities in the motion of the ſecondary planets have place likewiſe here, but are too minute to be obſervable, becauſe they are produced and rectified alternately, for the moſt part in the time of a ſingle revolution; whereas the motion of the aphelion and nodes which increaſe continually, become ſenſible after a long ſeries of years.

269 **Jupiter and Saturn influence eachother's motions.**

Yet ſome of theſe other inequalities are diſcernible in Jupiter and Saturn; in Saturn chiefly: for when Jupiter, who moves faſter than Saturn, approaches to a conjunction with him, his action upon the latter will a little retard the motion of that planet; and by the reciprocal action of Saturn, he will himſelf be accelerated. After conjunction, Jupiter will again accelerate Saturn, and be likewiſe retarded in the ſame degree as before the firſt was retarded and the latter accelerated. Whatever inequalities beſides are produced in the motion of Saturn by the action of Jupiter upon that planet, will be ſufficiently rectified by placing the focus of Saturn's ellipſis, which ſhould otherwiſe be in the ſun, in the common centre of gravity of the ſun and Jupiter. And all the inequalities of Jupiter's motions, cauſed by the action of Saturn upon him, are much leſs conſiderable than the irregularities of Saturn's motion. This one principle therefore of the planets having a power as well as the ſun to cauſe bodies gravitate towards them, which is proved by the motion of the ſecondary planets to obtain in fact, explains all the irregularities relating to the planetary motions ever obſerved by aſtronomers (A).

270 **Method of correcting the planetary motions.**

"Sir Iſaac Newton after this proceeds to make an improvement in aſtronomy, by applying this theory to the farther correction of their motions. For as we have here obſerved the planets to poſſeſs a principle of gravitation as well as the ſun; ſo it will be explained at large hereafter, that the third law of motion, which makes action and reaction equal, is to be applied in this caſe, and that the ſun does not only attract each planet, but is alſo itſelf attracted by them; the force wherewith the planet is acted on bearing to the force wherewith the ſun itſelf is acted upon at the ſame time, the proportion which the quantity of matter in the ſun bears to the quantity of matter in the planet. From the action of the ſun and planet being thus mutual, Sir Iſaac Newton proves that the ſun and planet will deſcribe about their common centre of gravity ſimilar ellipſes; and then, that the tranſverſe axis of the ellipſes, which would be deſcribed about the ſun at reſt in the ſame time, the ſame proportion as the quantity of ſolid matter in the ſun and planet together bears to the firſt of two mean proportionals between this quantity and the quantity of matter in the ſun only.

271 **Sun moves round the common centre of gravity of him and the planets.**

"It will be aſked, perhaps, how this correction can be admitted, when the cauſe of the motions of the planets was before found, by ſuppoſing them to be the centre of the power which acted upon them? for, according to the preſent correction, this power appears rather to be directed to the common centre of gravity. But whereas the ſun was at firſt concluded to be the centre to which the power acting on the planets was directed, becauſe the ſpaces deſcribed in equal times round the ſun were found to be equal; ſo Sir Iſaac Newton proves, that if the ſun and planet move round their common centre of gravity, yet, to an eye placed in the planet, the ſpaces which will appear to be deſcribed about the ſun will have the ſame relation to the times of their deſcription as the real ſpaces would if the ſun were at reſt. I further aſſerted, that, ſuppoſing the planets to move round the ſun at reſt, and to be attracted by a power which ſhould every where act with degrees of ſtrength reciprocally in the duplicate proportions of their diſtances; then the periods of the planets muſt obſerve the ſame relations to their diſtances as aſtronomers have found them to do. But here it muſt not be ſuppoſed, that the obſervations of aſtronomers abſolutely agree without any the leaſt difference: and the preſent correction will not cauſe a deviation

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(A) Profeſſor J. Robiſon, however, informs us in his paper on the *Georgium Sidus* (Edinburgh Philoſophical Tranſactions, Vol. I.), That *all* the irregularities in the planetary motions *cannot* be accounted for from the laws of gravitation; for which reaſon he was obliged to ſuppoſe the exiſtence of planets beyond the orbit of Saturn, even before the diſcovery of the *Georgium Sidus*. M. de la Lande alſo has obſerved ſome unaccountable inequalities in the motion of Saturn for more than 30 years paſt.

Fig. 135

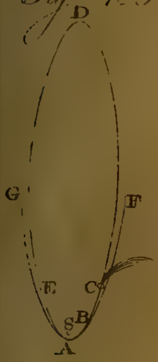


Fig. 136

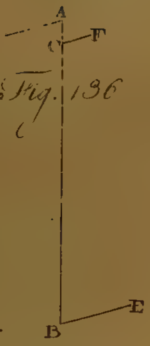


Fig. 137

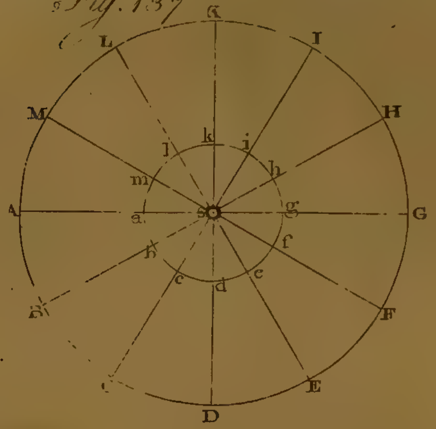


Fig. 140

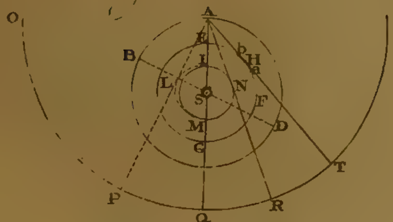


Fig. 138

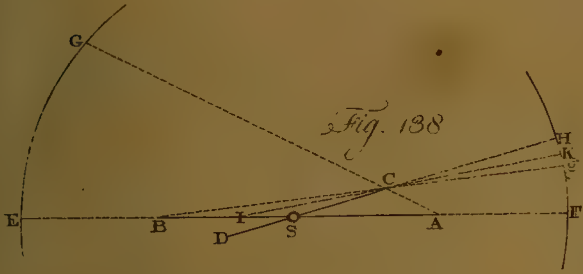


Fig. 139

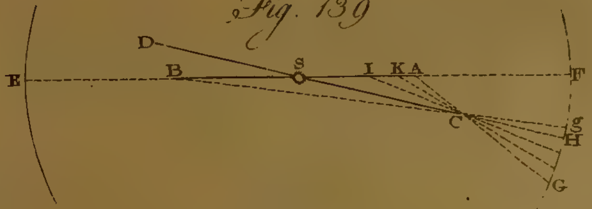


Fig. 143

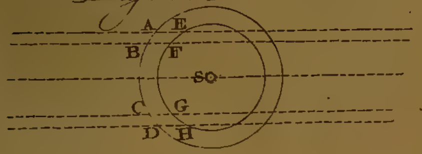


Fig. 145

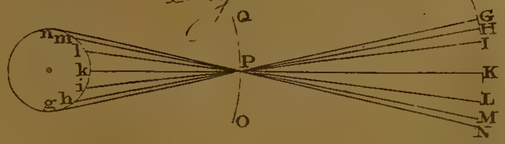


Fig. 141

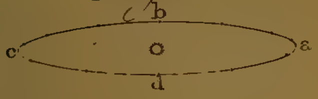


Fig. 142

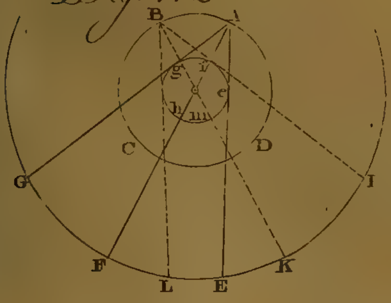


Fig. 146

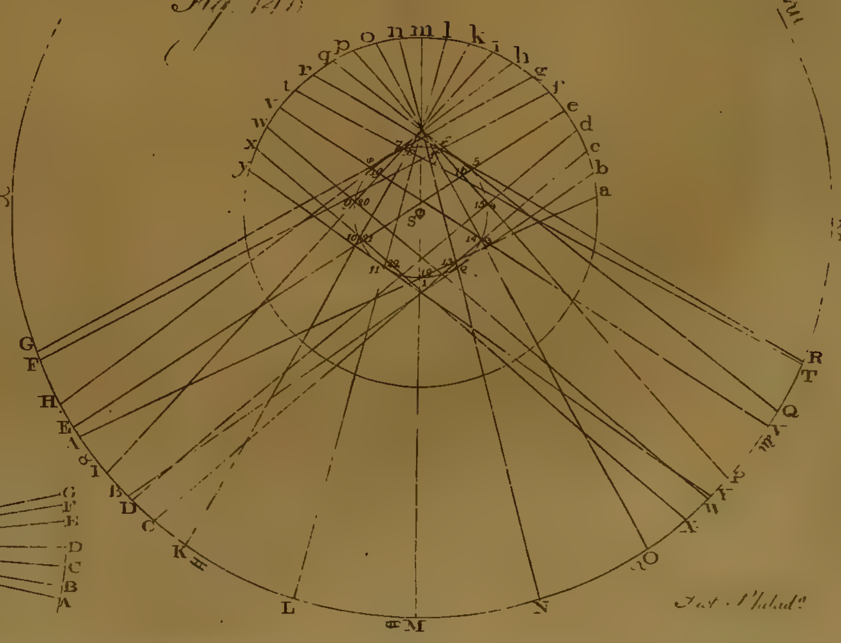
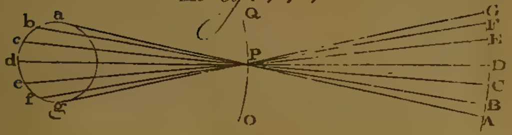


Fig. 144



Jas. Phil. del.

deviation from any one aſtronomer's obſervations ſo much as they differ from one another; for in Jupiter, where this correction is greateſt, it hardly amounts to the 3000th part of the whole axis.

272
Argument againſt the eternity of the world.

“ Upon this head, I think it not improper to mention a reflection made by our excellent author upon theſe ſmall inequalities in the planets motions, which contains in it a very ſtrong philoſophical argument againſt the eternity of the world. It is this, that theſe inequalities muſt continually increaſe by ſlow degrees, till they render at length the preſent frame of nature unfit for the purpoſes it now ſerves. And a more convincing proof cannot be deſired againſt the preſent conſtitution's having exiſted from eternity than this, that a certain period of years will bring it to an end. I am aware, that this thought of our author has been repreſented even as impious, and as no leſs than caſting a reflection upon the wiſdom of the Author of nature for framing a periſhable work. But I think ſo bold an aſſertion ought to have been made with ſingular caution: for if this remark upon the increaſing irregularies in the heavenly motions be true in fact, as it really is, the imputation muſt return upon the aſſertor, that this does not detract from the divine wiſdom. Certainly we cannot pretend to know all the omniſcient Creator's purpoſes in making this world, and therefor cannot pretend to determine how long he deſigned it ſhould laſt; and it is ſufficient if it endure the time deſigned by the Author. The body of every animal ſhows the unlimited wiſdom of the Author no leſs, nay, in many reſpects more, than the larger frame of nature; and yet we ſee they are all deſigned to laſt but a ſmall ſpace of time.

§ 3. *The Motions of the Secondary Planets explained from the Principles laid down in* § 1.

The excellency of the Newtonian philoſophy is diſcoverable even more in its ſolution of the motions of the ſecondary than in thoſe of the primary planets; for thus not only all the irregularities formerly diſcovered by aſtronomers in theſe motions are ſolved in a ſatisfactory manner, but ſeveral others are diſcovered of ſuch a complicated nature that they could never be diſtinguiſhed into proper heads. Theſe, however, are now not only found out from their cauſes, which this philoſophy has brought to light; but the dependence of them upon their cauſes is alſo ſhown in ſuch a perfect manner, that the degree of them may be exactly computed. Thus Sir Iſaac Newton found means to compute the moon's motion ſo exactly, that he framed a theory from which the place of that planet may at all times be computed very nearly, or altogether, as exactly as the places of the primary planets themſelves; which is much beyond what the greateſt aſtronomers could ever effect.

273
Secondaries attracted by their primaries.

The firſt thing demonſtrated of theſe ſecondary planets is, that they are drawn towards their reſpective primaries in the ſame manner as the latter are attracted by the ſun. That each ſecondary planet is kept in its orbit by a power directed towards its primary, &c. is proved from the phenomenon of the ſatellites of Jupiter and Saturn; becauſe they move in circles, as far as we can obſerve, about their reſpective primaries with an equable courſe, the primary being the centre of each orbit: and by comparing the times in which the different ſatellites of the ſame primary perform their periods, they are found to obſerve the ſame relation to the diſtances from their primary as the primary planets obſerve in reſpect of their mean diſtances from the ſun. The ſame thing holds good alſo with regard to the earth and moon: for ſhe is found to move round the earth in an ellipſis after the ſame manner as the primary planets do about the ſun, excepting only ſome ſmall irregularities in her motions, the cauſe of which will be particularly explained in what follows; whereby it will appear that they are no objections againſt the earth's acting on the moon in the ſame manner as the ſun acts on the primary planets; that is, as Jupiter and Saturn act upon their ſatellites.

274
Power of Jupiter and Saturn diſcovered by their ſatellites.

By the number of ſatellites which move round Jupiter and Saturn, the power of each of theſe planets may be meaſured to a very conſiderable diſtance; for the diſtance of the outermoſt ſatellite in each of theſe planets exceeds ſeveral times the diſtance of the innermoſt. The force of the earth upon the moon, however, at different diſtances, is more confirmed by the following conſideration than any analogical reaſoning.

275
Gravity retains the moon in her orbit.

It will appear, that if the power of the earth by which it retains the moon in her orbit be ſuppoſed to act at all diſtances between the earth and moon, according to the rule already mentioned, this power will be ſufficient to produce upon bodies near the ſurface of the earth all the effects aſcribed to the principle of gravity. This is diſcovered by the following method. Let A (in fig. 122.) repreſent the earth, B the moon, BCD the moon's orbit; which differs little from a circle of which A is the centre. If the moon in B were left to itſelf to move with the velocity it has in the point B, it would leave the orbit, and proceed ſtraight forward in the line BE which touches the orbit in B.

276
Her motion particularly explained.

Suppoſe the moon would upon this condition move from B to E in the ſpace of one minute of time. By the action of the earth upon the moon, whereby it is retained in its orbit, the moon will really be found at the end of this minute in the point F, from whence a ſtright line drawn to A ſhall make the ſpace BFA in the circle equal to the triangular ſpace BEA; ſo that the moon in the time wherein it would have moved from B to E, if left to itſelf, has been impelled towards the earth from E to F. And when the time of the moon's paſſing from B to F is ſmall, as here it is only one minute, the diſtance between E and F ſcarce differs from the ſpace through which the moon would deſcend in the ſame time if it were to fall directly down from B toward A without any other motion. AB, the diſtance of the moon from the earth, is about 60 of the ſemidiameters of the latter; and the moon completes her revolution round the earth in about 27 days 7 hours and 43 minutes; therefore the ſpace EF will here be found by computation to be about $16\frac{1}{8}$ feet.

277
Calculation of the velocity of falling bodies.

Conſequently, if the power by which the moon is retained in its orbit be near the ſurface of the earth greater than at the diſtance of the moon in the duplicate proportion of that diſtance, the number of feet a body would deſcend near the ſurface of the earth by the action of this power upon it, in one minute, would be equal to the number $16\frac{1}{8}$ multiplied twice into the number 60; that is, to 58050. But how faſt bodies fall near the ſurface of the earth may be known by the pendulum; and by the exacteſt experiments, they are

Motions of the Secondary Planets.

are found to deſcend the ſpace of $16\frac{1}{8}$ feet in one ſecond; and the ſpaces deſcribed by falling bodies being in the duplicate proportion of the times of their fall, the number of feet a body would deſcribe in its fall near the ſurface of the earth in one minute of time will be equal to $16\frac{1}{8}$ twice multiplied by 60; the ſame as would be cauſed by the power which acts upon the moon.

278 Earth and moon move about their common centre of gravity.

In this computation the earth is ſuppoſed to be at reſt: but it would have been more exact to have ſuppoſed it to move, as well as the moon, about their common centre of gravity; as will eaſily be underſtood from what has been already ſaid concerning the motion of the ſun and primary planets about their common centre of gravity. The action of the ſun upon the moon is alſo here neglected; and Sir Iſaac Newton ſhows, if you take in both theſe conſiderations, the preſent computation will beſt agree to a ſomewhat greater diſtance of the moon and earth, viz. to $61\frac{1}{2}$ ſemidiameters of the latter, which diſtance is more conformable to aſtronomical obſervations; and theſe computations afford an additional proof that the action of the earth obſerves the ſame proportion to the diſtance which is here contended for. In Jupiter and Saturn this power is ſo far from being confined to a ſmall extent of ſpace, that it not only reaches to ſeveral ſatellites at very different diſtances, but alſo from one planet to another, nay, even through the whole planetary ſyſtem; conſequently there is no appearance of reaſon why this power ſhould not act at all diſtances, even at the very ſurfaces of theſe planets as well as farther off. But from hence it follows, that the power which retains the moon in her orbit is the ſame as that which cauſes bodies near the ſurface of the earth to gravitate: for ſince the power by which the earth acts on the moon will cauſe bodies near the ſurface of it to deſcend with all the velocity they are found to do, it is certain no other power can act upon them beſides; becauſe if it did, they muſt of neceſſity deſcend ſwifter. Now, from all this, it is at length very evident, that the power in the earth which we call *gravity* extends up to the moon, and decreaſes in the duplicate proportion of the increaſe of the diſtance from the earth.

279 Action of the ſun upon the ſecondary Planets.

Thus far with reſpect to the action of the primary planets upon their ſecondaries. The next thing to be ſhown is, that the ſun likewiſe acts upon them. For this purpoſe we muſt obſerve, that if to the motion of the ſatellite whereby it would be carried round its primary at reſt, we ſuperadd the ſame motion, both in regard to the velocity and direction, as the primary itſelf has, it will deſcribe about the primary the ſame orbit with as great regularity as if the primary had been indeed at reſt. This proceeds from the law of motion, which makes a body near the ſurface of the earth deſcend perpendicularly, though the earth be in ſo ſwift a motion, that if the falling body did not partake of it, its deſcent would be remarkably oblique; and that a body projected deſcribes in the moſt regular manner the ſame parabola, whether projected in the direction in which the earth moves, or in the oppoſite direction, if the projecting force be the ſame. From this we learn, that if the ſatellite moved about its primary with perfect regularity, beſides its motion about the primary it would have the ſame progreſſive velocity with which the primary is carried about the ſun, in a direction parallel to that impulſe of its primary: And, on the contrary, the want of either of theſe, in particular of the impulſe towards the ſun, will occaſion great inequalities in the motion of the ſecondary planet. The inequalities which would ariſe from the abſence of this impulſe towards the ſun are ſo great, that by the regularity which appears in the motion of the ſecondary planets, it is proved, that the ſun communicates to them the ſame velocity by its action as it gives to their primary at the ſame diſtance. 280 Secondary planets equally attracted by the ſun with their primaries. For Sir Iſaac Newton informs us, that upon examination he found, that if any of the ſatellites of Jupiter were attracted by the ſun more or leſs than Jupiter himſelf at the ſame diſtance, the orbit of that ſatellite, inſtead of being concentrical to Jupiter, would have its centre at a greater or leſſer diſtance than the centre of Jupiter from the ſun, nearly in the ſubduplicate proportion of the difference between the ſun's action upon the ſatellite and upon Jupiter. Therefore, if any ſatellite were attracted by the ſun but one hundredth part more or leſs than Jupiter is at the ſame diſtance, the orbit of that ſatellite would be diſtant from the centre of Jupiter no leſs than a fifth part of the outermoſt ſatellite from Jupiter; which is almoſt the whole diſtance of the innermoſt ſatellite. By the like argument, the ſatellites of Saturn gravitate towards the ſun as much as Saturn itſelf at the ſame diſtance, and the moon as much as the earth.

281 Whence the inequalities in the motions of the ſecondary planets ariſe.

Thus it is proved, that the ſun acts upon the ſecondary planets as much as upon the primaries at the ſame diſtance: but it has alſo been ſhown, that the action of the ſun upon bodies is reciprocally in the duplicate proportion of the diſtance; therefore the ſecondary planets being ſometimes nearer to the ſun than to the primary, and ſometimes more remote, they are not always acted upon in the ſame degree with their primary, but when nearer to the ſun are attracted more, and when further off are attracted leſs. Hence ariſe various inequalities in the motion of the ſecondary planets. 282 Inequalities of the moon's motion explained. Some of theſe inequalities, however, would take place, though the moon if undiſturbed by the ſun had moved in a circle concentrical to the earth, and in the plane of the earth's motion; others depend on the elliptical figure and oblique ſituation of the moon's orbit. One of the former is, that the moon does not deſcribe equal ſpaces in equal times, but is continually accelerated as ſhe paſſes from the quarter to the new or full, and is retarded again by the like degrees in returning from the new and full to the next quarter: but here we conſider not ſo much the abſolute as the apparent motions of the moon with reſpect to us. Theſe two may be diſtinguiſhed in the following manner. Let S, in fig. 123. repreſent the ſun, A the earth moving in its orbit BC, DEFG the moon's orbit, and H the place of the moon in her orbit. Suppoſe the earth to have moved from A to I. Becauſe it has been ſhown that the moon partakes of all the progreſſive motion of the earth, and likewiſe that the ſun attracts both the earth and moon equally when they are at the ſame diſtance from it, or that the mean action of the ſun upon the moon is equal to its action upon the earth; we muſt therefore conſider the moon as carrying about with it the moon's orbit: ſo that when the earth is removed from A to I, the moon's orbit ſhall likewiſe be removed from its former ſituation into that denoted by KLMN. But now the earth being in I, if the moon were found in O, ſo that OI ſhould be parallel to HA, though the moon would readily have moved from H to O, yet it would not have appeared to a ſpectator upon the earth to have moved at all, becauſe the earth has moved as much as itſelf; ſo that the moon would ſtill appear in the ſame place with reſpect to the fixed ſtars. But if the moon be obſerved in P, it will then appear to have moved, its apparent motion being meaſured by the angle under OIP. And if the angle under PIS be leſs than the angle under HAS, the moon will have approached nearer its conjunction with the ſun. Now, to explain particularly the inequality of the moon's motion already mentioned, let S, in fig. 124. repreſent the ſun, A the earth, BCDE the moon's orbit, C the place of the moon when in the latter quarter. Here it will be nearly at the ſame diſtance from the ſun as the earth is. In this caſe, therefore, they will be both equally attracted, the earth in the direction AS, and the moon in that CS. Whence, as the earth, in moving round the ſun, is continually deſcending towards it, ſo the moon in this ſituation muſt in any equal portion of time deſcend as much; and therefore the poſition of the line AC in reſpect of AS, and the change which the moon's motion produces in the angle CAS, will not be altered by the ſun; but as ſoon as the moon is advanced from the quarter toward the new or conjunction, ſuppoſe to G, the action of the ſun upon it will have a different effect. Were the ſun's action upon the moon here to be applied in the direction GH parallel to AS, if its action on the moon were equal to its action on the earth, no change would be wrought by the ſun on the apparent motion of the moon round the earth. But the moon receiving a greater impulſe in G than the earth receives in A, were the ſun to act in the direction GH, yet it would accelerate the deſcription of the ſpace DAG, and cauſe the angle under GAD to decreaſe faſter than it otherwiſe would. The ſun's action will have this effect upon account of the obliquity of its direction to that in which the earth attracts the moon. For the moon by this means is drawn by two forces oblique to one another; one drawing from G towards A, the other from G towards H; therefore the moon muſt neceſſarily be impelled toward D. Again, becauſe the ſun does not act in the direction GH parallel to SA, but in the direction GS oblique to it, the ſun's action on the moon will, by reaſon of this obliquity, farther contribute to the moon's acceleration. Suppoſe the earth, in any ſhort ſpace of time, would have moved from A to I, if not attracted by the ſun, the point I being in the ſtraight line CE, which touches the earth's orbit in A. Suppoſe the moon in the ſame time would have moved in her orbit from G to K, and beſides have partook of all the progreſſive motion of the earth. Then, if KL be drawn parallel to AI, and taken equal to it, the moon, if not attracted to the ſun, would be found in L. But the earth, by the ſun's action, is removed from I. Suppoſe it were moved down to M in the line IMN parallel to SA, and if the moon were attracted but as much, and in the ſame direction, as the earth is here ſuppoſed to be attracted, ſo as to have deſcended during the ſame time in the line LO parallel alſo to AS, down as far as P, till LP were equal to IM, the angle under PMN would be equal to that under LIN; that is, the moon will appear advanced as much farther forward than if neither it nor the earth had been ſubject to the ſun's action. But this is on the ſuppoſition that the actions of the ſun upon the earth and moon are equal; whereas the moon being acted upon more than the earth, did the ſun's action draw the moon in the line LO parallel to AS, it would draw it down ſo far as to make LP greater than IM, whereby the angle under PMN will be rendered greater than that under LIN. But, moreover, as the ſun draws the earth in a direction oblique to IN, the earth will be found in its orbit ſomewhat ſhort of the point M. However, the moon is attracted by the ſun ſtill more out of the line LO than the earth is out of the line IN; therefore this obliquity of the ſun's action will yet farther diminiſh the angle under PMN. Thus the moon at the point G receives an impulſe from the ſun whereby her motion is accelerated; and the ſun producing this effect in every place between the quarter and the conjunction, the moon will move from the quarter with a motion continually more and more accelerated; and therefore, by acquiring from time to time an additional degree of velocity in its orbit, the ſpaces which are deſcribed in equal times by the line drawn from the earth to the moon will not be every where equal, but thoſe toward the conjunction will be greater than thoſe towards the quarter. But in the moon's paſſage from the conjunction D to the next quarter, the ſun's action will again retard the moon, till, at the next quarter at E, it be reſtored to the firſt velocity which it had in C. When the moon moves from E to the full, or oppoſition to the ſun in B, it is again accelerated; the deficiency of the ſun's action on the moon from what it has upon the earth producing here the ſame effect as before the exceſs of its action.

Let us now conſider the moon in Q as moving from E towards B. Here, if ſhe were attracted by the ſun in a direction parallel to AS, yet being acted on leſs than the earth, as the latter deſcends towards the ſun, the moon will in ſome meaſure be left behind. Therefore, QF being drawn parallel to SB, a ſpectator on the earth would ſee the moon move as if attracted from the point Q in the direction QF, with a degree of force equal to that whereby the ſun's action on the moon falls ſhort of its action on the earth. But the obliquity of the ſun's action has here alſo an effect. In the time the earth would have moved from A to I without the influence of the ſun, let the moon have moved in its orbit from Q to R. Drawing, therefore, RT parallel and equal to AI, the moon, by the motion of its orbit, if not attracted by the ſun, muſt be found in T; and therefore, if attracted in a direction parallel to SA, would be in the line TV parallel to AS; ſuppoſe in W. But the moon in Q being farther off the ſun than the earth, it will be leſs attracted; that is, TW will be leſs than IM; and if the line SM be prolonged towards X, the angle under XMW will be leſs than XIT. Thus, by the ſun's action, the moon's paſſage from the quarter to the full would be accelerated, if the ſun were to act on the earth and moon in a direction parallel to AS: and the obliquity of the ſun's action will ſtill increaſe this acceleration:

For the action of the ſun on the moon is oblique to the line SA the whole time of the moon's paſſage from Q to T, and will carry her out of the line TV towards the earth. Here we ſuppoſe the time of the moon's paſſage from Q to T ſo ſhort, that it ſhall not paſs beyond the line SA. The earth will alſo come a little ſhort of the line IN, as was already mentioned; and from theſe cauſes the angle under XMW will be ſtill farther leſſened. The moon, in paſſing from the oppoſition B to the next quarter, will be retarded again by the ſame degrees as it was accelerated before its appulſe to the oppoſition; and thus the moon, by the ſun's action upon it, is twice accelerated and twice reſtored to its firſt velocity every circuit it makes round the earth; and this inequality of the moon's motion about the earth is called by aſtronomers its variation.

283
Effect of the ſun's attraction in different parts of the moon's orbit.

The next effect of the ſun upon the moon is, that it gives the orbit of the latter in the quarters a greater degree of curvature than it would receive from the earth alone; and, on the contrary, in the conjunction and oppoſition the orbit is leſs inflected. When the moon is in the conjunction with the ſun at D, the latter attracting her more forcibly than it does the earth, the moon is by that means impelled leſs to the earth than otherwiſe it would be, and thus the orbit leſs incurvated: for the power by which the moon is impelled towards the earth being that by which it is inflected from a rectilinear courſe, the leſs that power is the leſs it will be inflected. Again, when the moon is in the oppoſition in B farther removed from the ſun than the earth is, it follows then, that though the earth and moon are both continually deſcending toward the ſun, that is, are drawn by the ſun towards itſelf out of the place they would otherwiſe move into, yet the moon deſcends with leſs velocity than the earth; inſomuch that, in any given ſpace of time from its paſſing the point of oppoſition, it will have leſs approached the earth than otherwiſe it would have done; that is, its orbit, in reſpect to the earth, will approach nearer to a ſtraight line. Laſtly, when the moon is in the quarter in F, and equally diſtant from the ſun as the earth, it was before obſerved, that they would both deſcend with equal velocity towards the ſun, ſo as to make no change in the angle FAS; but the length of the line FA muſt neceſſarily be ſhortened. Therefore the moon, in moving from F toward the conjunction with the ſun, will be impelled more toward the earth by the ſun's action than it would have been by the earth alone, if neither the earth nor the moon had been acted upon by the ſun; ſo that, by this additional impulſe, the orbit is rendered more curve than it otherwiſe ſhould be. The ſame effect will alſo be produced in the other quarter.

284
Moon comes neareſt the earth when leaſt attracted by it.

A third effect of the ſun's action, and which follows from that juſt now explained, is, that though the moon undiſturbed by the ſun might move in a circle, having the earth for its centre, by the ſun's action, if the earth were to be in the very middle or centre of the moon's orbit, yet the moon would be nearer the earth at the new and full than in the quarters. This may at firſt appear ſomewhat difficult to be underſtood, that the moon ſhould come neareſt to the earth where it is leaſt attracted by it: yet, upon a little conſideration, it will evidently appear to flow from that very cauſe, becauſe her orbit, in the conjunction and oppoſition, is rendered leſs curve; for the leſs curve the orbit is, the leſs will the moon have deſcended from the place it would move into without the action of the earth. Now, if the moon were to move from any place without farther diſturbance from that action, ſince it would proceed on the line touching the orbit in that place, it would continually recede from the earth; and therefore, if the power of the earth upon the moon be ſufficient to retain it at the ſame diſtance, this diminution of that power will cauſe the diſtance to increaſe, though in a leſs degree. But, on the other hand, in the quarters, the moon being preſſed in a leſs degree towards the earth than by the earth's ſingle action, will be made to approach it: ſo that, in paſſing from the conjunction or oppoſition to the quarters, the moon aſcends from the earth; and in paſſing from the quarters to the oppoſition or conjunction, it deſcends again, becoming nearer in theſe laſt mentioned places than in the other.

285
Cauſe of the dilatation of the moon's orbit.

All the inequalities we have mentioned are different in degree as the ſun is more or leſs diſtant from the earth; being greateſt when the earth is in its perihelion, and ſmalleſt when it is in its aphelion: for in the quarters, the nearer the moon is to the ſun the greater is the addition to the earth's action upon it by the power of the ſun; and in the conjunction and oppoſition, the difference between the ſun's action upon the earth and upon the moon is likewiſe ſo much the greater. This difference in the diſtance between the earth and the ſun produces a farther effect upon the moon's motion; cauſing her orbit to dilate when leſs remote from the ſun, and become greater than when at a farther diſtance: For it is proved by Sir Iſaac Newton, that the action of the ſun by which it diminiſhes the earth's power over the moon in the conjunction or oppoſition, is about twice as great as the addition to the earth's action by the ſun in the quarters; ſo that, upon the whole, the power of the earth on the moon is diminiſhed by the ſun, and therefore is moſt diminiſhed when that action is ſtrongeſt: but as the earth, by its approach to the ſun, has its influence leſſened, the moon, being leſs attracted, will gradually recede from the earth; and as the earth, in its receſs from the ſun, recovers by degrees its former power, the orbit of the moon muſt again contract. Two conſequences follow from hence, viz. that the moon will be more remote from the earth when the latter is neareſt the ſun, and alſo will take up a longer time in performing its revolution through the dilated orbit than through the more contracted.

Theſe irregularities would be produced if the moon, without being acted upon unequally by the ſun, ſhould deſcribe a perfect circle about the earth and in the plane of its motion; but though neither of theſe circumſtances take place, yet the abovementioned inequalities occur only with ſome little variation with regard to the degree of them; but ſome others are obſerved to take place from the moon's motion being performed in the manner already deſcribed: For, as the moon deſcribes an ellipſis, having the earth in one of its foci, this curve will be ſubjected to various changes, neither preſerving conſtantly the ſame figure nor poſition; and becauſe the plane of this ellipſis is not the ſame with that of the earth's orbit, it thence follows, that the former will continually change; ſo

ASTRONOMY

Plate LXXIV

Fig. 117

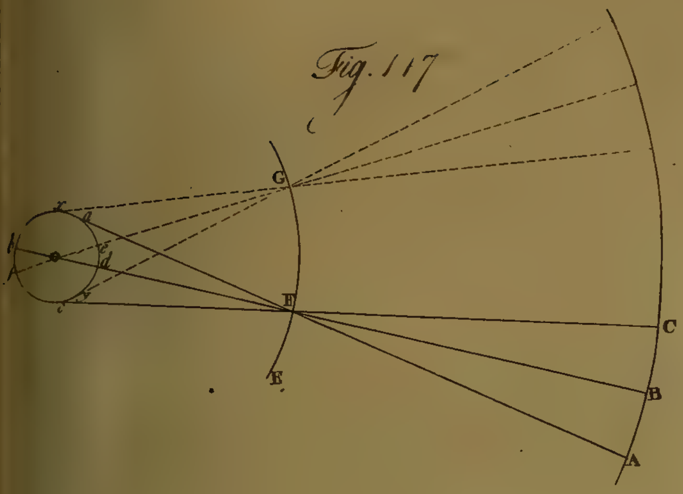


Fig. 149

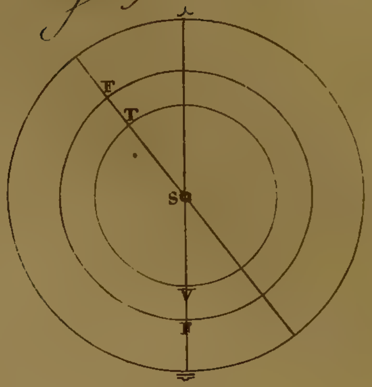


Fig. 148

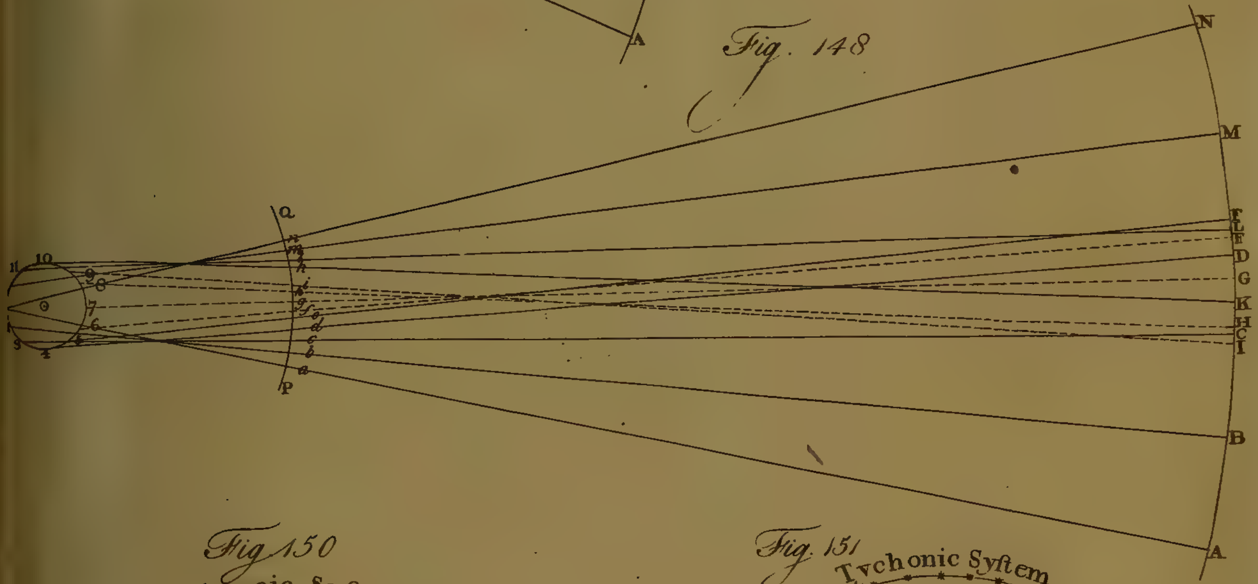


Fig. 150

Ptolemaic Syſtem

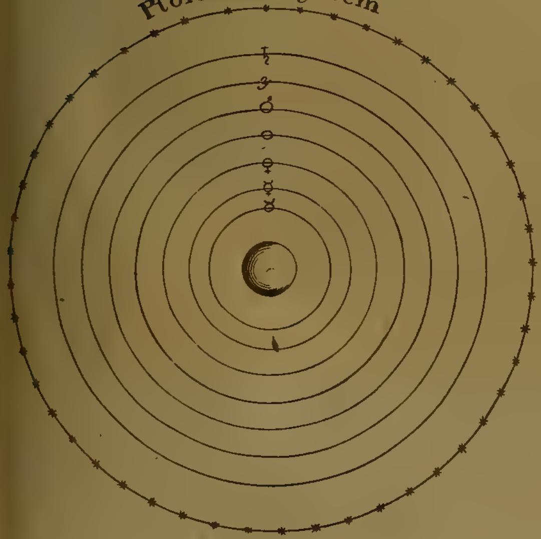
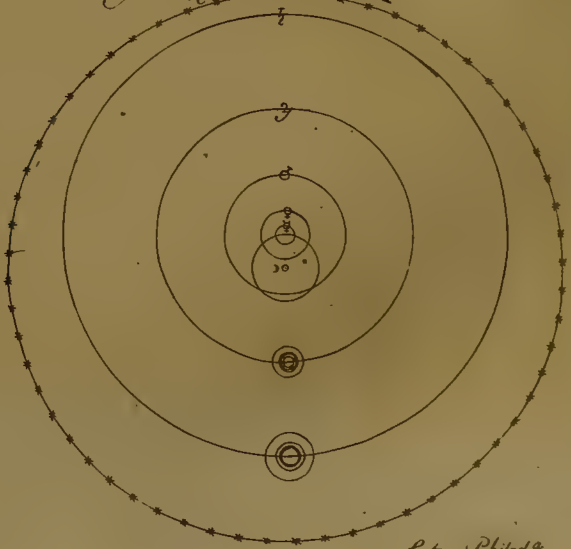


Fig. 151

Tychonic Syſtem



Scot Philad^a

that neither the inclination of the two planes towards each other, nor the line in which they interſect, will remain for any length of time unaltered.

286 Action of the ſun cauſes the plane of the moon's orbit to change.

As the moon does not move in the ſame plane with the earth, the ſun is but ſeldom in the plane of her orbit, viz. only when the line made by the common interſection of the two planes, if produced, will paſs through the ſun. Thus, let S, in fig. 125. denote the ſun, T the earth, ATB the plane of the earth's orbit, CDEF the moon's orbit; the part CDE being raiſed above, and the part CFE depreſſed under the former. Here the line CE, in which the two planes interſect each other, being continued, paſſes through the ſun in S. When this happens, the action of the ſun is directed in the plane of the moon's orbit, and cannot draw her out of this plane, as will evidently appear from an inſpection of the figure; but in other caſes the obliquity of the ſun's action to the plane of the orbit will cauſe this plane continually to change.

Let us now ſuppoſe, in the firſt place, the line in which the two planes interſect each other to be perpendicular to the line which joins the earth and ſun. Let T, in fig. 126, 127, 128, 129. repreſent the earth; S the ſun; the plane of the ſcheme the plane of the earth's orbit, in which both the ſun and earth are placed. Let AC be perpendicular to ST, which joins the earth and ſun; and let the line AC be that in which the plane of the moon's orbit interſects the orbit of the earth. On the centre T deſcribe in the plane of the earth's motion the circle ABCD; and in the plane of the moon's orbit deſcribe the circle AECF; one-half of which, AEC, will be elevated above the plane of this ſcheme, and the other half, AFC, as much depreſſed below it. Suppoſe then the moon to ſet out from the point A, in fig. 127. in the direction of the plane AEC. Here ſhe will be continually drawn out of this plane by the action of the ſun; for this plane AEC, if extended, will not paſs through the ſun, but above it; ſo that the ſun, by drawing the moon directly toward itſelf, will force it continually more and more from that plane towards the plane of the earth's motion in which itſelf is, cauſing it to deſcribe the line AKGHI, which will be convex to the plane AEC and concave to the plane of the earth's motion. But here this power of the ſun, which is ſaid to draw the moon toward the plane of the earth's motion, muſt be underſtood principally of as much only of the ſun's action upon the moon as it exceeds the action of the ſame upon the earth: For ſuppoſe the laſt mentioned figure to be viewed by the eye placed in the plane of that ſcheme; and in the line CTA, on the ſide A, will appear as the ſtraight line TDB in fig. 130. and the plane AECF as another ſtraight line FE, and the curve line AKGHI under the form of the line TKGHI. Now it is plain, that the earth and moon being both attracted by the ſun, if the ſun's action upon both was equally ſtrong, the earth T, and with it the plane AECF, or the line FTE, would be carried towards the ſun with as great velocity as the moon, and therefore the moon not drawn out of it by the ſun's action, except only from the ſmall obliquity of direction of this action upon the moon to that of the ſun's action upon the earth, which ariſes from the moon being out of the plane of the earth's motion, and is not conſiderable; but the action of the ſun upon the moon being greater than upon the earth all the time the moon is nearer to the ſun than the earth is, it will be drawn from the plane AEC, or the line TE, by that exceſs, and made to deſcribe the curve line AGI or TGI. But it is the cuſtom of aſtronomers, inſtead of conſidering the moon as moving in ſuch a curve line, to refer its motion continually to the plane which touches the true line wherein it moves at the point where at any time the moon is. Thus, when the moon is in the point A, its motion is conſidered as being in the plane AEC, in whoſe direction it then attempts to move; and when in the point K, fig. 127. its motion is referred to the plane which paſſes through the earth and touches the line AKGHI in the point K. Thus the moon, in paſſing from A to I, will continually change the plane of her motion in the manner we ſhall now more particularly explain.

Let the plane which touches the line AKI in the point K, fig. 127. interſect the plane of the earth's orbit in the line LTM. Then, becauſe the line AKI is concave to the plane ABC, it falls wholly between that plane and the plane which touches it in K; ſo that the plane MKL will cut the plane AEC before it meets the plane of the earth's motion, ſuppoſe in the line YT, and the point A will fall between K and L. With a radius equal to TY or TL deſcribe the ſemicircle LYM. Now, to a ſpectator on the earth, the moon when in A will appear to move in the circle AECF; and when in K, will appear to be moving in the ſemicircle LYM. The earth's motion is performed in the plane of this ſcheme; and to a ſpectator on the earth the ſun will always appear to move in that plane. We may therefore refer the apparent motion of the ſun to the circle ABCD deſcribed in this plane about the earth. But the points where this circle in which the ſun ſeems to move interſects the circle in which the moon is ſeen at any time to move, are called the nodes of the moon's orbit at that time. When the moon is ſeen moving in the circle AECD, the points A and C are the nodes of the orbit; when ſhe appears in the ſemicircle LYM, then L and M are the nodes. It will now appear, from what has been ſaid, that while the moon has moved from A to K, one of the nodes has been carried from A to L, and the other as much from C to M. But the motion from A to L and from C to M is backward in regard to the motion of the moon, which is the other way from A to K, and from thence toward C. Again, the angle which the plane wherein the moon at any time appears makes with the plane of the earth's motion, is called the inclination of the moon's orbit at that time: we ſhall now therefore proceed to ſhow, that this inclination of the orbit, when the moon is in K, is leſs than when ſhe was in A; or, that the plane LYM, which touches the line of the moon's motion in K, makes a leſs angle with the plane of the earth's motion, or with the circle ABCD, than the plane AEC makes with the ſame. The ſemicircle LYM interſects the ſemicircle AEC in Y, and the arch AY is leſs than LY, and both together leſs than half a circle. But it is demonſtrated by ſpheric geometry, that when a triangle is made as here, by three arches of circles AL, AY, and YL, the angle under YAB without the triangle is greater than the angle YLA within, if the two arches AY, YL, taken together,

287 Nodes of the moon's orbit.

288 Inclination of her orbit.

ther, do not amount to a ſemicircle. If the two arches make a complete ſemicircle, the two angles will be equal; but if the two arches taken together exceed a ſemicircle, the inner angle YLA is greater than the other. Here then the two arches AY and LY together being leſs than a ſemicircle, the angle under ALY is leſs than the angle under BAE. But from the doctrine of the ſphere it is alſo evident, that the angle under ALY is equal to that in which the plane of the circle LYKM, that is, the plane which touches the line AKGHI in K is inclined to the plane of the earth's motion ABC; and the angle under BAE is equal to that in which the plane AEC is inclined to the ſame plane. Therefore the inclination of the former plane is leſs than that of the latter. Suppoſe, now, the moon to be advanced to the point G in fig. 128. and in this point to be diſtant from its node a quarter part of the whole circle; or, in other words, to be in the mid-way between its two nodes. In this caſe the nodes will have receded yet more, and the inclination of the orbit be ſtill more diminiſhed: for ſuppoſe the line AKGHI to be touched in the point G by a plane paſſing through the earth T, let the interſection of this plane with the plane of the earth's motion be the line WTO, and the line TP its interſection with the plane LKM. In this plane let the circle NGO be deſcribed with the ſemidiameter TP or NT cutting the other circle LKM in P. Now, the line AKGI is convex to the plane LKM which touches it in K; and therefore the plane NGO, which touches it in G, will interſect the other touching plane between G and K; that is, the point P will fall between theſe two points, and the plane continued to the plane of the earth's motion will paſs beyond L; ſo that the points N and O, or the places of the nodes when the moon is in G, will be farther from A and C than L and M; that is, will have moved farther backward. Beſides, the inclination of the plane NGO to the plane of the earth's motion ABC is leſs than the inclination of the plane LKM to the ſame; for here alſo the two arches LP and NP, taken together, are leſs than a ſemicircle, each of them being leſs than a quadrant, as appears, becauſe GN, the diſtance of the moon in G from its node N, is here ſuppoſed to be a quarter part of a circle. After the moon is paſſed beyond G, the caſe is altered: for then theſe arches will be greater than quarters of a circle; by which means the inclination will be again increaſed, though the nodes ſtill go on to move the ſame way. Suppoſe the moon in H (fig. 129), and that the plane which touches the lines AKGI in H interſects the plane of the earth's motion in the line QTR, and the plane NGO in the line TV, and beſides, that the circle QHR be deſcribed in that plane: then, for the ſame reaſon as before, the point V will fall between H and G, and the plane RVQ will paſs beyond the laſt plane OVN, cauſing the points Q and K to fall farther from A and C than N and O. But the arches NV, VQ are each greater than the quarter of a circle; conſequently the angle under BQV will be greater than that under BNV. Laſtly, when the moon is by this attraction of the ſun drawn at length into the plane of the earth's orbit, the node will have receded yet more, and the inclination be ſo much increaſed, as to become ſomewhat more than at firſt: for the line AKGHI being convex to all the planes which touch it, the part HI will wholly fall between the plane QVR and the plane ABC; ſo that the point I will fall between B and R; and, drawing ITW, the point W, will be farther removed from A than Q. But it is evident, that the plane which paſſes through the earth T and touches the line AGI in the point I, will cut the plane of the earth's motion ABCD in the line ITW, and be inclined to the ſame in the angle under HIB; ſo that the node which was firſt in A, after having paſſed into L, N, and Q, comes at laſt into the point W, as the node which was at firſt in C has paſſed from thence ſucceſſively through the points M, O, and R, to I. But the angle HIB, which is now the inclination of the orbit to the plane of the ecliptic, is manifeſtly not leſs than the angle under ECB or EAB, but rather ſomething greater. Thus the moon, while it paſſes from the plane of the earth's motion in the quarter, till it comes again into the ſame plane, has the nodes of its orbit continually moved backward, and the inclination of it at firſt diminiſhed till it comes to G in fig. 128, which is near to its conjunction with the ſun, but afterwards is increaſed again almoſt by the ſame degrees, till upon the moon's arrival again to the plane of the earth's motion the inclination of the orbit is reſtored to ſomething more than its firſt magnitude, though the difference is not very great, becauſe the points I and C are not ſo far diſtant from each other.

In like manner, if the moon had departed from the quarter at C, it ſhould have deſcribed the curve line CXW in fig. 126. between the planes AFC and ADC, which would be convex to the former planes and concave to the latter; ſo that here alſo the nodes would continually recede, and the inclination of the orbit gradually diminiſh more and more, till the moon arrived near its oppoſition to the ſun in X; but from that time the inclination ſhould again increaſe till it become a little greater than at firſt. This will eaſily appear by conſidering, that as the action of the ſun upon the moon, by exceeding its action upon the earth, drew it out of the plane AEC towards the ſun, while the moon paſſed from A to I; ſo during its paſſage from C to W, the moon being all that time farther from the ſun than the earth, it will be attracted leſs; and the earth together with the plane AECF, will as it were be drawn from the moon, in ſuch a manner, that the path the moon deſcribes ſhall appear from the earth as it did in the former caſe by the moon being drawn away.

286
Motion of the nodes explained.

Such are the changes which the nodes and inclination of the moon's orbit undergo when the nodes are in the quarters; but when the nodes by their motion, and the motion of the ſun together, come to be ſituated between the quarter and conjunction or oppoſition, their motion and the change made in the inclination of the orbit are ſomewhat different.—Let AGH, in fig. 131. be a circle deſcribed in the plane of the earth's motion, having the earth in T for its centre, A the point oppoſite to the ſun, and G a fourth part of the circle diſtant from A. Let the nodes of the moon's orbit be ſituated in the line BTD, and B the node falling between A, the place where the moon would be in the full, and G the place where ſhe would be in the quarter. Suppoſe BEDF to be the plane in which the moon attempts to move when it proceeds from the point B; then, becauſe the moon in B is more diſtant

Motions of the Secondary Planets.

diſtant from the ſun than the earth, it will be leſs attracted by the ſun, and will not deſcend towards the ſun ſo faſt as the earth, conſequently it will quit the plane BEDF, which is ſuppoſed to accompany the earth, and deſcribe the line BIK convex to it, till ſuch time as it comes to the point K, where it will be in the quarter; but from thenceforth being more attracted than the earth, the moon will change its courſe, and the following part of the path it deſcribes will be concave towards the plane BED or BGD, and continue concave to the plane BGD till it croſſes that plane in L, juſt as in the preceding caſe. Now, to ſhow that the nodes, while the moon is paſſing from B to K, will proceed forward, or move the ſame way with the moon, and at the ſame time the inclination of the orbit will increaſe when the moon is in the point I, let the line MIN paſs through the earth T, and touch the path of the moon in I, cutting the plane of the earth's motion in the line MTN, and the line BED in TO. Becauſe the line BIK is convex to the plane BED, which touches it in B, the plane NIM muſt croſs the plane DEB before it meets the plane CGB; and therefore the point M will fall from G towards B; and the node of the moon's orbit being tranſlated from B towards M is moved forward.

Again, the angle under OMG, which the plane MON makes with the plane BGC, is greater than the angle OBG, which the plane BOD makes with the ſame. This appears from what has been already demonſtrated, becauſe the arches BO and OM are each of them leſs than the quarter of a circle; and therefore, taken both together are leſs than a ſemicircle. But further, when the moon is come to the point K in its quarter, the nodes will be advanced yet further forward, and the inclination of the orbit alſo more augmented. Hitherto we have referred the moon's motion to the plane which, paſſing through the earth, touches the path of the moon in the point where the moon is, as we have already ſaid that the cuſtom of aſtronomers is. But in the point K no ſuch plane can be found: on the contrary, ſeeing the line of the moon's motion on one ſide the point K is convex to the plane BED, and on the other ſide concave to the ſame, ſo that no plane can paſs through the points T and K, but will cut the line BKL in that point; therefore, inſtead of ſuch a touching plane, we muſt make uſe of PKQ, which is equivalent, and with which the line BKL ſhall make a leſs angle than with any other plane; for this does as it were touch the line BK in the point K, ſince it cuts it in ſuch a manner that no other plane can be drawn ſo as to paſs between the line BK and the plane PKQ. But now it is evident, that the point P, or the node, is removed from M towards G, that is, has moved yet farther forwards; and it is likewiſe as manifeſt, that the angle under KPG, or the inclination of the moon's orbit in the point K, is greater than the angle under IMG for the reaſon already given.

After the moon has paſſed the quarter, her plane being concave to the plane AGCH, the nodes will recede as before till ſhe arrives at the point L; which ſhows, that, conſidering the whole time of the moon's paſſing from B to L, at the end of that time the nodes ſhall be found to have receded, or to be placed more backward, when the moon is in L than when it was in B: for the moon takes a longer time in paſſing from K to L than in paſſing from B to K; and therefore the nodes continue to recede a longer time than they moved forwards; ſo that their receſs muſt ſurmount their advance. In the ſame manner, while the moon is in its paſſage from K to L, the inclination of the orbit ſhall diminiſh till the moon come to the point in which it is one quarter part of a circle diſtant from its node, ſuppoſe in the point R; and from that time the inclination will again increaſe. Since, therefore, the inclination of the orbit increaſes while the moon is paſſing from B to K, and diminiſhes itſelf again only while the moon is paſſing from K to R, then augments again while the moon paſſes from B to L; it thence comes to be much more increaſed than diminiſhed, and thus will be diſtinguiſhably greater, when the moon comes to L than when it ſets out from B. In like manner, when the moon is paſſing from L on the other ſide the plane AGCH, the node will advance forward as long as the moon is between the point L and the next quarter; but afterwards it will recede till the moon comes to paſs the plane AGCH again, in the point V between B and A: and becauſe the time between the moon's paſſing from L to the next quarter is leſs than the time between that quarter and the moon's coming to the point V, the node will have receded more than it has advanced; ſo that the point V will be nearer to A than L is to C. So alſo the incination of the orbit, when the moon is in V, will be greater than when ſhe was in L: for this inclination increaſes all the time the moon is betwixt L and the next quarter, decreaſing only when ſhe is paſſing from this quarter to the mid-way between the two nodes, and from thence increaſes again during the whole paſſage through the other half of the way to the next node.

In this manner we ſee, that at every period of the moon the nodes will have receded, and thereby have approached towards a conjunction with the ſun; but this will be much forwarded by the motion of the earth, or the apparent motion of the ſun himſelf. In the laſt ſcheme the ſun will appear to have moved from S towards W. Let us ſuppoſe it had appeared to have moved from S to W while the moon's node has receded from B to V: then drawing the line WTX, the arch VX will repreſent the diſtance of the line drawn between the nodes from the ſun when the moon is in V; whereas the arch BA repreſented that diſtance when the moon was in B. This viſible motion of the ſun is much greater than that of the node; for the ſun appears to revolve quite round in one year, while the node is near nineteen in making its revolution. We have alſo ſeen, that when the moon was in the quadrature, the inclination of her orbit decreaſed till ſhe came to the conjunction or oppoſition, according to the node it ſet out from; but that afterwards it again increaſed till it became at the next node rather greater than at the former. When the node is once removed from the quarter nearer to a conjunction with the ſun, the inclination of the moon's orbit when ſhe comes into the node is more ſenſibly greater than it was in the node preceding; the inclination of the orbit by this means more and more increaſing till the node comes into conjunction with the ſun: at which time it has been ſhown that the latter has no power to change the plane of her orbit. As ſoon, however, as the nodes are got out of conjunction towards the other quarters, they begin to recede as before; but the inclination of the orbit in the appulſe of the moon to each ſucceeding node is leſs than at the preceding, till the nodes come again into the quarters. This will appears as follows: Let A, in fig. 132. repreſent one of the moon's nodes placed between the point of oppoſition B and the quarter C. Let the plane ADE paſs through the earth T, and touch the path of the moon in A. Let the line AFGH be the path of the moon in her paſſage from A to H, where ſhe croſſes again the plane of the earth's motion. This line will be convex towards the plane ADE, till the moon comes to G, where ſhe is in the quarter; and after this, between G and H, the ſame line will be concave towards this plane. All the time this line is convex towards the plane ADE, the nodes will recede; and, on the contrary, move forward when the line is concave towards that plane. But the moon is longer in paſſing from A to G, and therefore the nodes go backward farther than they proceed; and therefore, on the whole, when the moon has arrived at H, the nodes will have receded, that is, the point H will fall between B and E. The inclination of the orbit will decreaſe till the moon is arrived at the point F in the middle between A and H. Through the paſſage between F and G the inclination will increaſe, but decreaſe again in the remaining part of the paſſage from G to H, and conſequently at H muſt be leſs than at A. Similar effects, both with reſpect to the nodes and inclination of the orbit, will take place in the following paſſage of the moon on the other ſide of the plane ABEC from H, till it comes over that plane again in I.

Thus the inclination of the orbit is greateſt when the line drawn between the moon's nodes will paſs through the ſun, and leaſt when this line lies in the quarters; eſpecially if the moon at the ſame time be in conjunction with the ſun, or in the oppoſition. In the firſt of theſe caſes the nodes have no motion; in all others, the nodes will each month have receded: and this retrograde motion will be greateſt when the nodes are in the quarters, for in that caſe they will have no progreſſive motion during the whole month; but in all other caſes they at ſome times go forward, viz. whenever the moon is between either of the quarters and the node which is leſs diſtant from that quarter than the fourth part of a circle.

290
Irregularities ariſing from the moon's motion in an ellipſis.

We have now only to explain thoſe irregularities of the lunar motion which ariſe from her motion in an ellipſis. From what has been already ſaid it appears, that the earth acts on the moon in the reciprocal duplicate proportion of the diſtance; therefore the moon, if undiſturbed by the ſun, would move round the earth in a true ellipſis, and a line drawn from the earth to the ſun would paſs over equal ſpaces in equal times. We have, however, already ſhown, that this equality is diſturbed by the ſun, and likewiſe how the figure of the orbit is changed each month; that the moon is nearer the earth at the new and full, and more remote in the quarters, than it would be without the ſun. We muſt, however, paſs by thoſe monthly changes, and conſider the effect which the ſun will have in the different ſituations of the axis of the orbit in reſpect of that luminary. This action varies the force wherewith the moon is drawn towards the earth. In the quarters the force of the earth is directly increaſed by the ſun, but diminiſhed at the new and full; and in the intermediate places the influence of the earth is ſometimes leſſened, ſometimes aſſiſted, by the action of that luminary. In theſe intermediate places, however, between the quarters and the conjunction or oppoſition, the ſun's action is ſo oblique to that of the earth on the moon, as to produce that alternate acceleration and retardation of her motion ſo oftened mentioned. But beſides this effect, the power by which the moon attracts the earth towards itſelf, will not be at full liberty to act with the ſame force as if the ſun acted not at all on the moon; and this effect of the ſun's action, whereby it corroborates or weakens the action of the earth, is here only to be conſidered; and by means of this influence it comes to paſs, that the power by which the moon is impelled towards the earth is not perfectly in the reciprocal duplicate proportion of the diſtance, and of conſequence the moon will not deſcribe a perfect ellipſis. One particular in which the lunar orbit will differ from a perfect elliptical figure, conſiſts in the places where the motion of the moon is perpendicular to the line drawn from itſelf to the earth. In an ellipſis, after the moon ſhould have ſet out in the direction perpendicular to this line, drawn from itſelf to the earth, and at its greateſt diſtance from the earth, its motion would again become perpendicular to this line drawn between itſelf and the earth, and the moon be at its neareſt diſtance from the earth, when it ſhould have performed half its period; after having performed the other half period of its motion, would again become perpendicular to the forementioned line, and the moon return to the place whence it ſet out, and have recovered again its greateſt diſtance. But the moon in its real motion, after ſetting out as before, ſometimes makes more than half a revolution before its motion comes again to be perpendicular to the line drawn from itſelf to the earth, and the moon is at its neareſt diſtance; and then performs more than another half of an entire revolution before its motion can a ſecond time recover its perpendicular direction to the line drawn from the moon to the earth, and the former arrive again at its greateſt diſtance from the earth. At other times the moon will deſcend to her neareſt diſtance before ſhe has made half a revolution, and recover again its greateſt diſtance before it has made an entire revolution. The place where the moon is at its greateſt diſtance is called the *moon's apogeon*, and the place of her neareſt diſtance her *perigeon*; and this change of place, where the moon comes ſucceſſively to its greateſt diſtance from the earth, is called the *motion of the apogeon*. The manner in which this motion of the apogeon is cauſed by the ſun comes now to be explained.

291
Apogeon and perigeon of the moon.

Sir Iſaac Newton has ſhown, that if the moon were attracted toward the earth by a compoſition of two powers, one of which were reciprocally in the duplicate proportion of the diſtance from the earth, and the other reciprocally in the triplicate proportion of the ſame diſtance; then, though the line deſcribed by the moon would not be in reality an ellipſis, yet the moon's motion might be perfectly explained by an ellipſis whoſe axis ſhould be made to move round the earth; this motion being in conſequence, as aſtronomers expreſs themſelves, that is, the ſame way as the moon itſelf moves, if the moon be attracted by the ſum of the two powers; but the axis muſt move in antecedence, or the contrary way, if the moon be acted upon by the difference of theſe forces. We have already explained what is meant by duplicate proportion, namely, that if three magnitudes, as A, B, and C, are ſo related that the ſecond B bears the ſame proportion to the third C as the firſt A bears to the ſecond B; then the proportion of the firſt A to the third C is the duplicate of the proportion of the firſt A to the ſecond B. Now if a fourth magnitude as D be aſſumed, to which C ſhall bear the ſame proportion as A bears to B, and B to C; then the proportion of A to D is the triplicate of the proportion of A to B.

292
Motion in antecedence and conſequence explained.

293
Triplicate proportion explained.

294
Motion of the moon's apogeon determined.

Let now T (fig. 133. 134.) denote the earth, and ſuppoſe the moon in the point A its apogeon or greateſt diſtance from the earth, moving in the direction AF perpendicular to AB, and acted upon from the earth by two ſuch forces as already mentioned. By that power alone, which is reciprocally in the duplicate proportion of the diſtance, if the moon ſet out with a proper degree of velocity, the ellipſis AMB may be deſcribed: but if the moon be acted upon by the ſum of the forementioned powers, and her velocity in the point A be augmented in a certain proportion; or if that velocity be diminiſhed in a certain proportion *, and the moon be acted upon by the difference of thoſe powers; in both theſe caſes the line AE, which ſhall be deſcribed by the moon, ſhall thus be determined. Let the point M be that into which the moon would have arrived in any given point of time, had it moved in the ellipſis AMB; draw MT and likewiſe CTD in ſuch a manner that the angle ATM ſhall bear the ſame proportion to the angle under ATC as the velocity with which the ellipſis muſt have been deſcribed bears to the difference between this velocity and that with which the moon muſt ſet out from the point A, in order to deſcribe the path AE. Let the angle ATC be taken toward the moon, as in fig. 133. if the moon be attracted by the ſum of the powers; but the contrary way (as in fig. 134.) if by their difference. Then let the line AB be moved into the poſition CD, and the ellipſis AMB into the ſituation CND, ſo that the point M be tranſlated to L; then the point L ſhall fall upon the path of the moon AE. Now the angular motion of the line AT, whereby it is removed into the ſituation CT, repreſents the motion of the apogeon; by the means of which the motion of the moon might be fully explained by the ellipſis AMB, if the action of the ſun upon it was directed to the centre of the earth, and reciprocally in the triplicate proportion of the moon's diſtance from it; but that not being ſo, the motion of the apogeon will not proceed in the regular manner now deſcribed. It is, however, to be obſerved here, that in the firſt of the two preceding caſes, where the apogeon moves forward, the whole centripetal power increaſes faſter, with the decreaſe of diſtance, than if the entire power were reciprocally in the duplicate proportion of the diſtance; becauſe one part only is already in that proportion, and the other part, which is added to this to make up the whole power, increaſes faſter with the decreaſe of diſtance. On the other hand, when the centripetal power is the difference between theſe two bodies, it increaſes leſs with the decreaſe of the diſtance, than if it were ſimply in the reciprocal duplicate proportion of the diſtance. Therefore, if we chooſe to explain the moon's motion by an ellipſis, which may be done without any ſenſible error, we may collect in general, that when the power by which the moon is attracted to the earth, by varying the diſtance, increaſes in a greater than the duplicate proportion of the diſtance diminiſhed, a motion in conſequence muſt be aſcribed to the apogeon; but that when the attraction increaſes in a ſmaller proportion than that juſt mentioned, the apogeon muſt have given to it a motion in antecedence. It is then obſerved by Sir Iſaac Newton, that the former of theſe caſes obtains when the moon is in the conjunction and oppoſition, and the latter when ſhe is in the quarters; ſo that in the former the apogeon moves according to the order of the ſigns; in the other, the contrary way. But, as has been already mentioned, the diſturbance given to the action of the earth by the ſun in the conjunction and oppoſition, being near twice as great as in the quarters, the apogeon will advance with a greater velocity than recede, and in the compaſs of a whole revolution of the moon will be carried in conſequence.

295
Inequality of the motion of the apogeon.

Sir Iſaac ſhows, in the next place, that when the line AB coincides with the line that joins the ſun and earth, the progreſſive motion of the apogeon, when the moon is in conjunction or oppoſition, exceeds the retrograde, in the quadratures, more than in any other ſituation of the line AB. On the contrary, when the line AB makes right angles with that which joins the earth and ſun, the retrograde motion will be more conſiderable, nay, is found ſo great as to exceed the progreſſive; ſo that in this caſe the apogeon, in the compaſs of an entire revolution of the moon, is carried in antecedence. Yet from the conſiderations already mentioned, the progreſſive motion exceeds the other; ſo that on the whole, the motion of the apogeon is in conſequence. The line AB alſo changes its ſituation with that which joins the earth and ſun by ſuch ſlow degrees, that the inequalities of the motion of the apogeon, ariſing from this laſt conſideration, are much greater than what ariſe from the other.

296
Occaſions another inequality in the eccentricity of the moon's orbit.

This unſteady motion of the apogeon gives riſe to another inequality in the motion of the moon herſelf, ſo that it cannot at all times be explained by the ſame ellipſis. For whenever the apogeon moves in conſequence, the motion of the luminary muſt be referred to an orbit more eccentric than what the moon would deſcribe, if the whole power by which the moon was acted upon in its paſſing from the apogeon changed according to the reciprocal duplicate proportion of its diſtance from the earth, and by that means the moon did deſcribe an immoveable ellipſis: and when the apogeon moves in antecedence, the moon's motion muſt be referred to an orbit leſs eccentric. In the former of the two figures laſt referred to, the true place of the moon L falls without the orbit AMB, to which its motion is referred: whence the orbit ALE truly deſcribed by the moon, is leſs incurvated in the point A than is the orbit AMB; therefore this orbit is more oblong, and differs farther from a circle than the ellipſis would, whoſe curvature in A were equal to that of the line ALB: that is, the proportion of the diſtance of the earth T from the centre of the ellipſis to its axis, will be greater in AMB than in the other; but

that

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* See *Newton's Principia*, book i. prop. 44. corol. 2.

that other is the ellipſis which the moon would deſcribe, if the power acting upon it in the point A were altered in the reciprocal duplicate proportion of the diſtance; and conſequently the moon being drawn more forcibly towards the earth, it will deſcend nearer to it. On the other hand, when the apogeon recedes, the power acting on the moon increaſes with the decreaſe of diſtance, in leſs than the duplicate proportion of the diſtance, and therefore the moon is leſs impelled towards the earth, and will not deſcend ſo low. Now, ſuppoſe, in the former of theſe figures, that the apogeon A is in the ſituation where it is approaching towards the conjunction or oppoſition of the ſun; in this caſe its progreſſive motion will be more and more accelerated. Here ſuppoſe the moon, after having deſcended from A through the orbit AE as far as F, where it is come to its neareſt diſtance from the earth, aſcends again up the line FG. As the motion of the apogeon is here more and more accelerated, it is plain that the cauſe of its motion muſt alſo be on the increaſe; that is, the power by which the moon is drawn to the earth, will decreaſe with the increaſe of the moon's diſtance in her aſcent from F, in a greater proportion than that wherewith it is increaſed with the decreaſe of diſtance in the moon's deſcent to it. Conſequently the moon will aſcend to a greater diſtance than AT from whence it is deſcended; therefore the proportion of the greateſt diſtance of the moon to the leaſt is increaſed. But further, when the moon again deſcends, the power will increaſe yet farther with the decreaſe of diſtance than in the laſt aſcent it increaſed with the agmentation of diſtance. The moon therefore muſt deſcend nearer to the earth than it did before, and the proportion of the greateſt diſtance to the leaſt be yet more increaſed. Thus, as long as the apogeon is advancing to the conjunction or oppoſition, the proportion of the greateſt diſtance of the moon from the earth to the leaſt will continually increaſe; and the elliptical orbit to which the moon's motion is referred, will become more and more eccentric. As ſoon, however, as the apogeon is paſſed the conjunction or oppoſition with the ſun, its progreſſive motion abates, and with it the proportion of the greateſt diſtance of the moon from the earth to the leaſt will alſo diminiſh: and when the apogeon becomes retrograde, the diminution of this proportion will be ſtill farther continued on, till the apogeon comes into the quarter; from thence this proportion, and the eccentricity of the orbit, will increaſe again. Thus the orbit of the moon is moſt eccentric when the apogeon is in conjunction with the ſun, or in oppoſition to it, and leaſt of all when the apogeon is in the quarters. Theſe changes in the nodes, the inclination of the orbit to the plane of the earth's motion, in the apogeon and in the eccentricity, are varied like the other inequalities in the motion of the moon, by the different diſtance of the earth from the ſun being greateſt when their cauſe is greateſt; that is, when the earth is neareſt the ſun.

297 Computation of the lunar inequalities

Sir Iſaac Newton has computed the very quantity of many of the moon's inequalities. That acceleration of the moon's motion which is called the variation, when greateſt, removes the luminary out of the place in which it would otherwiſe be found, ſomewhat more than half a degree. If the moon, without diſturbance from the ſun, would have deſcribed a circle concentrical to the earth, his action would cauſe her approach nearer in the conjunction and oppoſition than in the quarters, nearly in the proportion of 69 to 70. It has already been mentioned, that the nodes perform their period in almoſt 19 years. This has been found by obſervation; and the computations of Sir Iſaac aſſign to them the ſame period. The inclination of the moon's orbit, when leaſt, is an angle about one-eighteenth of that which conſtitutes a right angle; and the difference between the greateſt and leaſt inclination is about one-eighteenth of the leaſt inclination, according to our author's computations: which is alſo agreeable to the general obſervations of aſtronomers. The motion of the apogeon and the changes in the eccentricity have not been computed by Sir Iſaac.

298 How to compute the inequalities of the motions of Jupiter's ſatellites.

The ſame incomparable geometer ſhows how, by comparing the periods of the motions of the ſatellites which revolve round Jupiter and Saturn with the period of our moon round the earth, and the periods of thoſe planets round the ſun with our earth's motion, the inequalities in the motion of thoſe ſatellites may be computed from thoſe of our moon, excepting only the motion of the apogeon; for the orbits of thoſe ſatellites, as far as can be diſcerned by us at this diſtance, appearing little or nothing eccentric, this motion, as deduced from the moon, muſt be diminiſhed.

§ 4. *Of the Nature and Motions of the Comets.*

THAT theſe bodies are not meteors in our air is manifeſt, becauſe they riſe and ſet in the ſame manner as the moon and ſtars. The aſtronomers have gone ſo far in their inquiries concerning them as to prove by their obſervations that they moved in the celeſtial ſpaces beyond the moon; but they had no notion of the path which they deſcribed. Before the time of our author, it was ſuppoſed that they moved in ſtraight lines; and Des Cartes, finding that ſuch a motion would interfere with his vortices, removed them entirely out of the ſolar ſyſtem.

299 Comets generally inviſible until they come nearer than Jupiter.

Sir Iſaac Newton, however, diſtinctly proves from aſtronomical obſervation, that the comets paſs through the planetary regions, and are generally inviſible at a ſmaller diſtance than that of Jupiter. Hence, finding that they were evidently within the ſphere of the ſun's action, he concludes, that they muſt neceſſarily move about the ſun as the planets do; and he proves, that the power of the ſun being reciprocally in the duplicate proportion of the diſtance, every body acted upon by him muſt either fall directly down, or move about him in one of the conic ſections, viz. either the ellipſis, parabola, or hyperbola. If a body which deſcends towards the ſun as low as the orbit of any planet, move with a ſwifter motion than the planet, it will deſcribe an orbit of a more oblong figure than that of the planet, and have at leaſt a longer axis. The velocity of the body may be ſo great, that it ſhall move in a parobola; ſo that having once paſſed the ſun, it ſhall aſcend for ever without returning, though the ſun will ſtill continue in the focus of that parabola; and with a velocity ſtill greater, they will move in an hyberbola. It is, however, moſt probable, that the comets move in very eccentric ellipſis, ſuch as is repreſented in fig. 135. where S repreſents the ſun, C the comet, and ABDE its orbit; wherein the diſtance of S and D far exceeds that of S and A. Hence thoſe bodies are ſometimes found at a moderate diſtance from the ſun, and appear within

Nature and Motions of the Comets.

within the planetary regions; at other times they aſcend to vaſt diſtances, far beyond the orbit of Saturn, and thus become inviſible.

300 They move in eccentric ellipſes.

That the comets do move in this manner is proved by our author from computations built upon the obſervations made by many aſtronomers. Theſe computations were made by Sir Iſaac Newton himſelf upon the comet which appeared toward the latter end of the year 1680 and beginning of 1681, and the ſame were proſecuted more at large by Dr Halley upon this and other comets. They depend on this principle, that the eccentricity of the orbits of the comets is ſo great, that if they are really elliptical, yet that part of them which comes under our view approaches ſo near to a parabola that they may be taken for ſuch without any ſenſible error, as in the foregoing figure the parabola FAG, in the lower part of it about A, differs very little from the ellipſis DEAB; on which foundation Sir Iſaac teaches a method of finding the parabola in which any comet moves, by three obſervations made upon it in that part of its orbit where it agrees neareſt with a parabola: and this theory is confirmed by aſtronomical obſervations; for the places of the comets may thus be computed as exactly as thoſe of the primary planets. Our author afterwards ſhows how to make uſe of any ſmall deviation from the parabola which may be obſerved, to determine whether the orbits of the comets be elliptical or not; and thus to know whether or not the ſame comet returns at different ſeaſons. On examining by this rule the comet of 1680, he found its orbit to agree more exactly with an ellipſis than a parabola, tho' the ellipſis be ſo very eccentric, that it cannot perform its revolution in 500 years. On this Dr Halley obſerved, that mention is made in hiſtory of a comet with a ſimilar large tail, which appeared three ſeveral times before. The firſt was before the death of Julius Cæſar; and each appearance happened at the interval of 575 years, the laſt coinciding with the year 1680. He therefore calculated the motion of this comet to be in ſuch an eccentric orbit, that it could not return in leſs than 575 years; which computations agree yet more perfectly with the obſervations made on this comet than any parabolic orbit will do. To compare together different appearances of the ſame comet, is indeed the only method of diſcovering with certainty the form of its orbit; for it is impoſſible to diſcover the form of one ſo exceedingly eccentric from obſervations taken in a ſmall part of it. Sir Iſaac Newton therefore propoſes to compare the orbits, on the ſuppoſition that they are parabolical, of ſuch comets as appear at different times, for if we find the ſame orbit deſcribed by a comet at different times, in all probability it will be the ſame comet that deſcribes it. Here he remarks from Dr Halley, that the ſame orbit very nearly agrees to two appearances of a comet about the ſpace of 75 years diſtance; ſo that if theſe two appearances were really of the ſame comet, the tranſverſe axis of its orbit would be 18 times that of the axis of the earth's orbit; and therefore, when at its greateſt diſtance from the ſun, this comet would be removed not leſs than 35 times the mean diſtance of the earth from the ſame luminary.

301 How to calculate the motion of a comet.

Even this is the leaſt diſtance aſſigned by our author to any comet in its greateſt elongation from the ſun; and on the foundation of Dr Halley's computations it was expected in the year 1758 or 1759.

Nature and Motions of the Comets.

The Aſtronomer Royal advertiſes us of the expected return of the comet of 1532 and 1661, in the latter end of the year 1788, or beginning of 1789, in the following particulars.

"The elements of the orbits of the comets obſerved by Apian in 1532, and by Hevelius in 1661, are ſo much alike as to have induced Mr Halley to ſuppoſe them to be one and the ſame comet; and aſtronomers ſince have joined in the ſame opinion. Hence it ſhould return to its perihelium the 27th of April 1789. But from the diſturbances of the planets, it will probably come a few months ſooner. It will firſt be ſeen in the ſouthern parts of the heavens, if any aſtronomers ſhould watch for it in ſituations near the line, or in ſouthern climates, in the courſe of the year 1788, and probably not before the month of *September*. Aſtronomers who may happen to be in thoſe parts will be enabled to direct their teleſcopes for diſcovering it as early as poſſible, by being furniſhed with the following elements of its orbit:

The perihelium diſtance	0.44851
Place of aſcending node	2ˢ 24° 18′
Inclination of the orbit to the ecliptic	32° 36′
Perihelium forwarder in the orbit than the aſcending node	33° 28′

time of the perihelium in the latter end of the year 1788, or beginning of 1789. Its motion is direct. If it ſhould come to its perihelium on *January* 1, 1789, it might be ſeen in the ſouthern parts of the world with a good achromatic teleſcope about the middle of *September*, towards the middle of *Piſces*, with 55° ſouth latitude, and 53 ſouth declination."

Sir Iſaac Newton obſerves, that as the great eccentricity of the orbits of comets renders them very liable to be diſturbed by the attraction of the planets and other comets, it is probably, to prevent too great diſturbances from theſe, that while all the planets revolve nearly in the ſame plane, the comets are diſpoſed in very different ones, and diſpoſed all over the heavens; that when in their greateſt diſtance from the ſun, and moving ſloweſt, they might be removed as far as poſſible out of the reach of each other's action. The ſame end is likewiſe anſwered in theſe comets, which by moving ſloweſt in the aphelion or remoteſt diſtance from the ſun, deſcend neareſt to it by placing their aphelion at the greateſt height from the ſun. See more on the ſubject of comets by Sir Iſaac, Sect. III. nº 169.

§ 5. *Of the Bodies of the Sun and Planets, with the Method of computing the Quantity of Matter they contain.*

302 Attractive power diffuſed throughout the ſubſtance of all matter.

Our author having proved, as has been related, that the primary planets and comets are retained in their orbits by a power directed towards the ſun, and that the ſecondaries are alſo retained by a power of the like kind directed to the centre of their primaries, proceeds next to demonſtrate, that the ſame power is diffuſed through their whole ſubſtance and inherent in every particle. For this purpoſe he ſhows firſt, that each of the heavenly bodies attracts the reſt and other bodies with ſuch different degrees of force, as that the force of the ſame attracting body is exerted on others exactly in proportion to the quantity of matter contained in the body attracted. The firſt proof of this he brings from experiments made on bodies here on earth. The power by which the moon is influenced has been already ſhown to be the ſame with that which we call *gravity*. Now, one of the effects of the principle of gravity is, that all bodies deſcend by this force from equal heights in equal times.

303 Properties of gravity demonſtrated by pendulums.

This was taken notice of long ago; and particular methods have been invented to ſhow, that the only cauſe why ſome bodies were obſerved to fall in a ſhorter time than others was the reſiſtance of the air. As theſe methods, however, have been found liable to ſome uncertainty, Sir Iſaac Newton had recourſe to experiments made on pendulums. Theſe vibrate by the ſame power which makes heavy bodies fall to the ground; but if the ball of any pendulum of the ſame length with another were more or leſs attracted in proportion to the quantity of ſolid matter it contains, that pendulum muſt then vibrate faſter or ſlower than the other. Now the vibrations of pendulums continue for a long time, and the number of vibrations they make may be eaſily determined without any ſuſpicion of error; ſo that this experiment may be extended to what exactneſs we pleaſe: and Sir Iſaac aſſures us, that he examined in this way ſeveral ſubſtances, as gold, ſilver, lead, glaſs, ſand, common ſalt, wood, water, and wheat; in all which he found not the leaſt deviation from the theory, tho' he made the experiment in ſuch a manner, that in bodies of the ſame weight, a difference in the quantity of their matter leſs than the thouſandth part of the whole would have diſcovered itſelf. It appears, therefore, that all bodies are made to deſcend here by the power of gravity with the ſame degree of ſwiftneſs. This deſcent has already been determined at $16\frac{1}{8}$ feet in a ſecond from the beginning of their fall. It has alſo been obſerved, that if any terreſtrial body could be conveyed as high up as the moon, it would deſcend with the very ſame degree of velocity with which the moon is attracted toward the earth; and therefore that the power of the earth upon the moon bears the ſame proportion it would have upon thoſe bodies at the ſame diſtance as the quantity of matter in the moon bears to the quantity in thoſe bodies.

304 Attraction proportioned to the quantity of matter

Thus the aſſertion is proved in the earth, that its power on every body it attracts is, at the ſame diſtance from the earth, proportional to the quantity of ſolid matter in the body acted upon. As to the ſun, it has been ſhown, that the power of his action upon the ſame primary planet is reciprocally in the duplicate proportion of its diſtance; and that the power of the ſun decreaſes throughout in the ſame proportion, is teſtified by the motion of the planets traverſing the whole planetary region. This proves, that if any planet were removed from the ſun to any diſtance whatever, the degree of its acceleration towards the ſun would yet be reciprocally in the duplicate proportion of their diſtance. But it has already been proved, that the degree of acceleration given to the planets by the ſun is reciprocally in the duplicate proportion of their reſpective diſtances; all which compared together, puts it out of doubt, that the power of the ſun upon any planet removed into the place of any other, would give it the ſame velocity of deſcent as it gives that other; and conſequently that the ſun's action upon different planets at the ſame diſtance would be proportionable to the quantity of matter in each. It has likewiſe been ſhown, that the ſun attracts the primary planets and their reſpective ſecondaries, when at the ſame diſtance, in ſuch a manner as to communicate to both the ſame degree of velocity; and therefore the force wherewith the ſun acts on the ſecondary planet bears the ſame proportion to the force wherewith it attracts the primary, as the quantity of matter in the ſecondary planet bears to the quantity of matter in the primary. This property therefore is found in the ſun with regard to both kinds of planets; ſo that he poſſeſſes the ſame quality found in the earth, viz. that of acting on bodies with a degree of force proportional to the quantity of matter they contain.

This point being granted, it is hardly to be ſuppoſed that the power of attraction with which the other planets are endowed, ſhould be different fom that of the earth, if we conſider the ſimilitude of theſe bodies: and that it does not in this reſpect, is farther evident from the ſatellites of Saturn and Jupiter which are attracted according to this law; that is, in the ſame proportion to their diſtances that their primaries are attracted by the ſun. So that what has been concluded of the ſun in relation to the primary planets may be juſtly concluded of thoſe primaries in reſpect to their ſecondaries; and in conſequence of that likewiſe in regard to all other bodies, viz. that they will attract every other body in proportion to the quantity of ſolid matter it contains. Hence it follows, that this attraction extends itſelf to every particle of matter in the attracted body, and that no proportion of matter is exempted from the influence of theſe bodies to which this attractive power has been proved to belong.

305 Attraction acts equally throughout the bodies in the univerſe.

Here we may remark, that the attractive power both of the ſun and planets appears to be the ſame in all; for it acts in each in the ſame proportion to the diſtance, and in the ſame manner acts alike upon every particle of matter. This power, therefore, in the ſun and planets, is not of a different nature from the power of gravity in the earth: and this enables us to prove, that the attracting power lodged in the ſun and planets belongs likewiſe to every part of them; and that their reſpective powers upon the ſame body are proportional to the quantity of matter of which they are compoſed; for inſtance, that the force with which the earth attracts the moon, is to the force with which the ſun would attract it at the ſame diſtance, as the quantity of ſolid matter in the earth is to that in the ſun.

Before we proceed to a full proof of theſe aſſertions, it will be neceſſary to ſhow that the third law of motion, viz. That action is equal to reaction, holds good in attractive powers as well as in any other. The moſt remarkable force of this kind with which we are acquainted, next to that of gravity, is the attraction the loadſtone has for iron. Now if a loadſtone and piece of iron were both made to ſwim on water, both of them would move towards each other, and thus the attraction would be ſhown to be mutual; and when they meet, they will mutually ſtop each other: which ſhows that their velocities are reciprocally proportioned to the quantities of ſolid matter in each; and that by the ſtone's attracting the iron, it receives as much motion itſelf, in the ſtrict philoſophic ſenſe of the word, as it communicates to the iron: for it is proved from experiments on the percuſſion of bodies, that if two meet with velocities reciprocally proportional to the reſpective bodies, they will be ſtopt by the concourſe, unleſs they meet with ſome other velocity, or their elaſticity

Fig. 153

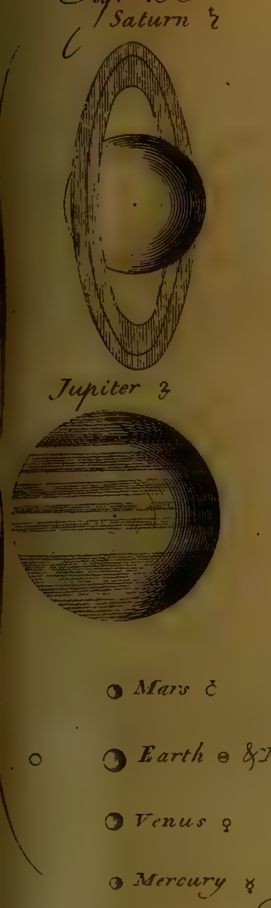


Fig. 152

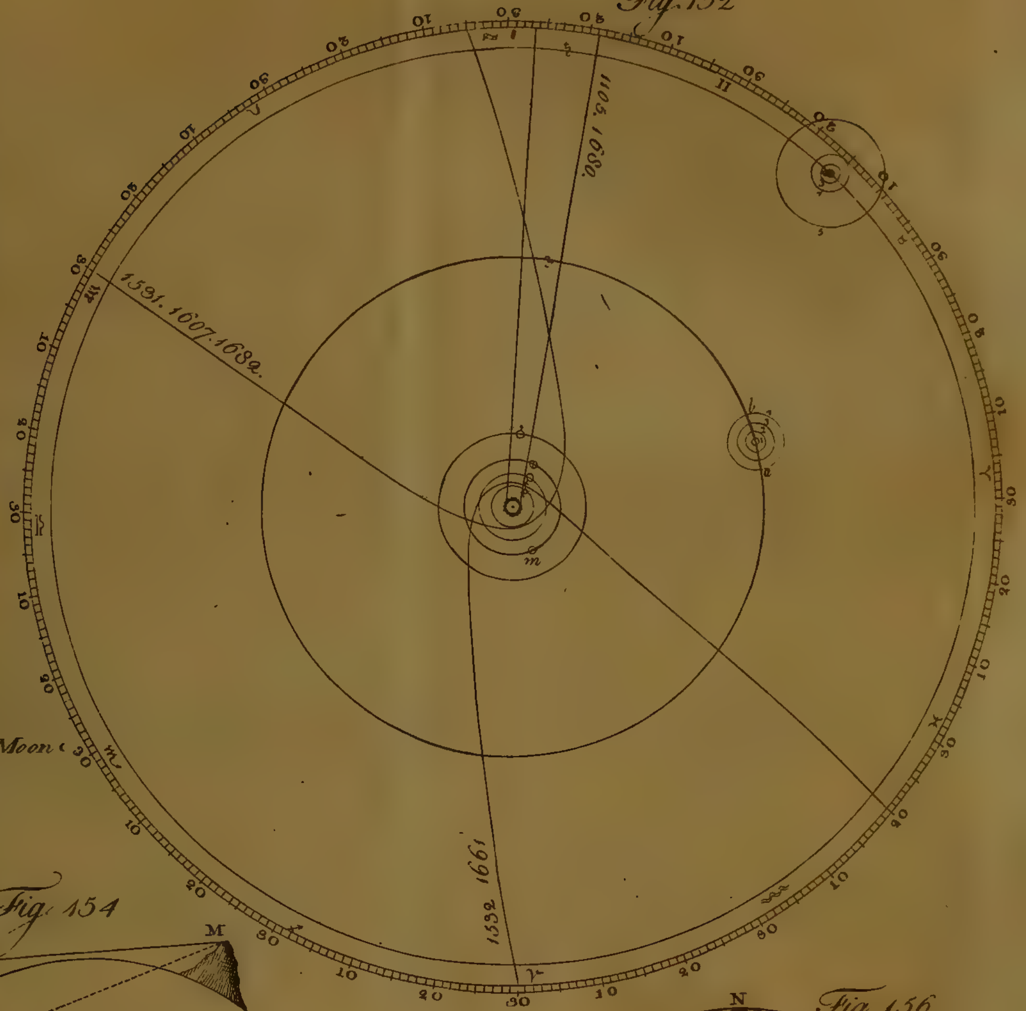


Fig. 154

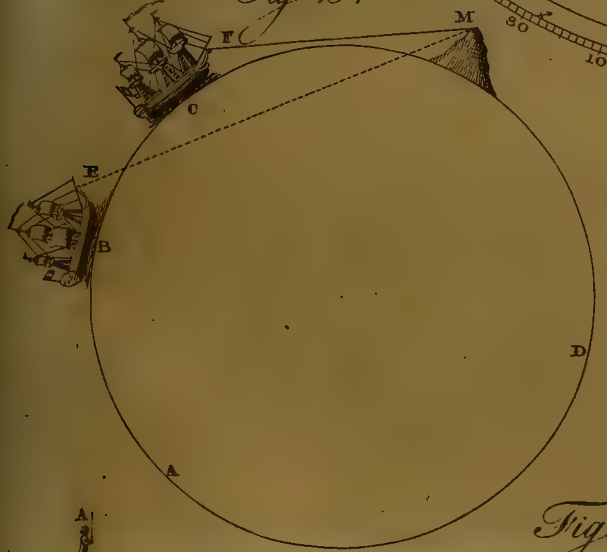


Fig. 156

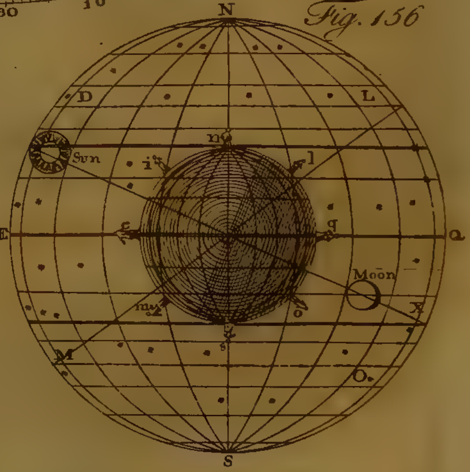
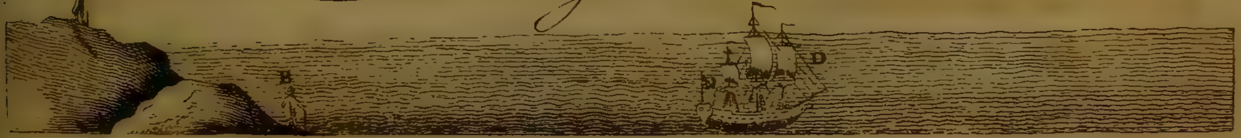


Fig. 155



Scot Philada

Of the Bodies of the Sun and Planets.

city put them into freſh motion. Hitherto, however, for the ſake of brevity, in ſpeaking of theſe forces, we have aſcribed them to the body which is leaſt moved; as when we called the power which exerts itſelf between the ſun and planets, *the attractive power of the ſun:* but to ſpeak more correctly, we ſhould rather call this power in any caſe the force which acts between the ſun and earth, between the earth and moon, &c. for both the bodies are moved by the power acting between them, in the ſame manner as when two bodies are tied together by a rope, if that ſhould ſhrink by being wet or otherwiſe, and thereby cauſe the bodies to approach; by drawing both, it will communicate to both the ſame degree of motion, and cauſe them to approach each other with velocities proportional to their quantities of matter. From this mutual action of the ſun and planets upon each other, it follows, as has been already mentioned, that they both revolve about their common centre of gravity. Thus let A (in fig. 136.) repreſent the ſun, B, a planet and C their common centre of gravity. If theſe bodies were once at reſt, they would directly approach each other by their mutual attraction, and that with ſuch velocities, that their common centre of gravity would remain at reſt, and they would meet in that point. Were the planet B to receive an impulſe, as in the direction DE, this would prevent the two bodies from falling together; but their common centre of gravity would be put into motion in the direction of the line CF, equidiſtant from BE. In this caſe Sir Iſaac Newton proves, that the ſun and planet would deſcribe round their common centre of gravity ſimilar orbits, while that centre would proceed with an uniform velocity in the line CF, and ſo the ſyſtem of the two bodies would move on with the centre of gravity without end. In order to keep the ſyſtem in the ſame place, it is neceſſary, that when the planet received its impulſe in the direction BE, the ſun ſhould receive ſuch another the contrary way, ſo as to keep the centre of gravity C without any motion, in which caſe it would always remain fixed.

306 Why the ſun and planets revolve about their common centre of gravity.

Thus we may underſtand in what manner the action between the ſun and planets is mutual. It has alſo been ſhown, that the power which acts between the ſun and primary planets is altogether of the ſame nature with that which acts between the ſecondary planets and their primaries, or which acts between the earth and bodies near its ſurface. It has alſo been already proved, that in different planets the force of the ſun's action upon each at the ſame diſtance would be proportional to the quantity of ſolid matter contained in the planet: therefore the reaction of the planet on the ſun at the ſame diſtance, or the motion which he would receive from each planet, would alſo be proportional to the quantity of matter in the planet; that is, theſe planets, at the ſame diſtance, would act on the ſame body with degrees of ſtrength proportioned to the quantity of ſolid matter contained in each.

307 The ſmalleſt particles of matter attract each other according to the ſame law.

In the next place, our author deduces from the principles above demonſtrated, that each of the particles out of which the ſun, moon, and planets, are formed, exert their power of gravitation by the ſame law, and in the ſame proportion to the diſtance, as the great bodies they compoſe. For this purpoſe, he firſt demonſtrates, that if a globe were compounded of particles which will attract the particles of any other body reciprocally in the duplicate proportion of their diſtances, the whole globe will attract the ſame in the reciprocal duplicate proportion of their diſtances from the centre of the globe, provided it be of equal denſity throughout. Hence alſo he deduces the reverſe; that if a globe acts upon diſtant bodies by the law juſt now ſpecified, and the power of the globe be derived from its being compoſed of attracting particles, each of theſe will attract after the ſame proportion. The manner of deducing this is as follows: The globe is ſuppoſed to act upon the particles of a body without it conſtantly in the reciprocal duplicate proportion of their diſtances from the centre; and therefore, at the ſame diſtance from the globe, on which ſide ſoever the body be placed, the globe will act equally upon it. Now; becauſe if the particles of which the globe is compoſed acted upon thoſe without in the reciprocal duplicate proportion of their diſtances, the whole globe would act upon them in the ſame manner as it does; therefore, if the particles of the globe have not all of them that property, ſome muſt act ſtronger than in that proportion, whilſt others act weaker: and if this be the condition of the globe, it is plain, that when the body attracted is in ſuch a ſituation in reſpect of the globe that the greater number of the ſtrongeſt particles are neareſt to it, the body will be more forcibly attracted than when, by turning the globe about, the greater quantity of weak particles would be neareſt, though the diſtance of the body ſhould remain the ſame from the centre of the globe; which is contrary to what was at firſt remarked, that the globe acts equally on all ſides.

Of the Bodies of the Sun and Planets.

It is farther deduced from theſe propoſitions, that if all the particles of one globe attract all the particles of another in the proportion already mentioned, the attracting globe will act upon the other in the ſame proportion to the diſtance between the centre of the globe which attracts and the centre of that which is attracted: and farther, that the proportion holds true, though either or both of the globes be compoſed of diſſimilar parts, ſome rarer, and ſome more denſe; provided only, that all the parts in the ſame globe, equally diſtant from the centre, be homogeneous, and likewiſe if both globes attract each other.

308 Attraction an univerſal property of matter.

Thus has our author ſhown that this power in the great bodies of the univerſe is derived from the ſame being lodged in every particle of the matter which compoſes them; and conſequently that it is no leſs than univerſal in matter, though the power be too minute to produce any viſible effects on the ſmall bodies with which we are converſant by their action on one another. In the fixed ſtars indeed we have no particular proof that they have this power, as we find no appearance to demonſtrate that they either act or are acted upon by it. But ſince this power is found to belong to all bodies whereon we can make obſervation, and we find that it is not to be altered by any change in the ſhape of bodies, but accompanies them in every form, without diminution, remaining ever proportional to the quantity of ſolid matter in each; ſuch a power muſt without doubt univerſally belong to matter.

Of the Bodies of the Sun and Planets.

All this naturally follows from a conſideration of the phenomena of thoſe planets which have ſecondaries revolving about them. By the times in which theſe ſatellites perform their revolutions, compared with their diſtances from their reſpective primaries, the

309 How to determine the power of gravity on any of the planets.

proportion between the power with which one primary attracts his ſatellites and the force with which any other attracts his will be known; and the proportion of the power with which any planet attracts his ſecondary to the power with which it attracts a body at its ſurface, is found by comparing the diſtance of the ſecondary planet from the centre of the primary to the diſtance of the primary planet's ſurface from the ſame: and from hence is deduced the proportion between the power of gravity upon the ſurface of one planet to the gravity upon the ſurface of another. By the like method of comparing the periodical time of a primary planet about the ſun with the revolution of a ſatellite about its primary, may be found the proportion of gravity or of the weight of any body on the ſurface of the ſun, to the gravity or to the weight of the ſame body upon the ſurface of the planet which carries about the ſatellite. By computations of this kind it is found, that the weight of any body on the ſurface of the ſun will be about 23 times as great as on the ſurface of the earth; about 10 times as great as on the ſurface of Jupiter; and near 19 times as great as on Saturn. The quantity of matter contained in each of theſe bodies is proportional to the power it has upon a body at a given diſtance. Thus it is found, that the ſun contains 1067 times as much matter as Jupiter; Jupiter 158$\frac{2}{3}$ times as the earth, and 2$\frac{2}{3}$ times as much as Saturn. The diameter of the ſun, according to the data with which Sir Iſaac Newton was furniſhed, was calculated at 92 times, that of Jupiter about 9 times, and that of Saturn about 7 times as large as the diameter of the earth.

310 Denſities of the heavenly bodies.

By comparing the quantities of matter in each of theſe bodies with their reſpective magnitudes their denſities are likewiſe eaſily diſcovered; the denſity of every body being meaſured by the quantity of matter contained under the ſame bulk. Thus the earth is found 4$\frac{1}{4}$ times more denſe than Jupiter, while Saturn has only between two-thirds and three-fourths of the denſity of the latter, and the ſun has only one-fourth part of the denſity of the earth. From all this our author draws the following concluſions, viz. That the ſun is rarefied by its great heat; and of the three planets abovementioned, the moſt denſe is that neareſt the ſun. This it was highly reaſonable to expect, the denſeſt bodies requiring the greateſt heat to agitate and keep their parts in motion; as on the contrary, the planets which are more rare would be rendered unfit for their office by the intenſe heat to which the denſer are expoſed. Thus the waters of our ſeas, if removed to the diſtance of Saturn would remain perpetually frozen, and at Mercury would conſtantly boil. The denſities of the planets Mars, Venus, Mercury, and the *Georgium Sidus*, as they are not attended with planets on which many obſervations have been made, cannot be aſcertained. From analogy, however, we ought to conclude, that the inferior planets, Venus and Mercury are more denſe than the earth, Mars more rare, and the Georgium Sidus much more rare, than any of the reſt.

Particular Explication of the Celeſtial Phenomena.

SECT. V. *The Newtonian Doctrine applied more particularly to the Explication of the Celeſtial Phenomena.*

FROM the general account of thoſe laws by which the univerſe is upheld, we now proceed to give an explanation of the particular parts of which it is compoſed. Thoſe which are moſt expoſed to our reſearches, beſides the Earth we inhabit, are the Sun, Moon, Mercury, Venus, Mars, Jupiter, Saturn, and the Georgium Sidus (ſee fig. 119.). The ſun, an immenſe globe of fire, is ſituated near the centre of the ſyſtem, round which he turns by a ſmall and irregular motion, according as the common centre of gravity betwixt him and the planets, which is the true centre of the ſyſtem, varies by their different poſitions on this or that ſide of him. All the planets move round this common centre of gravity together with the ſun; but the latter, by reaſon of his vaſt bulk, is ſo near the true centre, that the motions of the celeſtial bodies are by aſtronomers always referred to the centre of the ſun as the point round which they are directed. The motions of all of them are performed the ſame way, viz. from weſt to eaſt; and ſome comets have been obſerved to move alſo in this way, though the motion of others has been directly contrary. This motion, from weſt to eaſt, is ſaid to be in the order of the ſigns, or *in conſequence*, as has been already mentioned, with regard to the moon; while that from eaſt to weſt is in *antecedence*, or contrary to the order of the ſigns. Though all of them, however, revolve round the ſun, their motions, as we have already obſerved, are not in the ſame plane, but inclined to one another by ſmall angles: and the way in which we compute this inclination is by conſidering the orbit of the earth as a ſtandard, and calculating the angle which each of their orbits makes with it.

311 Heliocentric circles of the planets.

To a ſpectator placed in the ſun, all the planets would appear to deſcribe circles annually in the heavens; for though their motions are really elliptical, the eccentricity is ſo ſmall, that the difference between them and true circles is not eaſily perceived even on earth; and at the ſun, whether great or ſmall, it would entirely vaniſh. Theſe circles, which in ſuch a ſituation would appear to be annually deſcribed among the fixed ſtars are called the *heliocentric circles* of the planets; and if we ſuppoſe the orbits of the planets to be extended to the extreme bounds of the creation, they would deſcribe among the fixed ſtars thoſe circles juſt mentioned. To a ſpectator in the ſun, the comets, though moving in the moſt eccentric orbits, would alſo appear to deſcribe circles in the heavens; for though their orbits are in reality very long ellipſes, the planes of them extended to the heavens would mark a great circle thereon, whereof the eye would be the centre; only, as the real motion is in an ellipſis, the body would appear to move much more ſlowly in ſome part of the circle than another, and to differ exceſſively in magnitude. To an inhabitant of any planet, however, the ſun appears to go round in its own heliocentric circle, or to deſcribe in the heavens that ſame curve which the planet would appear to do if ſeen from the ſun. Thus (fig. 137), when the earth is at *a*, if we

Particular Explication of the Celeſtial Phenomena.

we draw a line from *a* through the ſun at S, the point G, in the ſphere of the heavens where the line terminates, is the place where the ſun then appears to an inhabitant of the earth. In a month's time the earth will be got from *a* to *b*; draw a line then through the ſun, and its extremity at H will point out his apparent place at that time. In like manner, if we draw lines from the earth in the twelve ſeveral ſituations in which it is repreſented for the twelve months of the year, the ſun's apparent place will be found as above, and ſo it would be found by a ſpectator placed in Venus or any other planet.

312 Ecliptic, why ſo named.

The heliocentric circle of the earth is called the *ecliptic*; becauſe eclipſes of the ſun or moon can only happen when the latter is in or near it, as will afterwards be more particularly explained. By ſome ancient writers it has been called the circle of the ſun, or the oblique circle, becauſe it cuts the equator at oblique angles. It is alſo called by Ptolemy the circle which paſſes through the midſt of the animals; becauſe the twelve conſtellations through which it paſſes were anciently all repreſented by animals, or parts of them, though now the *balance* is introduced in place of the claws of the *ſcorpion*. For this reaſon, a belt or hoop taken in the concave ſphere of the heavens about 10 degrees on each ſide of the ecliptic, is called the *zodiac*, from a Greek word which ſignifies an animal; and the conſtellations through which the ecliptic is drawn, are called the conſtellations of the zodiac.

313 Zodiac.

314 How to determine the ſun's place.

Though the ſun, as we have ſaid, apparently goes round the earth annually in the circle juſt mentioned, we cannot determine his place by mere inſpection as we can do that of any of the other heavenly bodies; for the fixed ſtars are the only marks by which we can determine the places of any of the celeſtial bodies, and the ſuperior brightneſs of the ſun renders them totally inviſible except in the time of a great eclipſe when his light is for a time totally obſcured. But though we cannot know the place of the ſun directly, it is eaſily found from a knowledge of thoſe fixed ſtars which are oppoſite to him. Thus, in fig. 137. ſuppoſe it the time of the year in which the earth it at *g*, if we know that the point G is then diametrically oppoſite to the ſun, we know that A, its oppoſite, is the ſun's place; and conſequently, by finding the places throughout the year diametrically oppoſite to the ſun, as GHIKLM ABCDEF, we may be aſſured that in theſe times the ſun's place was in the points ABCDEFGHIKLM. The point in the heavens diametrically oppoſite to the ſun may be known every night at twelve o'clock when the ſtars are viſible; for the ſtar which has an elevation above the horizon at that time equal to the ſun's depreſſion below it, is directly oppoſite to him.

315 Latitude, declination, &c. explained.

The ecliptic being thus found, the latitude of the moon or any ſtar is counted by its diſtance from the ecliptic, as the latitude of places on earth is counted by their diſtance from the equator; and is marked upon circles drawn through the pole of the ecliptic, and perpendicular to its plane, as the latitude of places is marked on one of the meridians of a terreſtrial globe. Theſe are called *circles of latitude*, and each of them is ſuppoſed to divide the celeſtial concave into two equal hemiſpheres; and the *declination* of any celeſtial body is its deviation from the ecliptic towards the celeſtial equator perpendicular to that of the earth.

Particular Explication of the Celeſtial Phenomena.

The latitude of any planet is either heliocentric or geocentric. The heliocentric latitude is its diſtance from the ecliptic as ſeen from the ſun, and its geocentric as ſeen from the earth, and is conſiderably different from the former. With the fixed ſtars indeed it is otherwiſe; for their diſtance is ſo vaſt, that the whole diameter of the earth's orbit is but a point in compariſon with it. For this reaſon, whatever part of its orbit the earth may be in, the fixed ſtars always appear to keep the ſame place; but with reſpect to the planets, the orbit of the earth, or *magnus orbis*, as it has ſometimes been called, bears a very conſiderable proportion, excepting only to the Georgium Sidus, of whoſe diſtance the diameter of the earth's orbit forms little more than a tenth part; and therefore all calculations with regard to that ſtar are much more difficult than the reſt. The apparent places of the planets therefore are conſiderably altered by the earth's change of place as well as by their own motions; ſo that though a planet ſhould ſtand ſtill for a whole year, it would nevertheleſs appear to us to deſcribe a circle round the heavens, as in that ſpace of time we would have been carried by the earth round the ſun, and have continually taken a view of it from different ſtations. As the orbits of the planets are inclined in different angles to the ecliptic, it thence happens, that the heliocentric latitude of any planet is almoſt always different from its geocentric latitude. Thus, let AB, fig. 138. be the orbit of the earth, CD the orbit of Venus, viewed with the eye in their common ſection, wherein they appear ſtraight lines; let E and F be two oppoſite points of the ecliptic; and ſuppoſe Venus to be in the point C in her utmoſt north limit. If ſhe were at that time viewed from the ſun S, ſhe would appear in the point of the heavens marked H, and her heliocentric latitude is then FH: but if viewed from the earth in B, ſhe will appear at *g*; at which time her heliocentric latitude is FH, and her geocentric only F*g*. When at I, her apparent place is at K, her heliocentric latitude FH, and her geocentric FK; but when the earth is at A, her apparent place will then be at G, and her geocentric latitude EG, while her heliocentric is only FH as before.

316 How to find the geocentric latitude of a ſuperior planet.

The two planets, Mercury and Venus, whoſe orbits are included in that of the earth, are called *inferior*; and Mars, Jupiter, Saturn, and the Georgium Sidus, whoſe orbits include that of the earth, are called *ſuperior*; and from the circumſtance juſt mentioned, they muſt preſent very different appearances in the heavens, as will afterwards be particularly explained. The geocentric latitude of a ſuperior planet may be underſtood from fig. 139. Let AB be the orbit of the earth, CD that of Mars, both viewed with the eye in their common ſection continued, by which they appear in ſtraight lines. Let E and F be oppoſite points of the ecliptic, and ſuppoſe Mars to be in his ſouth limit at C. If he were at that time viewed from S, the centre of the ſun, he would appear in the ſphere of the heaven at the point H; in which caſe his heliocentric latitude would be FH: But when viewed in C from the earth, or from its centre, which in this caſe is ſuppoſed to be the ſtation of the ſpectator, he will appear to be in different places of the heavens according to the poſition of the earth. When the earth, for inſtance, is at B, the place of Mars will appear to be at *g*, and his geocentric latitude will be F *g*. When the earth is at A, his apparent place will be in G, and his geocentric latitude FG: and in like manner, ſuppoſing the earth to be in any other part of its orbit, as in I or K, it is eaſy to ſee, that his apparent places, as well as geocentric latitudes at thoſe times, will be different.

317 Nodes of a planet.

The two points where the heliocentric circle of any planet cuts the ecliptic are called its *nodes*: and that which the planet paſſes through as it goes into north latitude, is called the *aſcending* node, and is marked thus ☊; and the oppoſite to this is called the *deſcending* node, and is marked ☋. A line drawn from one node to the other is called the *line of the nodes of the planet*, which is the common ſection of the plane of the ecliptic, and that of the planet produced on each ſide to the fixed ſtars.

318 Zodiac and ſigns explained.

The zodiac, of which we have already given ſome account, is either *aſtral* or *local*. The aſtral is divided into 12 unequal parts, becauſe it contains 12 celeſtial conſtellations, ſome of which are larger than others. This continues always invariably the ſame; becauſe the ſame ſtars now go to the making up of the different conſtellations as formerly, excepting ſome ſmall variations to be afterwards explained. The local zodiac is divided into twelve equal parts, each containing 30 degrees, called *ſigns*. Theſe are counted from the point where the equator and ecliptic interſect each other at the time of the vernal equinox; and are denoted by particular marks, according to the apparent annual motion of the ſun. See fig. 158. A motion in the heavens in the order of theſe ſigns, as from Aries to Taurus, is ſaid to be a motion *in conſequence*; and ſuch are the true motions of all the planets; tho' their apparent motions are ſometimes contrary, and then they are ſaid to move in *antecedence*. The local zodiac is not always invariably the ſame as to the places of the ſeveral ſigns, though the whole always takes up the ſame place in the heaven, viz. 10 degrees on each ſide the ecliptic. The points where the celeſtial equator cuts into the ecliptic are found to have a motion in antecedence of about 50 ſeconds in a year. This change of place of the firſt point of the ecliptic, from whence the ſigns are counted, occaſions a like change in the ſigns themſelves; which though ſcarce ſenſible for a few years, has now become very conſiderable. Thus, ſince aſtronomy was firſt cultivated among the Greeks, which is about 2000 years ago, the firſt point of the ecliptic is removed backward above a whole ſign; and though it was then about the middle of the conſtellation Aries, is now about the middle of Piſces. Notwithſtanding this alteration, however, the ſigns ſtill retain their ancient names and marks. When the zodiac is mentioned by aſtronomers, the local zodiac is generally meant.

319 Longitude of celeſtial bodies explained.

The longitude of a phenomenon in the heavens is the number of degrees counted from the firſt point of Aries on the ecliptic to the place where a circle of latitude drawn through the phenomenon would cut the ecliptic at right angles. Every phenomenon in the heavens, whether in the zodiac or not, is thus referred to the ecliptic by the circles of latitude, as the longitudes of terreſtrial places are referred to the equator by the meridians; and whatever ſign the circle of latitude paſſes through, the phenomenon is ſaid to have its place in that ſign, though ever ſo far diſtant from it.

Some aſtronomical writers have made the local zodiac invariable: for which purpoſe they imagine a circle of latitude drawn through the firſt ſtar of the conſtellation Aries, marked in Bayer's catalogue by the Greek letter γ; and reckon their longitude from the point where that circle cuts the ecliptic. This ſtar, from its uſe, is called the firſt ſtar of the Ram; and when this method is made uſe of, the longitude of any phenomenon is ſaid to be ſo many ſigns, degrees, minutes, &c. from the firſt ſtar of the Ram. Thus, in Street's Caroline tables, the longitude of Jupiter's aſcending node is two ſigns eight degrees from the firſt ſtar of Aries, which is thus marked: Long. ♃ ☊ ∂ 1 ✱ ♈ 2s 8°. The common way of reckoning the longitude of a phenemenon is to take ♈ for the firſt point of the ecliptic, and not to number the degrees quite round that circle as a continued ſeries, but to make a new beginning at the firſt point of every ſign, and to reckon from thence only the length of 30°. When this method is made uſe of, the longitude of any phenomenon is expreſſed, by ſaying it is in ſuch a degree and ſuch a minute of a ſign: and thus we may expreſs the longitude of the aſcending node of Mercury, ☿ ☊ ♉ 14° 40′; and ſo of any other. The place of a phenomenon in the heaven is expreſſed by ſetting down its longitude and latitude as is done with places ſituated any where on the ſurface of the earth.

Having thus explained the aſtronomical terms commonly made uſe of with reſpect to the planets; and likewiſe ſhown how from their motions and that of the earth, there muſt be a conſiderable variation in their apparent places, as ſeen from the ſun and from the earth; we ſhall now proceed to a more particular conſideration of their phenomena, as derived from a compoſition of the two motions juſt mentioned, viz. that of the planets in their reſpective orbits, and that of the earth in the ecliptic.

320 Conjunctions and oppoſitions of the planets explained.

Every planet, like the moon, is ſometimes in conjunction and ſometimes in oppoſition with the ſun. Its conjunction is when the geocentric place of the planet is the ſame with that of the ſun; though an exact or central conjunction can only take place when the line of its nodes paſſes through the earth, and the planet itſelf is in one of its nodes at the time. It is however, in general, called a conjunction, or oppoſition, when the ſame circle of latitude paſſes through the ſun and planet at the ſame time.

221 Aſpects of the planets.

When the geocentric place of a planet is 90°, or a quarter of a circle from the ſun's place, the planet is ſaid to be in *quadrature*, or in *quartile* aſpect with the ſun; and theſe terms are uſed in a like ſenſe when applied to any two of the heavenly bodies. Thus the ſun and moon, or the moon and any planet, or any two planets, may be in conjunction, oppoſition, or quadrature. Beſides theſe, the ancients reckoned other two aſpects, the *trine* and the *ſextile*; the former when the bodies were diſtant 120°, and the latter when only half that diſtance. Theſe aſpects they marked thus:

Conjunction.	Oppoſition.	Quadrature.	Trine.	Sextile.
☌	☍	□	△	✱

The aſpects were ſuppoſed to influence the affairs of mankind; and many concluſions drawn from them too abſurd to be mentioned here, and now indeed almoſt entirely buried in oblivion. The

322 **Geocentric places, &c. of the inferior planets.**

The inferior planets have two kinds of conjunction with the ſun; one in the inferior part of their ſemicircles, where they are nearer to the earth than the ſun; the other in the ſuperior part, where they are farther off. In the former, the planet is between the earth and the ſun; and in the latter, the ſun is between the earth and planet. The inferior planets can never be in oppoſition to the ſun, nor even appear at a great diſtance from him. The length they go is called their *elongation*. Thus, in fig. 140. let OPQRT be part of the ecliptic; S the ſun; and the three circles round him, the orbits of Mercury, Venus, and the Earth. Suppoſe the earth to be at A, the ſun's geocentric place will be at Q. If Mercury be then at I, his geocentric place is likewiſe at Q; ſo that he is in conjunction with the ſun in his inferior ſemicircle: if at M, his geocentric place is likewiſe at Q; ſo that he is in conjunction in his ſuperior ſemicircle. In like manner, Venus at E is in conjunction in her inferior ſemicircle, at G in her ſuperior: but if we ſuppoſe the earth to be at A, and Venus at H, her geocentric place is T, and her elongation QT, which in this figure is the greateſt poſſible; for this always takes place when a ſtraight line from the earth touches the orbit of the planet, as is evident from the figure; that is, provided the planet be in its aphelion at the time. Thus the greateſt poſſible elongation of Mercury is QP when he is in his aphelion at L; and the quantity of this is found by aſtronomical obſervations to be about 28 degrees, that of Venus about 48. The inferior planets in their elongations are ſometimes eaſtward and ſometimes weſtward of the ſun: in the former caſe they appear in the evening, and in the latter in the morning. The ſmallneſs of Mercury and his nearneſs to the ſun prevent him from being often taken notice of; but the largeneſs and beauty of Venus have made her, in all ages, celebrated as the *evening* and *morning ſtar*.

323 **Direct retrograde motions of the planets explained.**

The irregular apparent motion of the planets has been already taken notice of; ſometimes going forward, ſometimes backward, and ſometimes appearing to ſtand ſtill for a little. Theſe different conditions are by aſtronomers called *direct*, *retrograde*, and *ſtationary*. Were they to be viewed from the ſun, they would always appear direct, as has been already ſhown; but when viewed from the earth, the inferior planets appear direct when moving in their upper ſemicircle, and retrograde when in their lower ones. Thus, in fig. 140. ſuppoſe the earth at reſt at A, while Mercury is going on in his orbit from N to I. from I to L his motion appears to an obſerver at A to be retrograde, or contrary to the order of the ſigns, namely, from R to Q and from Q to P; but when in that part of his orbit which lies between L and N, his motion appears direct, or from P to Q and from Q to R.

When the earth is in the line of nodes of an inferior planet, the apparent motion of the former is then in a ſtraight line, becauſe the plane of it paſſes through the eye; if in a conjunction in his upper ſemicircle, he paſſes behind the ſun; if in his lower ſemicircle, he paſſes before it, and will then be ſeen by an obſerver on earth to paſs over the ſun's diſk like a round and very black ſpot. Were the plane of his orbit coincident with the ecliptic, this appearance would be ſeen every year; but by reaſon of the obliquity of the two planes to each other, it is much more rare. However, he was ſeen in this manner November 12th 1782, at 3 h. 44′ in the afternoon; May 4th 1786, at 6 h. 57′ in the morning; and will be ſeen again December 6th 1789, at 3 h. 55′ in the afternoon: but from that time not, in Britain at leaſt, until the year 1799, May 7th, at 2 h. 34′ in the afternoon. In like manner, Venus ſometimes appears as a black ſpot on the ſun, but much more ſeldom than Mercury. She was firſt ſeen by Mr Horrox, as we have already related, in the year 1639; afterwards in the years 1761 and 1769; but will not afterwards be viſible in this manner till the year 1874.

When the earth is out of the line of the nodes of an inferior planet, its orbit appears an ellipſis, more or leſs eccentric according to the ſituation of the eye of the ſpectator. Thus, ſuppoſe the earth to be as far as poſſible (that is 90°) out of the line of the nodes of Mercury, the projection of his orbit will be in ſuch an elliptic curve as is repreſented fig. 141. wherein he will appear to move in the order of the letters; direct when in his upper ſemicircle from *a* to *b*, from *b* to *c*, being above the ſun at *b* in his ſuperior conjunction: but in his inferior ſemicircle his motion will appear retrograde from *c* to *d*, and from *d* to *a*; in conjunction he will be at *d* below the ſun. In theſe caſes, the motion of Mercury is unequal; faſter near the inferior conjunction, but moſt unequal in the inferior ſemicircle, going through the unequal ſpaces into which the ellipſis is divided. The motions of the inferior planets, both direct and retrograde, are very unequal: and this inequality proceeds not from the eccentricity of their orbits, but from the projection of their orbits into long ellipſis; and is therefore a mere optical deception.

Theſe planets appear ſtationary while changing their motion from direct to retrograde, or from retrograde to direct. If the earth ſtood ſtill, the times of their appearing ſtationary would be at their greateſt elongation; for though it be a property of the circle that a ſtraight line can only touch it in one point, yet when the circle is very large the receſs from the tangent is not perceptible for a conſiderable time. Thus, in fig. 140. ſuppoſe the earth to be at reſt in A, Venus would appear ſtationary, her geocentric place continuing at T all the while ſhe is going in her orbit from *a* to *b*; becauſe her deviation from the viſual line AT would ſcarce be perceptible ſo near the point of contact H.

324 **Effects of the earth's motion on the appearances of the planets.**

To an inhabitant of the earth, therefore, the inferior planets appear always near the ſun; alternately going from and returning to him, ſometimes in ſtraight lines, at others in elliptical curves, firſt on one ſide and then on the other; ſometimes ſo near as to be rendered inviſible by his ſtronger light. Sometimes, when in or near their nodes, they paſs behind the ſun in their ſuperior ſemicircles, or paſs between him and us; in which caſe they appear like black ſpots on his diſk, as has been juſt now mentioned. For the better comprehending of theſe motions, however, we have hitherto ſuppoſed the earth to ſtand ſtill in ſome part of its orbit, while they go round the ſun in theirs; but as this is not the caſe, it now remains to conſider the changes which take place in conſequence of the earth's motion. Were the earth to ſtand ſtill in any part of her orbit as at A, the places of conjunction both in the ſuperior and inferior ſemicircle, as alſo of the greateſt elongation; and conſequently the places of direct and retrograde motion, and of the ſtations of an inferior planet, would always be in the ſame part of the heavens. Thus, in fig. 140. upon this ſuppoſition, the places of Mercury's ſtations would always be the points P and R, the arc of his motion PR, and of his retrograde motion RP; whereas, on account of the earth's motion, the places where theſe appearances happen are continually advancing forward in the ecliptic according to the order of the ſigns. In fig. 142, let ABCD be the orbit of the earth; *e f g h* that of Mercury; ☉ the ſun; GKI an arc of the ecliptic extended to the fixed ſtars. When the earth is at A, the ſun's geocentric place is at F; and Mercury, in order to a conjunction, muſt be in the line AF; that is, in his orbit he muſt be at *f* or *h*. Suppoſe him to be at *f* in his inferior ſemicircle: If the earth ſtood ſtill at A, his next conjunction would be when he is in his ſuperior ſemicircle at *h*; the places of his greateſt elongation alſo would be at *e* and *g*, and in the ecliptic at E and G: but ſuppoſing the earth to go on in its orbit from A to B; the ſun's geocentric place is now at K; and Mercury, in order to be in conjunction, ought to be in the line BK at *m*. As by the motion of the earth the places of Mercury's conjunction with the ſun are thus continually carried round in the ecliptic in conſequence, ſo the places of his utmoſt elongations muſt be carried in conſequence alſo. Thus, when the earth is at A, the places of his greateſt elongation from the ſun are in the ecliptic E and G; the motion of the earth from A to B advances them forward from G to L and from E to I. But the geocentric motion of Mercury will beſt be ſeen in fig. 146. Here we have part of the extended ecliptic marked ♈, ♉, ♊, &c. in the center of which S repreſents the ſun, and round him are the orbits of Mercury and the earth. The orbit of Mercury is divided into 11 equal parts, ſuch as he goes through once in eight days; and the diviſions are marked by numeral figures 1, 2, 3, &c. Part of the orbit of the earth is likewiſe divided into 22 equal arcs, each arc being as much as the earth goes through in eight days. The points of diviſion are marked with the letters *a, b, c, d, e, f,* &c. and ſhow as many ſeveral ſtations from whence Mercury may be viewed from the earth. Suppoſe then the planet to be at 1 and the earth at *a*; draw a line from *a* to 1, and it ſhews Mercury's geocentric place at A. In eight days he will be got to 2, and the earth to *b*; draw a line from 2 to *b*, and it ſhows his geocentric place at B. In other eight days he will have proceeded to 3, and the earth to *c*; a line drawn from 3 to *c* will ſhow his geocentric place at C. In this manner, going through the figure, and drawing lines from the earth at *d, e, f, g,* &c. through 4, 5, 6, 7, &c. we ſhall find his geocentric places ſucceſſively at the points D, E, F, G, &c. where we may obſerve, that from A to B, and from B to C, the motion is direct; from C to D, and from D to E, retrograde. In this figure 22 ſtations are marked in the earth's orbit, from whence the planet may be viewed; correſponding to which there ought to be as many in the orbit of Mercury: and for this purpoſe the place of that planet is marked at the end of every eight days for two of his periodical revolutions; and to denote this, two numeral figures are placed at each diviſion.

The geocentric motion of Venus may be explained in a ſimilar manner; only as the motion of Venus is much ſlower than that of Mercury, his conjunctions, oppoſitions, elongations, and ſtations all return much more frequently than thoſe of Venus.

To explain the ſtationary appearances of the planets, it muſt be remembered, that the diameter of the earth's orbit, and even that of Saturn, are but mere points in compariſon of the diſtance of the fixed ſtars; and therefore, any two lines abſolutely parallel, though drawn at the diſtance of the diameter of Saturn's orbit from each other; would, if continued to the fixed ſtars, appear to us to terminate in the ſame point. Let, then, the two circles fig. 143. repreſent the orbits of Venus and of the Earth; let the lines AE, BF, CG, DH, be parallel to SP, we may nevertheleſs affirm, that if continued to the diſtance of the fixed ſtars, they would all terminate in the ſame point with the line SP. Suppoſe then, Venus at E while the Earth is at A, the viſual ray by which ſhe is ſeen is the line AE. Suppoſe again, that while Venus goes from E to F, the Earth goes from A to B, the viſual ray by which Venus is now ſeen is BF parallel to AE; and therefore Venus will be all that time ſtationary, appearing in that point of the heaven where SP extended would terminate: this ſtation is at her changing from direct to retrograde. Again, ſuppoſe, when the Earth is at C, Venus is at G, and the viſual line CG; if, while the Earth goes from C to D, Venus goes from G to H, ſo that ſhe is ſeen in the line GH parallel to CG, ſhe will be all that time ſtationary, appearing in the point where a line drawn from S through P would terminate. This ſtation is at her changing from retrograde to direct; and both are in her inferior ſemicircle.

325 Perigee and apogee of the planets explained.

An inferior planet, when in conjunction with the ſun in its inferior ſemicircle, is ſaid to be in *perigee*, and in the other in *apogee*, on account of its different diſtances from the earth. Their real diſtances from the earth when in perigee are variable, partly owing to the eccentricities of their orbits, as well as that of the earth; and partly owing to the motions of the different bodies, by which it happens that they are in perigee in different parts of their orbits. The leaſt poſſible diſtance is when the perigee happens when the earth is in its perihelion, and the planet in its aphelion.

326 Differences in the apparent diameters of the planets.

The difference of diſtance between the earth and inferior planets at different times, makes a conſiderable variation in their apparent diameters, which indeed is very obſervable in all the planets; and thus they ſometimes look very conſiderably larger than at others. This difference in magnitude in Mercury is nearly as $5\frac{1}{4}$ to 1; and in Venus, no leſs than 32 to 1. A common ſpectator, unaſſiſted by any inſtrument, may obſerve an inferior planet alternately approach nearer and nearer the ſun, until at laſt it comes into conjunction with him, and then to recede farther and farther till it is at its greateſt elongation, which will be firſt on one ſide and then on the other: but if we obſerve the apparent change of place of an inferior planet in the ſphere of the heavens, its direct motions, ſtations, and retrogradations, meaſuring its diameter frequently with the micrometer, we ſhall find by its decreaſe at ſome times and increaſe at others, that its diſtance from us is very conſiderably varied; ſo that, taking the whole of its courſe into conſideration, it appears to move in a very complicated curve. See fig. 1. and C.

327 **Appearances of the ſuperior planets explained.** As the ſuperior planets move in a larger orbit than the earth, they can only be in conjunction with the ſun when they are on that ſide oppoſite to the earth; as, on the other hand, they are in oppoſition to him when the earth is between the ſun and them. They are in quadrature with him when their geocentric places are 90° diſtant from that of the ſun. In order to underſtand their apparent motions, we ſhall ſuppoſe them to ſtand ſtill in ſome part of their orbit while the earth makes a complete revolution in hers; in which caſe, any ſuperior planet would then have the following appearances: 1. While the earth is in her moſt diſtant ſemicircle, the motion of the planet will be direct. 2. While the earth is in her neareſt ſemicircle, the planet will be retrograde. 3. While the earth is near thoſe places of its orbit where a line drawn from the planet would be a tangent, it would appear to be ſtationary. Thus, in fig. 147. let *abcd* repreſent the orbit of the Earth; S the Sun; EFG an arc of the orbit of Jupiter; ABC an are of the ecliptic projected on the ſphere of the fixed ſtars. Suppoſe Jupiter to continue at F, while the earth goes round in her orbit according to the order of the letters *abcd*. While the earth is in the ſemicircle moſt diſtant from Jupiter going from *a* to *b* and from *b* to *c*, his motion in the heaven would appear direct, or from A to B and from B to C: but while the earth is in its neareſt ſemicircle *cde*, the motion of Jupiter would appear retrograde from C to B and from B to A; for *a, b, c, d,* may be conſidered as ſo many different ſtations from whence an inhabitant of the earth would view Jupiter at different ſeaſons of the year, and a ſtraight line drawn from each of theſe ſtations, through F the place of Jupiter, and continued to the ecliptic, would ſhow his apparent place there to be ſucceſſively at A, B, C, B, A. While the earth is near the points of contact *a* and *c*, Jupiter would appear ſtationary, becauſe the viſual ray drawn through both planets does not ſenſibly differ from the tangent F*a* or F*c*. When the earth is at *b*, a line drawn from *b* through S and F to the ecliptic, ſhows Jupiter to be in conjunction with the ſun at B. When the earth is at *d*, a line drawn from *d* through S, continued to the ecliptic, would terminate in a point oppoſite to B; which ſhows Jupiter then to be in oppoſition to the ſun: and thus it appears that his motion it direct in the conjunction, but retrograde when in oppoſition with the ſun.

The direct motion of a ſuperior planet is ſwifter the nearer it is to a conjunction, and ſlower as it approaches to a quadrature with the ſun. Thus, in fig. 144. let ☉ be the ſun; the little circle round it, the orbit of the earth, whereof *abcdefg* is the moſt diſtant ſemicircle: OPQ, an arc of the orbit of Jupiter; and ABCDEFG, an arc of the ecliptic in the ſphere of the fixed ſtars. If we ſuppoſe Jupiter to ſtand ſtill at P, by the earth's motion from *a* to *g*, he would appear to move direct from A to G, deſcribing the unequal arcs AB, BC, CD, DE, EF, FG, in equal times. When the earth is at *d*, Jupiter is in conjunction with the ſun at D, and there his direct motion is ſwifteſt. When the earth is in that part of her orbit where a line drawn from Jupiter would touch it, as in the points *e* or *g*, Jupiter is nearly in quadrature with the ſun; and the nearer the earth is to any of thoſe points, the ſlower is the geocentric motion of Jupiter; for the arcs CD and DE are greater than BC or EF, and the arcs BC and EF are greater than AB or FG.

The retrograde motion of a ſuperior planet is ſwifter the nearer it is to an oppoſition, and ſlower as it approaches to a quadrature with the ſun. Thus, let ☉, fig. 145. be the ſun; the little circle round it the orbit of the earth, whereof *g h i k l m n* is the neareſt ſemicircle; OPQ, an arc of the orbit of Jupiter; NKG an arc of the ecliptic: If we ſuppoſe Jupiter to ſtand ſtill at P, by the earth's motion from *g* to *n*, he would appear to move retrograde from G to N, deſcribing the unequal arcs GH, HI, IK, KL, LM, MN, in equal times. When the earth is at *k*, Jupiter appears at K, in oppoſition to the ſun, and there his retrograde motion is ſwifteſt. When the earth is either at *g* or *n*, the points of contact of the tangents P*g* and P*n*, Jupiter is nearly in quadrature with the ſun: and the nearer he is to either of theſe points, the ſlower is his retrogradation, for the arcs IK and KL are greater than HI or LM; and the arcs HI and LM are greater than GH or MN. Since the direct motion is ſwifteſt when the earth is at *d*, and continues diminiſhing till it changes to retrogade, it muſt be inſenſible near the time of change: and, in like manner, the retrograde motion being ſwifteſt when the earth is in *k*, and diminiſhing gradually till it changes to direct, muſt alſo at the time of that change be inſenſible; for any motion gradually decreaſing till it changes into a contrary one gradually increaſing, muſt at the time of the change be altogether inſenſible.

The ſame changes in the apparent motions of this planet will alſo take place if we ſuppoſe him to go on ſlowly in his orbit; only they will happen every year when the earth is in different parts of her orbit, and conſequently different times of the year. Thus, (fig. 147.) let us ſuppoſe, that while the earth goes round her orbit Jupiter goes from F to G, the points of the earth's orbit from which Jupiter will now appear to be ſtationary will be *a* and *y*; and conſequently his ſtations muſt be at a time of the year different from the former. Moreover, the conjunction of Jupiter with the ſun will now be when the earth is at *f*, and his oppoſition when it is at *e*; for which reaſon theſe alſo will happen at times of the year different from thoſe of the preceding oppoſition and conjunction. The motion of Saturn is ſo ſlow, that it makes but little alteration either in the times or places of his conjunction or oppoſition; and no doubt the ſame will take place in a more eminent degree in the Georgium Sidus; but the motion of Mars is ſo much ſwifter than even that of Jupiter, that both the times and places of his conjunctions and oppoſitions are thereby very much altered.

Fig. 148. exemplifies the geocentric motion of Jupiter in a very intelligible manner: where ☉ repreſents the ſun; the circle 1, 2, 3 4, the orbit of the earth, divided into twelve equal arcs for the twelve months of the year; PQ an arc of the orbit of Jupiter, containing as much as he goes through in a year, and divided in in like manner into twelve equal parts each as much as he goes through in a month. Now, ſuppoſe the earth to be at 1 when Jupiter is at *a*, a line drawn through 1 and *a* ſhows Jupiter's place in the celeſtial ecliptic to be at A. In a month's time the earth will have moved from 1 to 2, Jupiter from *a* to *b*; and a line drawn from 2 to *b* will ſhow his geocentric place to be in B. In another month, the earth will be in 3, and Jupiter at C, and conſequently his geocentric place will be at C; and in like manner his place may be found for the other months at D, E, F, &c. It is likewiſe eaſy to obſerve, that his geocentric motion is direct in the arcs AB, BC, ED, DE; retrograde in EF, FG, GH, HI; and direct again in IK, KL, LM, MN. The inequality of his geocentric motion is likewiſe apparent from the figure.

A ſuperior planet is in apogee when in conjunction with the ſun, and in perigee when in oppoſition; and every one of the ſuperior planets is at its leaſt poſſible diſtance from the earth where it is in perigee and perihelion at the ſame time. Their apparent diameters are variable, according to their diſtances, like thoſe of the inferior planets; and this, as might naturally be expected, is moſt remarkable in the planet Mars, who is neareſt us. In his neareſt approach, this planet is 25 times larger than when fartheſt off, Jupiter twice and a half, and Saturn once and a half.

328
Of the Georgium Sidus.

The honour of diſcovering the new attendant of the ſun, called the *Georgium Sidus*, is undoubtedly due to Mr Herſchel; though Mr Robiſon, profeſſor of Natural Philoſophy in Edinburgh, has given ſtrong reaſons for ſuppoſing that it had been marked by ſeveral aſtronomers as a fixed ſtar. It was firſt obſerved by Mr Herſchel on the 13th of March 1781, near the foot of Caſtor, and his attention was drawn by its ſteady light. On applying an higher magnifying power to his teleſcope, it appeared manifeſtly to increaſe in diameter; and two days after, he obſerved that its place was changed. From theſe circumſtances he concluded, that it was a comet: and ſent an account of it as ſuch to the aſtronomer-royal, which very ſoon ſpread all over Europe. It was not long, however, before it was known, by the Engliſh aſtronomers eſpecially, to be a planet.

329
How diſcovered to be a planet.

The circumſtances which led to this diſcovery were, its vicinity to the ecliptic, the direction of its motion, and its being nearly ſtationary at the time, in ſuch a manner as correſponds with the like appearances of the other planets. The French aſtronomers, however, ſtill imagined it to be a comet, although it had not that faint train of light which uſually accompanies theſe bodies, nor would its ſucceſſive appearances correſpond with ſuch an hypotheſis; ſo that they were at laſt obliged to own that it went round the ſun in an orbit nearly circular.

330
Computation of its diſtance, &c.

Its motion was firſt computed on this principle by Mr Lexel profeſſor of aſtronomy at St Peterſburgh; who ſhowed, that a circular orbit, whoſe radius is about 19 times the diſtance of the earth from the ſun, would agree very well with all the obſervations which had been made during the year 1781. On the 1ſt of December that year it was in oppoſition with the ſun; whence one of its ſtations was certainly determined. In the mean time, however, as aſtronomers were every where engaged in making obſervations on the ſame ſtar, it occurred to ſome, that it might poſſibly have been obſerved before, though not known to be a planet. Mr Bade of Berlin, who had juſt publiſhed a work containing all the catalogues of zodiacal ſtars which had appeared, was induced, by the obſervations which had been already made on the new planet, to conſult theſe catalogues, in order to diſcover whether any ſtar, marked by one aſtronomer and omitted by another, might not be the new planet in queſtion. In the courſe of this inquiry, he found, that the ſtar, N° 964 of Mayer's catalogue, had been unobſerved by others, and only once by Mr Mayer himſelf, ſo that no motion could have been perceived by him. On this Mr Bade immediately directed his teleſcope to that part of the heavens where he might expect to find the ſtar marked in Mayer's catalogue, but without ſucceſs. At the ſame time, by the calculations already made concerning the new planet, he diſcovered, that its apparent place in the year 1756 ought to have been that of Mayer's ſtar, and this was one of the years in which he was buſied in his obſervations; and on farther inquiry it was found, that the ſtar 964 had been diſcovered by Mr Mayer on the 15th of September 1756: So that it is now generally believed, that the ſtar N° 964 of Mayer's catalogue was the new planet of Herſchel.

Before the end of the year 1782, it was found, that the angular motion of the planet was increaſing; which ſhowed, that it was not moving in a circle, but in an eccentric orbit, and was approaching towards the ſun. Aſtronomers, therefore, began to inveſtigate the inequality of this angular heliocentric motion, in order to diſcover the form and poſition of the ellipſis deſcribed. This was a very difficult taſk, as the ſmall inequality of motion ſhowed that the orbit was nearly circular, and the arch already deſcribed was no more than one-fiftieth part of the whole circumference. It was, however, by no means eaſy, from the variation of curvature diſcoverable in this ſmall arch, to determine to what part of the circumference it belongs: though the Profeſſor is of opinion, that the ſuppoſition of its being the ſtar 964 of Mayer's catalogue renders the calculation eaſy. On this ſuppoſition, its motion has been calculated by ſeveral aſtronomers, as well as by Mr Robiſon himſelf. He obſerves, however, that if we do not admit the identity of theſe ſtars, near half a century muſt elapſe before we can determine the elements of this planet's motion with a preciſion equal to that of the others.

Some aſtronomers are of opinion, that the new planet is the ſame with the ſtar N° 34 Tauri of the Britannic catalogue. “In this caſe (ſays Mr Robiſon), the elements will agree very well with Flamſtead's obſervation of that ſtar on December 13th 1690, being only 40″, or perhaps only 12″, to the weſtward of it; but the latitude differs more than two minutes from Flamſtead's latitude, which is properly deduced from the zenith diſtance. This is too great an error for him to commit in the obſervation; and we ſhould therefore reject the ſuppoſition on this account alone: But there are ſtronger reaſons for rejecting it, ariſing from the diſagreement of thoſe elements with the obſervations made on the ſtations of the planet in October 1781 and in March and October 1782, which give a very near approximation of its diſtance from the ſun. When compared with obſervations of the planet near its ſtationary

Particular Explication of the Celeſtial Phenomena.

tionary points in the ſpring, they give the geocentric latitude conſiderably too great, while they give it too ſmall for the ſimilar obſervations in autumn."

331
To find the time when any planet will return into the ſame apparent ſituation.

As the times of conjunction, utmoſt elongation, direct or retrograde motions of the inferior planets, depend on the combinations of their motions in their orbits with the motion of the earth in its orbit; any of theſe appearances will be more frequent in Mercury than in Venus, becauſe the former moves with a ſwifter motion in his orbit, and conſequently muſt more frequently paſs through thoſe places where he is in conjunction, &c. The time in which any of the inferior planets will return into a given ſituation, may be known by the following examples. Let fig. 149. repreſent the orbits of Venus and the earth. Let the earth be at E, Venus at V, when ſhe is in the inferior conjunction with the ſun in ♈. From S, Venus and the earth would appear in conjunction in ♎: let Venus go round her orbit, and return to V; the earth taking longer time to go round than Venus, will, in the mean time, go from E, only through a part of her orbit, and Venus muſt overtake the earth before ſhe can have another inferior conjunction; that is, ſhe muſt, beſides an entire revolution, which is equal to four right angles, go through as much more angular motion round the ſun as the earth has done in the mean time, ſo as to be in a right line between the ſun and the earth. Suppoſe this is to happen when the earth is got to F and Venus to T, the angular motions of the earth and Venus performed in the ſame times are reciprocally as their periodical times: and therefore as the periodical time of the earth is to the periodical time of Venus; ſo is the angular motion of Venus, which is equal to four right angles, added to the angular motion of the earth, in the time between two like conjunctions of Venus, to the angular motion of the earth in the ſame time: and therefore, by diviſion of proportion, as the difference between the periodical times of Venus and the earth is to the periodical time of Venus; ſo are four right angles, or 360°, to a fourth quantity; namely, to the angular motion or number of degrees which the earth goes in her orbit from the time of one conjunction of Venus to the next conjunction of the ſame kind. Now the periodical time of the earth is 365 days 6 hours or 8766 hours; the period of Venus 224 days 16 hours or 5392 hours; the difference is 3374 hours. Say then, As 3374 is to 5392, ſo are four right angles, or 360 degrees, to a fourth number, which is 575°; which the earth goes through in a year and 218 days. Were Venus therefore this day in an inferior conjunction with the ſun, it would be a year and 218 days before ſhe come into another conjunction of the ſame kind; and this alteration in time occaſions a proportionable change in place: ſo that if one conjunction be in ♈, the next ſimilar conjunction will be in ♍. The time between any ſituation of Mercury, with regard to the ſun and the earth, and another like ſituation, may be found by the ſame method. The periodical time of the earth is 8766 hours; the period of Mercury 87 days 23 hours or 2111 hours; the difference 6655 hours. Say then, As 6655 is to 2111, ſo are four right angles or 360° to 114°, through which the earth paſſes in 116 days. If therefore Mercury were to be this day in his inferior conjunction, it would be 116 days before he were in a ſimilar ſituation.

Eucl. Elm. 5. prop 17.

Particular Explication of the Celeſtial Phenomena.

This problem is commonly reſolved in another manner. Aſtronomers compute the diurnal heliocentric motions of Venus and of the earth: the difference of theſe motions is the diurnal motion of Venus from the earth, or the quantity by which Venus would be ſeen to recede from the earth every day by a ſpectator placed in the ſun: thus the mean motion of Venus is every day about 59 minutes and 8 ſeconds; the difference is 37 minutes. Say, therefore, As 37 minutes is to 36°, or to 21,600 minutes, ſo is one day to the time wherein Venus, having left the earth, recedes from her 360 degrees; that is, to the time wherein ſhe returns to the earth again, or the time between two conjunctions of the ſame kind.

332
To find the true times of the conjunctions, oppoſitions, &c. of the planets.

The times are here computed according to the mean or equable motions of the planets; and this is therefore called a mean conjunction: but becauſe Venus and the earth are really carried in elliptic orbits, in which their motions are ſometimes ſwifter and ſometimes ſlower, the true conjunctions may happen ſome days either ſooner or later than what theſe rules will give. The time of the true conjunction is to be computed from that of the mean conjunction in the following manner. Find by aſtronomical tables the places of Venus and the earth in the ecliptic, from which we ſhall have the diſtance of the two as ſeen from the ſun; compute alſo for the ſame time the triangular motions of theſe two planets for any given time, ſuppoſe ſix hours; the difference of theſe two motions will give the acceſs of Venus to the earth, or her receſs from it in ſix hours: then ſay, as this difference is to the arc between the places of Venus and the earth at the time of a mean conjunction, ſo is ſix hours to the time between the mean conjunction and the true. This time added to or ſubtracted from the time of the mean conjunction, according as Venus is in antecedence or conſequence from the earth, ſhows the time of their true conjunction.

With regard to the conjunctions, oppoſitions, direct and retrograde motions, &c. of the ſuperior planets, as they depend on the combinations of their motions with that of the earth, they will be more frequent in Saturn than in Jupiter, in Jupiter than in Mars, but moſt frequent of all in the Georgium Sidus; becauſe the ſlower the motion of the planet is, the ſooner the earth will overtake it, ſo as to have it again in any given ſituation. Thus, ſuppoſe Saturn to be in conjunction with the ſun in ♈, if he were to ſtand ſtill for one year, then he would again be in conjunction in ♈; but as he goes on ſlowly, according to the order of the ſigns, about 12° annually, the earth muſt go through almoſt 13° more than an entire revolution; ſo that there will be almoſt a year and 13 days between any conjunction between the Sun and Saturn and the conjunction immediately following. As Jupiter moves in his orbit with greater velocity than Saturn, the earth muſt have a proportionably larger ſpace added to the year; and as Mars moves ſwifter ſtill, the time betwixt any two of his conjunctions muſt be ſtill longer.

The time when a ſuperior planet will return into any given ſituation may be found by the methods al-

Particular Explication of the Celeſtial Phenomena.

ready laid down for the inferior planets. Thus, the mean diurnal motion of the earth is about 59′ 8″; the mean motion of Saturn in a day is only two minutes; the difference 57′ 8″. Say therefore, As 57′ 8″ are to 360°, or 21,600 minutes, ſo is one day to the ſpace of time wherein the earth having left Saturn recedes from him 360°; that is, to the time of her return to Saturn again, or the time between two conjunctions, oppoſitions, or other like aſpects. This time will be found 378 days, or one year and 13 days. The mean motion of Jupiter in a day is 4′ 59″; the difference between this and the earth's diurnal motion is 54′ 59″. Say then, As 54′ 59″ are to 360° or 21,600′, ſo is one day to the ſpace of time when the earth, having left Jupiter, will overtake him again; which will be found to be 398 days, or one year and 33 days. The mean motion of Mars is 31′ 27″; the difference between which and the earth's diurnal motion is 27′ 41″. Say then, As 27′ 41″ are to 360° or 21,600′, ſo is one day to the ſpace of time wherein the earth, having left Mars, recedes from him 360°; which will be found two years and 50 days. The true conjunctions, &c. may be found in the ſuperior planets as in the inferior.

333
Diſtance, &c. of the earth.

The earth is the next planet above Venus in the ſyſtem. It is 95,173,000 miles from the ſun; and goes round him in 365 days 5 hours 49 minutes, from any equinox or ſolſtice to the ſame again; but from any fixed ſtar to the ſame again, as ſeen from the ſun, in 365 days 6 hours 9 minutes; the former being the length of the tropical year, and the latter the length of the ſidereal. It travels at the rate of 68,000 miles every hour; which motion, though upwards of 140 times ſwifter than that of a cannon ball, is little more than half as ſwift as Mecury's motion in his orbit. The earth's diameter is 7970 miles; and by turning round its axis every 24 hours from weſt to eaſt, it cauſes an apparent diurnal motion of all the heavenly bodies from eaſt to weſt. By this rapid motion of the earth on its axis, the inhabitants about the equator are carried 1042 miles every hour, whilſt thoſe on the parallel of London are carried only about 580, beſides the 68,000 miles by the annual motion abovementioned, which is common to all places whatever.

That the earth is of a globular figure may be proved from ſeveral different and evident circumſtances. 1. When we are at ſea on board a ſhip, we may be out of ſight of land when the land is near enough to be viſible if it were not hid from our eye by the convexity of the water. Thus, let ABCD (fig. 154.) repreſent a portion of the globe of our earth. Let M be the top of a mountain; this cannot be ſeen by a perſon on board the ſhip at B, becauſe a line drawn from M to his eye at E is intercepted by the convexity of the water, but let the ſhip come to C, then the mountain will be viſible, becauſe a line may be drawn from M to his eye at E. 2. The higher the eye, the further will the view be extended. It is very common for ſailors from the top of the maſt of a ſhip to diſcover land or ſhips at a much greater diſtance than they can do when they ſtand upon deck. 3. When we ſtand on ſhore, the higheſt part of a ſhip is viſible at the greateſt diſtance. If a ſhip is going from us out to ſea, we ſhall continue to ſee the maſt after the hull or body of the ſhip diſappears, and the top of the maſt will continue to be ſeen the longeſt. If a ſhip is coming towards us, the top of the maſt comes firſt in view, and we ſee more and more till at laſt the hull appears. If the ſurface of the ſea were a flat plain (fig. 155.), a line might be drawn from any object ſituated upon it, as the ſhip D, to the eye, whether placed high or low, at A or B. In this caſe, any object upon the earth or ſea, would be viſible at any diſtance which was not ſo great as to make the appearance of it too faint, or the angle under which it appears too ſmall, to be ſeen by us. An object would be viſible at the ſame diſtance, whether the eye were high or low. Not the higheſt, but the largeſt, objects would be viſible to the greateſt diſtance, ſo that we ſhould be able to ſee the hulk of a ſhip further off than the maſt: All which is contrary to experience. 4. Several navigators, ſuch as Ferdinand Magellan, Sir Francis Drake, Captain Cook, have ſailed round the globe; not in an exact circle, the land preventing them, but by going in and out as the ſhores happened to lie. 5. All the appearances in the heavens are the ſame, whether at land or ſea. 6. Eclipſes of the moon ariſe from the ſhadow of the earth, and this ſhadow is always circular. Although the earth preſents, during ſeveral hours, different portions of its ſurface to the moon, yet ſtill the ſhadow is round. The ſmall inequalities upon the ſurface of the earth bear no kind of proportion to its magnitude ſufficient to alter the appearance of its ſhadow.

Particular Explication of the Celeſtial Phenomena.

The earth's axis makes an angle of 23½ degrees with the axis of its orbit, and keeps always the ſame oblique direction, inclining nearly to the ſame fixed ſtars (A) throughout its annual courſe, which cauſes the returns of ſpring, ſummer, autumn, and winter.

334
Demonſtration of the earth's motion.

That the ſun, and not the earth, is the centre of our ſolar ſyſtem, may be demonſtrated beyond a poſſibility of doubt, from conſidering the forces of gravitation and projection, by which all the celeſtial bodies are retained in their orbits. For, if the ſun moves about the earth, the earth's attractive power muſt draw the ſun towards it from the line of projection ſo as to bend its motion into a curve: But the ſun being at leaſt 227,000 times as heavy as the earth, by being ſo much weightier as its quantity of matter is greater, it muſt move 227,000 times as ſlowly towards the earth as the earth does towards the ſun; and conſequently the earth would fall to the ſun in a ſhort time, if it had not a very ſtrong projectile motion to carry it off. The earth, therefore, as well as every other planet in the ſyſtem, muſt have a rectilineal impulſe, to prevent its falling into the ſun. To ſay, that gravitation retains

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(A) This is not ſtrictly true, as will appear when we come to treat of the receſſion of the equinoctial points in the heavens, which receſſion is equal to the deviation of the earth's axis from its paralleliſm: but this is rather too ſmall to be ſenſible in an age, except to thoſe who make very nice obſervations.

tains all the other planets in their orbits without affecting the earth, which is placed between the orbits of Mars and Venus, is as abſurd as to ſuppoſe that ſix cannon-bullets might be projected upwards to different heights in the air, and that five of them ſhould fall down to the ground; but the ſixth, which is neither the higheſt nor the loweſt, ſhould remain ſuſpended in the air without falling, and the earth move round about it.

There is no ſuch thing in nature as a heavy body moving round a light one as its center of motion. A pebble faſtened to a mill-ſtone by a ſtring, may by an eaſy impulſe be made to circulate round the mill-ſtone: but no impulſe can make a mill-ſtone circulate round a looſe pebble; for the mill-ſtone would go off, and carry the pebble along with it.

The ſun is ſo immenſely bigger and heavier than the earth, that, if he was moved out of his place, not only the earth, but all the other planets, if they were united into one maſs, would be carried along with the ſun as the pebble would be with the mill-ſtone.

335
From the proportional decreaſe of gravity, &c.

By conſidering the law of gravitation, which takes place throughout the ſolar ſyſtem, in another light, it will be evident that the earth moves round the ſun in a year, and not the ſun round the earth. It has been obſerved, that the power of gravity decreaſes as the ſquare of the diſtance increaſes; and from this it follows with mathematical certainty, that when two or more bodies move round another as their centre of motion, the ſquares of their periodic times would be to one another in the ſame proportion as the cubes of their diſtances from the central body. This holds preciſely with regard to the planets round the ſun, and the ſatellites round the planets; the relative diſtances of all which are well known. But, if we ſuppoſe the ſun to move round the earth, and compare its period with the moon's by the above rule, it will be found that the ſun would take no leſs than 173,510 days to move round the earth; in which caſe our year would be 475 times as long as it now is. To this we may add, that the aſpects of increaſe and decreaſe of the planets, the times of their ſeeming to ſtand ſtill, and to move direct and retrograde, anſwer preciſely to the earth's motion, but not at all to the ſun's, without introducing the moſt abſurd and monſtrous ſuppoſitions, which would deſtroy all harmony, order, and ſimplicity, in the ſyſtem. Moreover, if the earth be ſuppoſed to ſtand ſtill, and the ſtars to revolve in free ſpaces about the earth in 24 hours, it is certain that the forces by which the ſtars revolve in their orbits are not directed to the earth, but to the centres of the ſeveral orbits, that is, of the ſeveral parallel circles which the ſtars on different ſides of the equator deſcribe every day: and the like inferences may be drawn from the ſuppoſed diurnal motion of the planets, ſince they are never in the equinoctial but twice, in their courſes with regard to the ſtarry heavens. But, that forces ſhould be directed to no central body, on which they phyſically depend, but to innumerable imaginary points in the axis of the earth produced to the poles of the heavens, is an hypotheſis too abſurd to be allowed of by any rational creature. And it is ſtill more abſurd to imagine, that theſe forces ſhould increaſe exactly in proportion to the diſtances from this axis; for this is an indication of an increaſe to infinity; whereas the force of attraction is found to decreaſe in receding from the fountain from whence it flows. But the farther any ſtar is from the quieſcent pole, the greater muſt be the orbit which it deſcribes; and yet it appears to go round in the ſame time as the neareſt ſtar to the pole does. And if we take into conſideration the twofold motion obſerved in the ſtars, one diurnal round the axis of the earth in 24 hours, and the other round the axis of the ecliptic in 25,920 years, it would require an explication of ſuch a perplexed compoſition of forces, as could by no means be reconciled with any phyſical theory.

336
Objection againſt the earth's motion anſwered.

The ſtrongeſt objection that can be made againſt the earth's motion round the ſun is, that in oppoſite points of the earth's orbit, its axis, which always keeps a parallel direction, would point to different fixed ſtars; which is not found to be fact. But this objection is eaſily removed, by conſidering the immenſe diſtance of the ſtars in reſpect of the diameter of the earth's orbit; the latter being no more than a point when compared to the former. If we lay a ruler on the ſide of a table, and along the edge of the ruler view the top of a ſpire at ten miles diſtance; then lay the ruler on the oppoſite ſide of the table, in a parallel ſituation to what it had before, and the ſpire will ſtill appear along the edge of the rule; becauſe our eyes, even when aſſiſted by the beſt inſtruments, are incapable of diſtinguiſhing ſo ſmall a change at ſo great a diſtance.

337
Earth's motion demonſtrated from the aberration of light.

Dr Bradley, our late aſtronomer-royal, found by a long ſeries of the moſt accurate obſervations, that there is a ſmall apparent motion of the fixed ſtars, occaſioned by the aberration of their light; and ſo exactly anſwering to an annual motion of the earth, as evinces the ſame, even to a mathematical demonſtration. He conſidered this matter in the following manner: he imagined CA, fig. 33. to be a ray of light falling perpendicularly upon the line BD; that if the eye is at reſt at A, the object muſt appear in the direction AC, whether light be propagated in time or in an inſtant. But if the eye is moving from B towards A, and light is propagated in time, with a velocity that is to the velocity of the eye, as CA to BA; then light moving from C to A, whilſt the eye moves from B to A, that particle of it by which the object will be diſcerned when the eye comes to A, is at C when the eye is at B. Joining the points BC, he ſuppoſed the line CB to be a tube, inclined to the line BD in the angle DBC, of ſuch diameter as to admit but one particle of light. Then it was eaſy to conceive, that the particle of light at C, by which the object muſt be ſeen, when the eye, as it moves along, arrives at A, would paſs through the tube BC, if it is inclined to BD in the the angle BDC, and accompanies the eye in its motion from B to A; and that it could not come to the eye placed behind ſuch a tube, if it had any other inclination to the line BD. If, inſtead of ſuppoſing CB ſo ſmall a tube, we imagine it to be the axis of a larger; then, for the ſame reaſon, the particle of light at C would not paſs through the axis, unleſs it is inclined to BD in the angle CBD. In like manner, if the eye moved the contrary way, from D towards A, with the ſame velocity, then the tube muſt be inclined in the angle BCD. Although, therefore, the true or real place of an object is perpendicular to the line in which the eye is moving, yet the viſible place will not be ſo; ſince that, no doubt, muſt be in the direction of the tube; but the difference between the true and apparent place will be *cæteris paribus*, greater or leſs, according to the different proportion between the velocity of light and that of the eye. So that, if we could ſuppoſe that light was propagated in an inſtant, then there would be no difference between the real and viſible place of an object, although the eye was in motion: for in that caſe, AC being infinite with reſpect to AB, the angle ACB, the difference between the true and viſible place, vaniſhes. But if light be propagated in time, it is evident, from the foregoing conſiderations, that there will be always a difference between the real and viſible place of an object, unleſs the eye is moving either directly towards or from the object. And in all caſes the ſine of the difference between the real and viſible place of the object will be to the ſine of the viſible inclination of the object to the line in which the eye is moving, as the velocity of eye is to the velocity of light.

He then ſhows, that if the earth revolve round the ſun annually, and the velocity of light be to the velocity of the earth's motion in its orbit, as 1000 to 1, that a ſtar really placed in the very pole of the ecliptic would, to an eye carried along with the earth, ſeem to change its place continually; and, neglecting the ſmall difference on the account of the earth's diurnal revolution on its axis, would ſeem to deſcribe a circle round that pole every way diſtant from it $3\frac{1}{2}$; ſo that its longitude would be varied through all the points of the ecliptic every year, but its latitude would always remain the ſame. Its right aſcenſion would alſo change, and its declination, according to the different ſituation of the ſun with reſpect to the equinoctial points, and its apparent diſtance from the north pole of the equator, would be 7′ leſs at the autumnal than at the vernal equinox.

338 Velocity of light.

By calculating exactly the quantity of abberration of the fixed ſtars from their place, he found that light came from the ſun to us in 8′ 13″; ſo that its velocity is to the velocity of the earth in its orbit as 10,201 to 1.

339 Errors in the obſervation of ſmall angles.

It muſt here be taken notice of, however, that Mr Nevil Maſkelyne, in attempting to find the parallax of Sirius, with a ten-feet ſector, obſerved that by the friction of the plummet line on the pin which ſuſpended it, and error of 10″, 20″, and ſometimes 30″, was committed. The pin was $\frac{1}{50}$ of an inch diameter; and though he reduced it to $\frac{1}{70}$ of an inch, the error ſtill amounted to 3″. All obſervations, therefore, that have hitherto been made in order to diſcover the parallax of the fixed ſtars, are to be diſregarded.

340 Another objection againſt the earth's motion anſwered.

It is alſo objected, that the ſun ſeems to change his place daily, ſo as to make a tour round the ſtary heavens in a year. But whether the ſun or earth moves, this appearance will be the ſame, for when the earth is in any part of the heavens, the ſun will appear in the oppoſite. And therefore, this appearance can be no objection againſt the motion of the earth.

It is well known to every perſon who has ſailed on ſmooth water, or been carried by a ſtream in a calm, that, however faſt the veſſel goes, he does not feel its progreſſive motion. The motion of the earth is incomparably more ſmooth and uniform than that of a ſhip, or any machine made and moved by human art; and therefore it is not to be imagined that we can feel its motion.

We find that the ſun, and thoſe planets on which there are viſible ſpots, turn round their axis: for the ſpots move regularly over their diſks (B.) From hence we may reaſonably conclude, that the other planets on which we ſee no ſpots, and the earth, which is likewiſe a planet, have ſuch rotations. But being incapable of leaving the earth, and viewing it at a diſtance, and its rotation being ſmooth and uniform, we can neither ſee it move on its axis as we do the planets, nor feel ourſelves affected by its motion. Yet there is one effect of ſuch a motion, which will enable us to judge with certainty whether the earth revolves on its axis or not. All globes which do not turn round their axis will be perfect ſpheres, on account of the equality of the weight of bodies on their ſurfaces; eſpecially of the fluid parts. But all globes which turn on their axes will be oblate ſpheroids; that is, their ſurfaces will be higher or farther from the centre in the equatorial than in the polar regions: for as the equatorial parts move quickeſt, they will recede fartheſt from the axis of motion, and enlarge the equatorial diameter. That our earth is really of this figure, is demonſtrable from the unequal vibrations of a pendulum, and the unequal lengths of degrees in different latitudes. Since then the earth is higher at the equator than at the poles, the ſea, which naturally runs downward, or toward the places which are neareſt the centre, would run towards the polar regions, and leave the equatorial parts dry, if the centrifugal force of theſe parts, by which the waters were carried thither, did not keep them from returning. The earth's equatorial diameter is 36 miles longer than its axis.

341 Argument for the earth's motion from its ſpheroidal figure.

342 Weight of bodies increaſes towards the poles.

Bodies near the poles are heavier than thoſe towards the equator, becauſe they are nearer the earth's centre, where the whole force of the earth's attraction is accumulated. They are alſo heavier, becauſe their centrifugal force is leſs, on account of their diurnal motion being ſlower. For both theſe reaſons, bodies carried from the poles toward the equator gradually loſe their weight. Experiments prove, that a pendulum which vibrates ſeconds near the poles vibrates ſlower near the equator, which ſhows that it is lighter or leſs attracted there. To make it oſcillate in the ſame time, it is found neceſſary to diminiſh its length. By comparing the different lengths of pendulums ſwinging ſeconds at the equator and at London, it is found that a pendulum muſt be $2\frac{169}{1000}$ lines ſhorter at the equator than at the poles. A line is a twelfth part of an inch.

If the earth turned round its axis in 84 minutes 43 ſeconds, the centrifugal force would be equal to the power of gravity at the equator: and all bodies there would entirely loſe their weight. If the earth revolved quicker, they would all fly off and leave it.

A perſon on the earth can no more be ſenſible of its undiſturbed motion on its axis, than one in the cabbin of

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(B.) This, however, muſt be underſtood with ſome degree of limitation, as will evidently appear from what has been already ſaid concerning the variable motion both of the ſpots of the ſun and planets.

ASTRONOMY

Plate LXXVII

Fig 162

Irregularities of the Moons Motion.

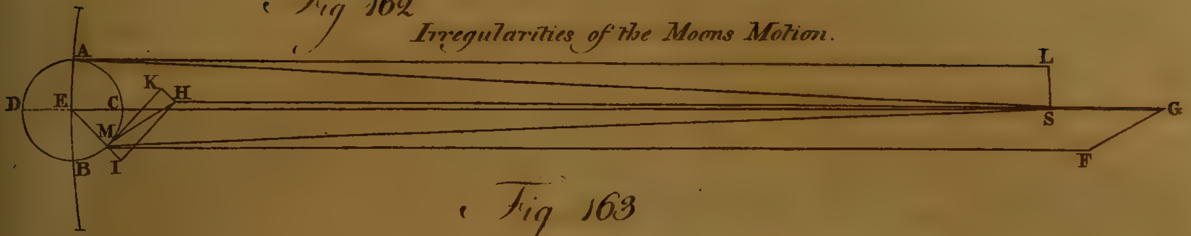


Fig 163

Irregularities of the Moons Motion.

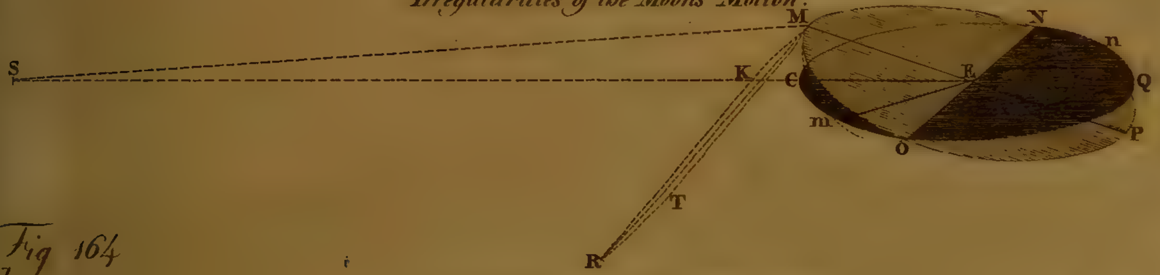
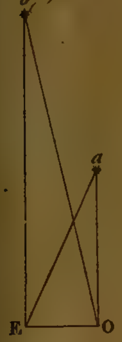


Fig 164



AZIMUTH Compaſs

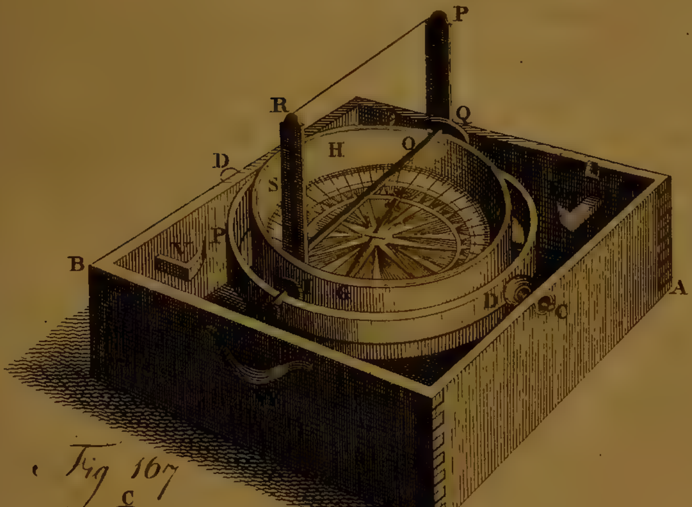


Fig 165

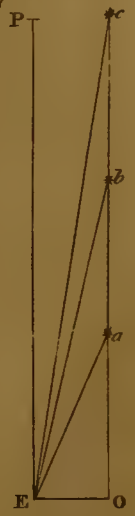


Fig 166

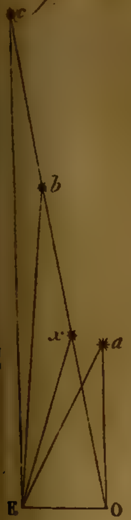


Fig 167

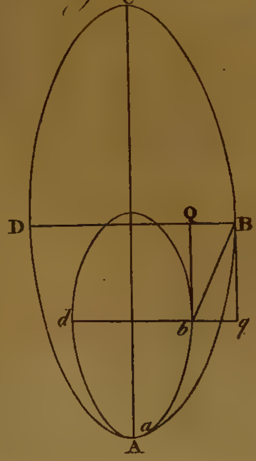


Fig 168

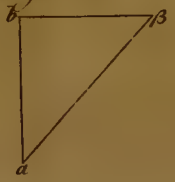
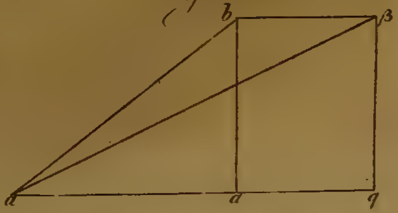


Fig 169



Thackara & Vallance Sculp.

of a ſhip on ſmooth water can be ſenſible of the ſhip's motion when it turns gently and uniformly round. It is therefore no argument againſt the earth's diurnal motion, that we do not feel it: nor is the apparent revolutions of the celeſtial bodies every day a proof of the reality of theſe motions; for whether we or they revolve, the appearance is the very ſame. A perſon looking through the cabin-windows of a ſhip, as ſtrongly fancies the objects on land to go round when the ſhip turns as if they were actually in motion.

343 Earth's motion proved from the celeſtial appearances from different planets.

If we could tranſlate ourſelves from planet to planet, we ſhould ſtill find that the ſtars would appear of the ſame magnitudes, and at the ſame diſtances from each other, as they do to us here; becauſe the width of the remoteſt planet's orbit bears no ſenſible proportion to the diſtance of the ſtars. But then the heavens would ſeem to revolve about very different axes; and conſequently, thoſe quieſcent points, which are our poles in the heavens, would ſeem to revolve about other points, which, though apparently in motion as ſeen from the earth, would be at reſt as ſeen from any other planet. Thus the axis of Venus, which lies at right angles to the axis of the earth, would have its motionleſs poles in two oppoſite points of the heavens lying almoſt in our equinoctial, where the motion appears quickeſt, becauſe it is ſeemingly performed in the greateſt circle: and the very poles, which are at reſt to us, have the quickeſt motion of all as ſeen from Venus. To Mars and Jupiter the heavens appear to turn round with very different velocities on the ſame axis, whoſe poles are about 23½ degrees from ours. Were we on Jupiter, we ſhould be at firſt amazed at the rapid motion of the heavens; the ſun and ſtars going round in 9 hours 56 minutes. Could we go from thence to Venus, we ſhould be as much ſurpriſed at the ſlowneſs of the heavenly motions; the ſun going but once round in 584 hours, and the ſtars in 540. And could we go from Venus to the moon, we ſhould ſee the heavens turn round with a yet ſlower motion; the ſun in 708 hours, the ſtars in 655. As it is impoſſible theſe various circumvolutions in ſuch different times, and on ſuch different axes, can be real, ſo it is unreaſonable to ſuppoſe the heavens to revolve about our earth more than it does about any other planet. When we reflect on the vaſt diſtance of the fixed ſtars, to which 190,000,000 of miles, the diameter of the earth's orbit, is but a point, we are filled with amazement at the immenſity of their diſtance. But if we try to frame an idea of the extreme rapidity with which the ſtars muſt move, if they move round the earth in 24 hours, the thought becomes ſo much too big for our imagination, that we can no more conceive it than we do infinity or eternity. If the ſun was to go round the earth in 24 hours, he muſt travel upwards of 300,000 miles in a minute: but the ſtars being at leaſt 400,000 times as far from the ſun as the ſun is from us, thoſe about the equator muſt move 400,000 times as quick. And all this to ſerve no other purpoſe than what can be as fully and much more ſimply obtained by the earth's turning round eaſtward, as on an axis, every 24 hours, cauſing thereby an apparent diurnal motion of the ſun weſtward, and bringing about the alternate returns of day and night.

344 Another objection anſwered.

As to the common objections againſt the earth's motion on its axis, they are all eaſily anſwered and ſet aſide. That it may turn without being ſeen or felt by us to do ſo, has been already ſhown. But ſome are apt to imagine, that if the earth turns eaſtward (as it certainly does if it turns at all), a ball fired perpendicularly upward in the air muſt fall conſiderably weſtward of the place it was projected from. The objection, which at firſt ſeems to have ſome weight, will be found to have none at all, when we conſider that the gun and ball partake of the earth's motion; and therefore the ball being carried forward with the air as quick as the earth and air turn, muſt fall down on the ſame place. A ſtone let fall from the top of a mainmaſt, if it meets with no obſtacle, falls on the deck as near the foot of the maſt when the ſhip ſails as when it does not. If an inverted bottle full of liquor be hung up to the ceiling of the cabin, and a ſmall hole be made in the cork to let the liquor drop through on the floor, the drops will fall juſt as far forward on the floor when the ſhip ſails as when it is at reſt. And gnats or flies can as eaſily dance among one another in a moving cabin as in a fixed chamber. As for thoſe ſcripture expreſſions which ſeem to contradict the earth's motion, this general anſwer may be made to them all, viz. It is plain from many inſtances, that the ſcriptures were never intended to inſtruct us in philoſophy or aſtronomy; and therefore on thoſe ſubjects expreſſions are not always to be be taken in the literal ſenſe, but for the moſt part as accommodated to the common apprehenſions of mankind. Men of ſenſe in all ages, when not treating of the ſciences purpoſely, have followed this method: and it would be in vain to follow any other in addreſſing ourſelves to the vulgar, or bulk of any community.

345 Diurnal motion of the earth, and different changes of the ſeaſons, illuſtrated by experiment

The following experiment will give a plain idea of the diurnal or annual motions of the earth, together with the different lengths of days and nights, and all the beautiful variety of ſeaſons, depending on thoſe motions.

Fig. 172.

Take about ſeven feet of ſtrong wire, and bend it into a circular form, as a b *c* d, which being viewed obliquely, appears elliptical, as in the figure. Place a lighted candle on a table; and having fixed one end of a ſilk thread K to the north pole of a ſmall terreſtrial globe H, about three inches diameter, cauſe another perſon to hold the wire circle, ſo that it may be parallel to the table, and as high as the flame of the candle I, which ſhould be in or near the centre. Then having twiſted the thread as towards the left hand, that by untwiſting it may turn the globe round eaſtward, or contrary to the way that the hands of a watch move, hang the globe by the thread within this circle, almoſt contiguous to it; and as the thread untwiſts, the globe (which is enlightened half round by the candle as the earth is by the ſun) will turn round its axis, and the different places upon it will be carried through the light and dark hemiſpheres, and have the appearance of a regular ſucceſſion of days and nights, as our earth has in reality by ſuch a motion. As the globe turns, move your hand ſlowly, ſo as to carry the globe round the candle according to the order of the letters a b *c* d, keeping its centre even with the wire circle; and you will perceive, that the candle, being ſtill perpendicular to the equator, will enlighten the globe from pole to pole in its whole motion round the circle; and that every place on the globe goes equally through the light and the dark, as it turns round by the untwiſting of the thread, and therefore has a perpetual equinox. The globe thus turning round repreſents the earth turning round its axis; and the motion of the globe round the candle repreſents the earth's annual motion round the ſun; and ſhows, that if the earth's orbit had no inclination to its axis, all the days and nights of the year would be equally long, and there would be no different ſeaſons. Hence alſo it appears why the planets Mars and Jupiter have a perpetual equinox, namely, becauſe their axes are perpendicular to the planes of their orbits, as the thread round which the globe turns in this experiment is perpendicular to the plane of the area incloſed by the wire.—But now deſire the perſon who holds the wire to hold it obliquely in the poſition ABCD, raiſing the ſide ♋ juſt as much as he depreſſes the ſide ♑, that the flame may be ſtill in the plane of the circle; and twiſting the thread as before, that the globe may turn round its axis the ſame way as you carry it round the candle; that is, from weſt to eaſt; let the globe down into the lowermoſt part of the wire circle at ♑: and if the circle be properly inclined, the candle will ſhine perpendicularly on the tropic of Cancer; and the frigid zone, lying within the arctic or north polar circle, will be all in the light, as in the figure: and will keep in the light let the globe turn round its axis ever ſo often. From the equator to the north polar circle, all the places have longer days and ſhorter nights; but from the equator to the ſouth polar circle, juſt the reverſe. The ſun does not ſet to any part of the north frigid zone, as ſhown by the candle's ſhining on it, ſo that the motion of the globe can carry no place of that zone into the dark; and at the ſame time the ſouth frigid zone is involved in darkneſs, and the turning of the globe brings none of its places into the light. If the earth were to continue in the like part of its orbit, the ſun would never ſet to the inhabitants of the north frigid zone, nor riſe to thoſe of the ſouth. At the equator, it would be always equal day and night; and as places are gradually more and more diſtant from the equator towards the arctic circle, they would have longer days and ſhorter nights; whilſt thoſe on the ſouth ſide of the equator would have their nights longer than their days. In this caſe, there would be continual ſummer on the north ſide of the equator, and continual winter on the ſouth ſide of it.

But as the globe turns round its axis, move your hand ſlowly forward, ſo as to carry the globe from H towards E, and the boundary of light and darkneſs will approach towards the north pole, and recede towards the ſouth pole; the northern places will go through leſs and leſs of the light, and the ſouthern places through more and more of it; ſhowing how the northern days decreaſe in length and the ſouthern days increaſe, whilſt the globe proceeds from H to E. When the globe is at E, it is at a mean ſtate between the loweſt and higheſt parts of its orbit; the candle is directly over the equator, the boundary of light and darkneſs juſt reaches to both the poles, and all places on the globe go equally through the light and dark hemiſpheres, ſhowing that the days and nights are then equal to all places of the earth, the poles only excepted; for the ſun is then ſetting to the north pole and riſing to the ſouth pole.

Continue moving the globe forward, and as it goes through the quarter A, the north pole recedes ſtill farther into the dark hemiſphere, and the ſouth pole advances more into the light, as the globe comes nearer to ♋: and when it comes there at F, the candle is directly over the tropic of Capricorn; the days are at the ſhorteſt and nights at the longeſt, in the northern hemiſphere, all the way from the equator to the arctic circle; and the reverſe in the ſouthern hemiſphere from the equator to the antarctic circle; within which circles it is dark to the north frigid zone and light to the ſouth.

Continue both motions; and as the globe moves through the quarter B, the north pole advances towards the light, and the ſouth pole recedes towards the dark; the days lengthen in the northern hemiſphere and ſhorten in the ſouthern; and when the globe comes to G, the candle will be again over the equator (as when the globe was at E), and the days and nights will again be equal as formerly; and the north pole will be juſt coming into the light, the ſouth pole going out of it.

Thus we ſee the reaſon why the days lengthen and ſhorten from the equator to the polar circles every year; why there is ſometimes no day or night for many turnings of the earth, within the polar circles; why there is but one day and one night in the whole year at the poles; and why the days and nights are equally long all the year round at the equator, which is always equally cut by the circle bounding light and darkneſs.

The inclination of an axis or orbit is merely relative, becauſe we compare it with ſome other axis or orbit which we conſider as not inclined at all. Thus, our horizon being level to us, whatever place of the earth we are upon, we conſider it as having no inclination; and yet, if we travel 90 degrees from that place, we ſhall then have an horizon perpendicular to the former; but it will ſtill be level to us.

346 Different ſeaſons particularly explained.

Let us now take a view of the earth in its annual courſe round the ſun, conſidering its orbit as having no inclination; and its axis as inclining 23½ degrees from a line perpendicular to the plane of its orbit, and keeping the ſame oblique direction in all parts of its annual courſe; or, as commonly termed, keeping always parallel to itſelf.

Fig. 174.

Let *a, b, c, d, e, f, g, h,* be the earth in eight different parts of its orbit, equidiſtant from one another; N*s* its axis, N its north pole, *s* its ſouth pole, and S the ſun nearly in the centre of the earth's orbit. As the earth goes round the ſun according to the order of the letters *abcd*, &c. its axis N*s* keeps the ſame obliquity, and is ſtill parallel to the line MN*s*. When the earth is at *a*, its north pole inclines towards the ſun S, and brings all the northern places more into the light than at any other time of the year. But when the earth is at *e* in the oppoſite time of the year, the north pole declines from the ſun, which occaſions the northern places to be more in the dark than in the light, and the reverſe at the ſouthern places; as is evident by the figure which is taken from Dr Long's aſtronomy. When the earth is either at *c* or *g*, its axis inclines not either to or from the ſun, but lies ſidewiſe to him, and then the poles are in the boundary of light and darkneſs; and the ſun, being directly over the equator, makes equal day and night at all places. When

Particular Explication of the Celeſtial Phenomena.

When the earth is at *b*, it is half-way between the ſummer ſolſtice and harveſt equinox; when it is at *d*, it is half-way from the harveſt equinox to the winter ſolſtice; at *f*, half-way from the winter ſolſtice to the ſpring equinox; and at *h*, half-way from the ſpring equinox to the ſummer ſolſtice.

Fig. 177.

From this oblique view of the earth's orbit, let us ſuppoſe ourſelves to be raiſed far above it, and placed juſt over its centre S, looking down upon it from its north pole; and as the earth's orbit differs but very little from a circle, we ſhall have its figure in ſuch a view repreſented by the circle ABCDEFG. Let us ſuppoſe this circle to be divided into 12 equal parts, called *ſigns*, having their names affixed to them; and each ſign into 30 equal parts, called *degrees*, numbered 10, 20, 30, as in the outermoſt circle of the figure, which repreſents the great ecliptic in the heavens. The earth is ſhown in eight different poſitions in this circle; and in each poſition Æ is the equator, T the tropic of Cancer, the dotted circle the parallel of London, U the arctic or north polar circle, and P the north pole, where all the meridians or hour-circles meet. As the earth goes round the ſun, the north pole keeps conſtantly towards one part of the heavens, as it keeps in the figure towards the right-hand ſide of the plate.

When the earth is at the beginning of Libra, namely on the 20th of March, in this figure the ſun S as ſeen from the earth, appears at the beginning of Aries in the oppoſite part of the heavens, the north pole is juſt coming into the light, and the ſun is vertical to the equator; which, together with the tropic of Cancer, parallel of London, and arctic circle, are all equally cut by the circle bounding light and darkneſs, coinciding with the ſix-o'clock hour-circle, and therefore the days and nights are equally long at all places: for every part of the meridian ÆTL*a* comes into the light at ſix in the morning, and, revolving with the earth according to the order of the hour-letters, goes into the dark at ſix in the evening. There are 24 meridians or hour-circles drawn on the earth in this figure, to ſhow the time of ſun-riſing and ſetting at different ſeaſons of the year.

As the earth moves in the ecliptic according to the order of the letters ABCD, &c. through the ſigns Libra, Scorpio, and Sagittarius, the north pole P comes more and more into the light; the days increaſe as the nights decreaſe in length, at all places north of the equator Æ; which is plain by viewing the earth at *b* on the 5th of May, when it is in the 15th degree of Scorpio, and the ſun as ſeen from the earth appears in the 15th degree of Taurus. For then the tropic of Cancer T is in the light from a little after five in the morning till almoſt ſeven in the evening; the parallel of London, from half an hour paſt four till half an hour paſt ſeven; the polar circle U, from three till nine; and a large track round the north pole P has day all the 24 hours, for many rotations of the earth on its axis.

When the earth comes to *c* (fig. 174.) at the beginning of Capricorn, and the ſun as ſeen from the earth appears at the beginning of Cancer, on the 21ſt of June, as in this figure, it is in the poſition C in fig. 177; and its north pole inclines towards the ſun, ſo as to bring all the north frigid zone into the light, and the northern parallels of latitude more into the light than the dark from the equator to the polar circle; and the more ſo as they are farther from the equator. The tropic of Cancer is in the light from five in the morning till ſeven at night, the parallel of London from a quarter before four till a quarter after eight; and the polar circle juſt touches the dark, ſo that the ſun has only the lower half of his diſk hid from the inhabitants on that circle for a few minutes about midnight, ſuppoſing no inequalities in the horizon, and no refractions.

Particular Explication of the Celeſtial Phenomena.

A bare view of the figure is enough to ſhow, that as the earth advances from Capricorn towards Aries, and the ſun appears to move from Cancer towards Libra, the north pole recedes from the light, which cauſes the days to decreaſe and the nights to increaſe in length, till the earth comes to the beginning of Aries, and then they are equal as before; for the boundary of light and darkneſs cuts the equator and all its parallels equally, or in halves. The north pole then goes into the dark, and continues therein until the earth goes half-way round its orbit; or, from the 23d of September till the 20th of March. In the middle between theſe times, viz. on the 22d of December, the north pole is as far as it can be in the dark, which is 23½ degrees, equal to the inclination of the earth's axis from a perpendicular to its orbit: and then the northern parallels are as much in the dark as they were in the light on the 21ſt of June; the winter nights being as long as the ſummer days, and the winter days as ſhort as the ſummer nights. Here it muſt be noted, that of all that has been ſaid of the northern hemiſphere, the contrary muſt be underſtood of the ſouthern; for on different ſides of the equator the ſeaſons are contrary, becauſe, when the northern hemiſphere inclines towards the ſun, the ſouthern declines from him.

347
Why the ſun appears bigger in winter than in ſummer.

The earth's orbit being elliptical, and the ſun conſtantly keeping in its lower focus, which is 1,617,941 miles from the middle point of the longer axis, the earth comes twice ſo much, or 3,235,882 miles nearer the ſun at one time of the year than at another; for the ſun appearing under a larger angle in our winter than ſummer, proves that the earth is nearer the ſun in winter. But here this natural queſtion will ariſe, Why have we not the hotteſt weather when the earth is neareſt the ſun? In anſwer it muſt be obſerved, that the eccentricity of the earth's orbit, or 1,617,941 miles, bears no greater proportion to the earth's mean diſtance from the ſun than 17 does to 1000; and therefore this ſmall difference of diſtance cannot occaſion any great difference of heat or cold. But the principal cauſe of this difference is, that in winter the ſun's rays fall ſo obliquely upon us, that any given number of them is ſpread over a much greater portion of the earth's ſurface where we live; and therefore each point muſt then have fewer rays than in ſummer. Moreover, there comes a greater degree of cold in the long winter-nights than there can return of heat in ſo ſhort days; and on both theſe accounts the the cold muſt increaſe. But in ſummer the ſun's rays fall more perpendicularly upon us; and therefore come with greater force, and in greater numbers, on the ſame place; and by their long continuance, a much greater degree of heat it imparted by day than can fly off by night. Beſides, thoſe parts which are once heated, retain the heat for ſome time; which, with the additional heat daily imparted,

Particular Explication of the Celeſtial Phenomena.

makes it continue to increaſe, though the ſun declines towards the ſouth: and this is the reaſon why July is hotter than June, although the ſun has withdrawn from the ſummer tropic; as we find it is generally hotter at three in the afternoon, when the ſun has gone towards the weſt, than at noon when he is on the meridian. Likewiſe thoſe places which are well cooled require time to be heated again; for the ſun's rays do not heat even the ſurface of any body till they have been ſome time upon it. And therefore we find January for the moſt part colder than December, although the ſun has withdrawn from the winter tropic, and begins to dart his beams more perpendicularly upon us. An iron bar is not heated immediately upon being in the fire, nor grows cold till ſome time after it has been taken out.

It has been already obſerved, that by the earth's motion on its axis, there is more matter accumulated all around the equatorial parts than any where elſe on the earth.

The ſun and moon, by attracting this redundancy of matter bring the equator ſooner under them in every return towards it, than if there was no ſuch accumulation. Therefore, if the ſun ſets out, as from any ſtar or other fixed point in the heavens, the moment when he is departing from the equinoctial or from either tropic, he will come to the ſame equinox or tropic again 20 min. 17½ ſec. of time, or 50 ſeconds of a degree, before he completes his courſe, ſo as to arrive at the ſame fixed ſtar or point from whence he ſet out. For the equinoctial points recede 50 ſeconds of a degree weſtward every year, contrary to the ſun's annual progreſſive motion.

When the ſun arrives at the ſame equinoctial or ſolſtitial point, he finiſhes what we call the *Tropical Year*; which, by obſervation, is found to contain 365 days 5 hours 48 minutes 57 ſeconds: and when he arrives at the ſame fixed ſtar again, as ſeen from the earth, he completes the ſidereal year, which contains 365 days 6 hours 9 minutes 14½ ſeconds. The ſidereal year is therefore 20 minutes 17½ ſeconds longer than the ſolar or tropical year, and 9 minutes 14½ ſeconds longer than the Julian or the civil year, which we ſtate at 365 days 6 hours, ſo that the civil year is almoſt a mean between the ſidereal and tropical.

As the ſun deſcribes the whole ecliptic, or 360 degrees, in a tropical year, he moves 50′ 8″ of a degree every day at a mean rate; and conſequently 50″ of a degree in 20 minutes 17½ ſeconds of time: therefore he will arrive at the ſame equinox or ſolſtice when he is 50″ of a degree ſhort of the ſame ſtar or fixed point in the heavens from which he ſet out the year before. So that, with reſpect to the fixed ſtars, the ſun and equinoctial points fall back (as it were) 30 degrees in 2160 years, which will make the ſtars appear to have gone 30 deg. forward with reſpect to the ſigns of the ecliptic in that time: for the ſame ſigns always keep in the ſame points of the ecliptic, without regard to the conſtellations.

348 Preceſſion of the equinoxes explained. Fig. 181.

To explain this by a figure, let the ſun be in conjunction with a fixed ſtar at S, ſuppoſe in the 30th degree of ♉, at any given time. Then, making 2160 revolutions through the ecliptic VWX, at the end of ſo many ſidereal years, he will be found again at S: but at the end of ſo many Julian years, he will be found at M, ſhort of S: and at the end of ſo many tropical years he will be found ſhort of M, in the 30th deg. of Taurus at T, which has receded back from S to T in that time, by the preceſſion of the equinoctial points ♈ Aries and ♎ Libra. The arc ST will be equal to the amount of the preceſſion of the equinox in 2160 years, at the rate of the 50″ of a degree, or 20 minutes 17½ ſeconds of time annually; this, in ſo many years, makes 30 days 10½ hours, which is the difference between 2160 ſidereal and tropical years; and the arc MT will be equal to the ſpace moved through by the ſun in 2160 times 11 min. 8 ſec. or 16 days 13 hours 48 minutes, which is the difference between 2160 Julian and tropical years.

349 Anticipation of the equinoxes explained.

The anticipation of the equinoxes, and conſequently of the ſeaſons, is by no means owing to the preceſſion of the equinoctial and ſolſtitial points in the heavens (which can only affect the apparent motions, places, and declinations, of the fixed ſtars), but to the difference between the civil and ſolar year, which is 11 minutes 3 ſeconds; the civil year containing 365 days 6 hours, and the ſolar year 365 days 5 hours 48 minutes 57 ſeconds.

The above 11 minutes 3 ſeconds, by which the civil or Julian year exceeds the ſolar, amounts to 11 days in 1433 years; and ſo much our ſeaſons have fallen back with reſpect to the days of the months, ſince the time of the Nicene council in A. D. 325; and therefore, in order to bring back all the faſts and feſtivals to the days then ſettled, it was requiſite to ſuppreſs 11 nominal days: and, that the ſame ſeaſons might be kept to the ſame times of the year for the future, to leave out the biſſextile-day in February at the end of every century of years not diviſible by 4; reckoning them only common years, as the 17th, 18th, and 19th centuries, viz. the years 1700, 1800, 1900, &c. becauſe a day intercalated every fourth year was too much; and retaining the biſſextile-day at the end of thoſe centuries of years which are diviſible by 4, as the 16th, 20th, and 24th centuries, viz. the years 1600, 2000, 2400, &c. otherwiſe, in length of time, the ſeaſons ſhould be quite reverſed with regard to the months of the year; though it would have required near 23,783 years to have brought about ſuch a total change. If the earth had made exactly 365¼ diurnal rotations on its axis, whilſt it revolved from any equinoctial or ſolſtitial point to the ſame again, the civil and ſolar years would always have kept pace together, and the ſtyle would never have needed any alteration.

Having thus mentioned the cauſe of the preceſſion of the equinoctial points in the heavens, which occaſions a ſlow deviation of the earth's axis from its parallelism, and thereby a change of the declination of the ſtars from the equator, together with a ſlow apparent motion of the ſtars forward with reſpect to the ſigns of the ecliptic, we ſhall now explain the phenomena by a diagram.

Fig. 182.

Let NZSVL be the earth, SONA its axis produced to the ſtary heavens, and terminating in A, the preſent north pole of the heavens, which is vertical to N the north pole of the earth. Let EOQ be the equator, T♋Z the tropic of Cancer, and VT ♑ the tropic of Capicorn; VOZ the ecliptic, and BO its axis, both which are immoveable among the ſtars. But as the equinoctial points recede in the ecliptic, the earth's

Fig. 170.

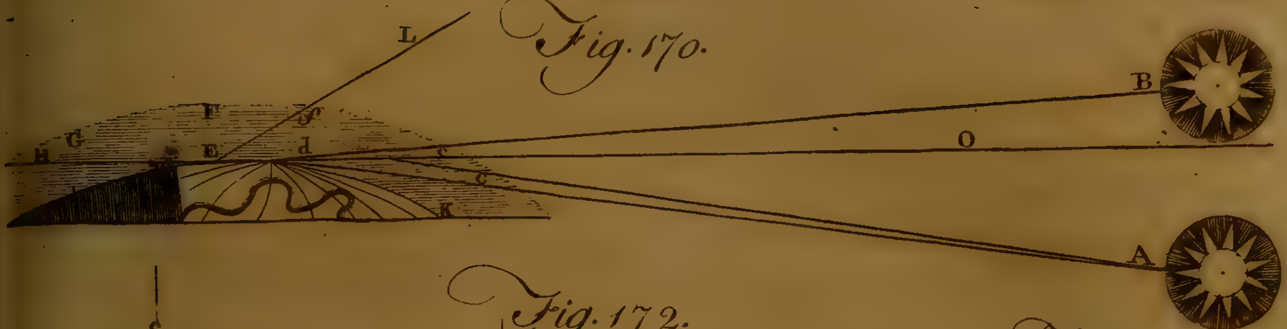


Fig. 172.

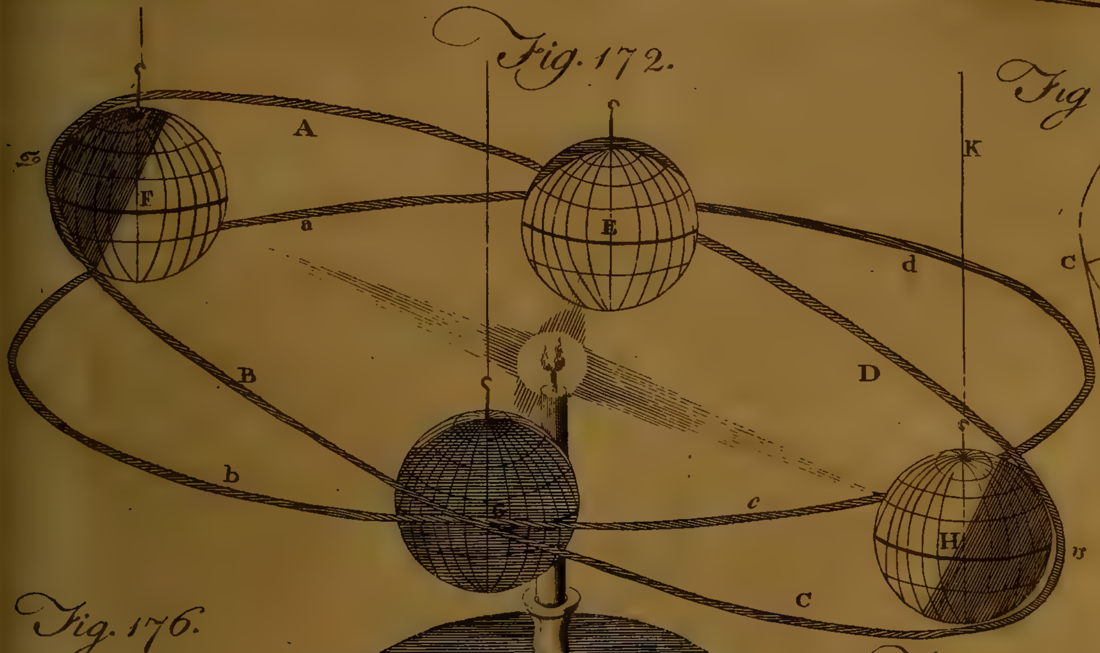


Fig. 173

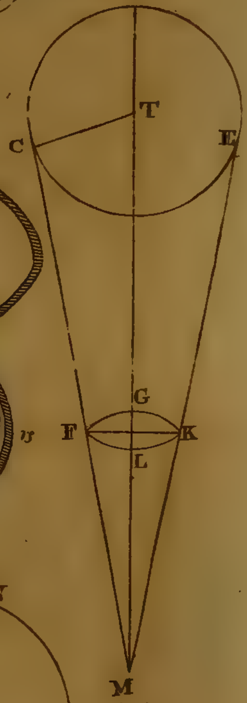


Fig. 176.

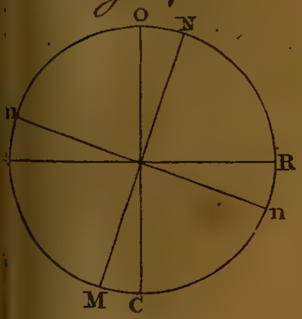


Fig. 175.

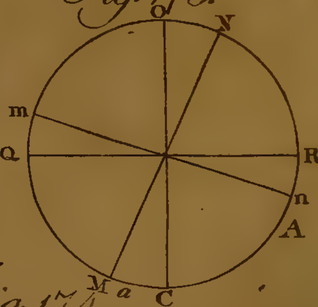


Fig. 174.

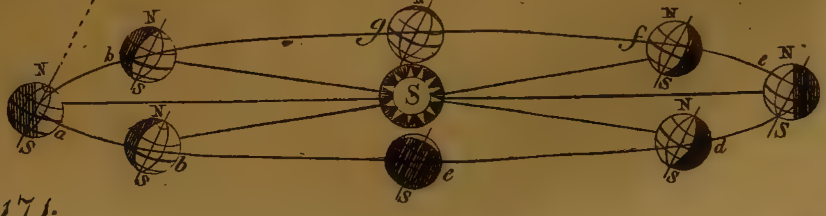
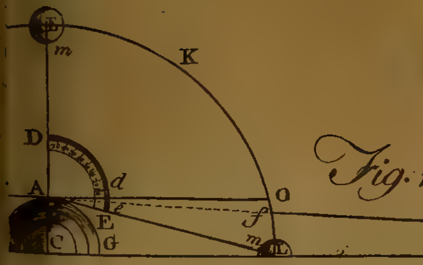


Fig. 171.



axis SON is in motion upon the earth's centre O, in ſuch a manner as to deſcribe the double cone NO*n* and SO*s*, round the axis of the ecliptic BO, in the time that the equinoctial points move quite round the ecliptic, which is 25,920 years; and in that length of time, the north pole of the earth's axis produced, deſcribes the circle ABCDA in the ſtarry heavens, round the pole of the ecliptic, which keeps immoveable in the centre of that circle. The earth's axis being $23\frac{1}{2}$ degrees inclined to the axis of the ecliptic, the circle ABCDA deſcribed by the north pole of the earth's axis produced to A, is 47 degrees in diameter, or double the inclination of the earth's axis. In conſequence of this, the point A, which at preſent is the north pole of the heavens, and near to a ſtar of the ſecond magnitude in the tail of the conſtellation called the *Little Bear*, muſt be deſerted by the earth's axis; which moving backwards a degree every 72 years, will be directed towards the ſtar or point B in 6480 years hence; and in double of that time, or in 12,960 years, it will be directed towards the ſtar or point C, which will then be the north pole of the heavens, although it is at preſent $8\frac{1}{2}$ degrees ſouth of the zenith of London L. The preſent poſition of the equator EOQ will then be changed into *e*O*q*, the tropic of Cancer T ♋ Z; into V*t*♋, and the tropic of Capricorn VT ♑ into *t*♑ Z; as is evident by the figure. And the ſun, in the ſame part of the heavens where he is now over the earthly tropic of Capricorn, and makes the ſhorteſt days and longeſt nights in the northern hemiſphere, will then be over the earthly tropic of Cancer, and make the days longeſt and nights ſhorteſt. So that it will require 12,960 years yet more, or 25,920 from the then preſent time, to bring the north pole N quite round, ſo as to be directed toward that point of the heavens which is vertical to it at preſent. And then, and not till then, the ſame ſtars which at preſent deſcribe the equator, tropics, and polar circles, &c. by the earth's diurnal motion, will deſcribe them over again.

From the ſhifting of the equinoctial points, and with them all the ſigns of the ecliptic, it follows that thoſe ſtars which in the infancy of aſtronomy were in Aries are now got into Taurus; thoſe of Taurus into Gemini, &c. Hence likewiſe it is that the ſtars which roſe or ſet at any particular ſeaſon of the year, in the times of Heſiod, Eudoxus, Virgil, Pliny, &c. by no means anſwer at this time to their deſcriptions.

350 Of the moon.

The moon is not a planet, but only a ſatellite or attendant of the earth, going round the earth from change to change in 29 days 12 hours and 44 minutes, and round the ſun with it every year. The moon's diameter is 2,180 miles; and her diſtance from the earth's centre is 240,000. She goes round her orbit in 27 days 7 hours 43 minutes, moving about 2290 miles every hour; and turns round her axis exactly in the time that ſhe goes round the earth, which is the reaſon of her keeping always the ſame ſide towards us, and that her day and night taken together is as long as our lunar month.

351 Reflects the ſun's light.

The moon is an opaque globe like the earth, and ſhines only by reflecting the light of the ſun: therefore, whilſt that half of her which is towards the ſun is enlightened, the other half muſt be dark and inviſible. Hence ſhe diſappears when ſhe comes between us and the ſun; becauſe her dark ſide is then towards us. When ſhe is gone a little way forward, we ſee a little of her enlightened ſide: which ſtill increaſes to our view as ſhe advances forward, until ſhe comes to be oppoſite to the ſun; and then her whole enlightened ſide is towards the earth, and ſhe appears with a round illumined orb, which we call the *full moon;* her dark ſide being then turned away from the earth. From the full ſhe ſeems to decreaſe gradually as ſhe goes through the other half of her courſe; ſhowing us leſs and leſs of her enlightened ſide every day, till her next change or conjunction with the ſun, and then ſhe diſappears as before.

The moon has ſcarce any difference of ſeaſons: her axis being almoſt perpendicular to the ecliptic. What is very ſingular, one half of her has no darkneſs at all; the earth conſtantly affording it a ſtrong light in the ſun's abſence; while the other half has a fortnight's darkneſs and a fortnight's light by turns.

352 Earth appears a moon to our moon.

Our earth is thought to be a moon to the moon; waxing and waning regularly, but appearing 13 times as big, and affording her 13 times as much light as ſhe does us. When ſhe changes to us, the earth appears full to her: and when ſhe is in her firſt quarter to us, the earth is in its third quarter to her; and *vice verſa.*

But from one half of the moon the earth is never ſeen at all: from the middle of the other half, it is always ſeen over head; turning round almoſt 30 times as quick as the moon does. From the circle which limits our view of the moon, only one half of the earth's ſide next her is ſeen; the other half being hid below the horizon of all places on that circle. To her the earth ſeems to be the biggeſt body in the univerſe; for it appears 13 times as big as ſhe does to us.

As the earth turns round its axis, the ſeveral continents, ſeas, and iſlands, appear to the moon's inhabitants like ſo many ſpots of different forms and brightneſs, moving over its ſurface; but much fainter at ſome times than others, as our clouds cover them or leave them. By theſe ſpots the Lunarians can determine the time of the earth's diurnal motion, juſt as we do the motion of the ſun: and perhaps they meaſure their time by the motion of the earth's ſpots; for they cannot have a truer dial.

353 How the Lunar inhabitants can meaſure their year.

The moon's axis is ſo nearly perpendicular to the ecliptic, that the ſun never removes ſenſibly from her equator; and the obliquity of her orbit, which is next to nothing as ſeen from the ſun, cannot cauſe the ſun to decline ſenſibly from her equator. Yet her inhabitants are not deſtitute of means for aſcertaining the length of their year, though their method and ours muſt differ. For we can know the length of our year by the return of our equinoxes; but the Lunarians, having always equal day and night, muſt have recourſe to another method: and we may ſuppoſe, they meaſure their year by obſerving when either of the poles of our earth begins to be enlightened and the other to diſappear, which is always at our equinoxes; they being conveniently ſituated for obſerving great tracts of land about our earth's poles, which are entirely unknown to us. Hence we may conclude, that the year is of the ſame abſolute length both to the earth and the moon, though very different as to the number of days: we having $365\frac{1}{4}$ natural days, and the Lunarians only $12\frac{7}{19}$, every day and night in the moon being as long as $29\frac{1}{2}$ on the earth.

The moon's inhabitants on the ſide next the earth may as eaſily find the longitude of their places as we can find the latitude of ours. For the earth keeping conſtantly, or very nearly ſo, over one meridian of the moon, the eaſt or weſt diſtances of places from that meridian are as eaſily found as we can find our diſtance from the equator by the altitude of our celeſtial poles.

354 Longitude eaſily found.

As the ſun can only enlighten that half of the earth which is at any moment turned towards him, and, being withdrawn from the oppoſite half, leaves it in darkneſs; ſo he likewiſe doth to the moon: only with this difference, that as the earth is ſurrounded by an atmoſphere, we have twilight after the ſun ſets; but if the moon has none of her own, nor is included in that of the earth, the lunar inhabitants have an immediate tranſition from the brighteſt ſun-ſhine to the blackeſt darkneſs. For, let t r k s w be the earth, and A, B, C, D, E, F, G, H, the moon in eight different parts of her orbit. As the earth turns round its axis from weſt to eaſt, when any place comes to t, the twilight begins there, and when it revolves from thence to r the ſun S riſes; when the place comes to s the ſun ſets, and when it comes to w the twilight ends. But as the moon turns round her axis, which is only once a month, the moment that any point of her ſurface comes to *r* (ſee the moon at G), the ſun riſes there without any previous warning by twilight; and when the ſame point comes to *s* the ſun ſets, and that point goes into darkneſs as black as at midnight.

Fig. 183.

355 Her phaſes explained.

The moon being an opaque ſpherical body (for her hills take off no more from her roundneſs than the inequalities on the ſurface of an orange takes off from its roundneſs), we can only ſee that part of the enlightened half of her which is towards the earth. And therefore, when the moon is at A, in conjunction with the ſun S, her dark half is towards the earth, and ſhe diſappears, as at *a*, there being no light on that half to render it viſible. When ſhe comes to her firſt octant at B, or has gone an eighth part of her orbit from her conjunction, a quarter of her enlightened ſide is towards the earth, and ſhe appears horned, as at *b*. When ſhe has gone a quarter of her orbit from between the earth and ſun to C, ſhe ſhows us one half of her enlightened ſide, as at *c*, and we ſay ſhe is a quarter old. At D, ſhe is in her ſecond octant; and by ſhowing us more of her enlightened ſide ſhe appears gibbous, as at *d*. At E, her whole enlightened ſide is towards the earth; and therefore ſhe appears round, as at *e*; when we ſay it is full moon. In her third octant at F, part of her dark ſide being towards the earth, ſhe again appears gibbous, and is on the decreaſe, as at *f*. At G, we ſee juſt one half of her enlightened ſide; and ſhe appears half decreaſed, or in her third quarter, as at *g*. At H, we only ſee a quarter of her enlightened ſide, being in her fourth octant; where ſhe appears horned, as at *h*. And at A, having completed her courſe from the ſun to the ſun again, ſhe diſappears; and we ſay it is new moon. Thus, in going from A to E, the moon ſeems continually to increaſe; and in going from E to A, to decreaſe in the ſame proportion; having like phaſes at equal diſtances from A to E, but as ſeen from the ſun S ſhe is always full.

356 Never appears perfectly round.

The moon appears not perfectly round when ſhe is full in the higheſt or loweſt part of her orbit, becauſe we have not a full view of her enlightened ſide at that time. When full in the higheſt part of her orbit, a ſmall deficiency appears on her lower edge; and the contrary when full in the loweſt part of her orbit.

It is plain by the figure, that when the moon changes to the earth, the earth appears full to the moon; and *vice verſa*. For when the moon is at A, new to the earth, the whole enlightened ſide of the earth is towards the moon; and when the moon is at E, full to the earth, its dark ſide is towards her. Hence a new moon anſwers to a full earth, and a full moon to a new earth. The quarters are alſo reverſed to each other.

357 Agreeable repreſentation of her phaſes.

Between the third quarter and change, the moon is frequently viſible in the forenoon, even when the ſun ſhines; and then ſhe affords us an opportunity of ſeeing a very agreeable appearance, wherever we find a globular ſtone above the level of the eye, as ſuppoſe on the top of a gate. For, if the ſun ſhines on the ſtone, and we place ourſelves ſo as the upper part of the ſtone may juſt ſeem to touch the point of the moon's lowermoſt horn, we ſhall then ſee the enlightened part of the ſtone exactly of the ſame ſhape with the moon; horned as ſhe is, and inclined the ſame way to the horizon. The reaſon is plain: for the ſun enlightens the ſtone the ſame way as he does the moon: and both being globes, when we put ourſelves into the above ſituation, the moon and ſtone have the ſame poſition to our eyes; and therefore we muſt ſee as much of the illuminated part of the one as of the other.

358 Nonageſimal degree.

The poſition of the moon's cuſps, or a right line touching the points of her horns, is very differently inclined to the horizon at different hours of the ſame days of her age. Sometimes ſhe ſtands, as it were, upright on her lower horn, and then ſuch a line is perpendicular to the horizon: when this happens, ſhe is in what the aſtronomers call *the nonageſimal degree*; which is the higheſt point of the ecliptic above the horizon at that time, and is 90 degrees from both ſides of the horizon where it is then cut by the ecliptic. But this never happens when the moon is on the meridian, except when ſhe is at the very beginning of Cancer or Capricorn.

That the moon turns round her axis in the time that ſhe goes round her orbit, is quite demonſtrable; for, a ſpectator at reſt, without the periphery of the moon's orbit, would ſee all her ſides turned regularly towards him in that time. She turns round her axis from any ſtar to the ſame ſtar again in 27 days 8 hours; from the ſun to the ſun again in 29½ days: the former is the length of the ſidereal day, and the latter the length of her ſolar day. A body moving round the ſun would have a ſolar day in every revolution, without turning on its axis; the ſame as if it had kept all the while at reſt, and the ſun moved round it: but without turning round its axis it could never have one ſidereal day, becauſe it would always keep the ſame ſide towards any given ſtar.

If the earth had no annual motion, the moon would go round it ſo as to complete a lunation, a ſidereal, and a ſolar day, all in the ſame time. But, becauſe the earth goes forward in its orbit while the moon goes round the earth in her orbit, the moon muſt go as much more than round her orbit from change to change in completing a ſolar day, as the earth has gone forward in its orbit during that time, i. e. almoſt a twelfth part of a circle.

359 Delineation of her path round the ſun.

If the earth had no annual motion, the moon's motion round the earth, and her track in open ſpace, would be always the ſame (c). But as the earth and moon move round the ſun, the moon's real path in the heavens is very different from her viſible path round the earth; the latter being in a progreſſive circle, and the former in a curve of different degrees of concavity, which would always be the ſame in the ſame parts of the heavens, if the moon performed a complete number of lunations in a year without any fraction.

Let a nail in the end of the axle of a chariot-wheel repreſent the earth, and a pin in the nave the moon; if the body of the chariot be propped up ſo as to keep that wheel from touching the ground, and the wheel be then turned round by hand, the pin will deſcribe a circle both round the nail and in the ſpace it moves through. But if the props be taken away, the horſes put to, and the chariot driven over a piece of ground which is circularly convex; the nail in the axle will deſcribe a circular curve, and the pin in the nave will ſtill deſcribe a circle round the progreſſive nail in the axle, but not in the ſpace through which it moves. In this caſe, the curve deſcribed by the nail will reſemble in miniature as much of the earth's annual path round the ſun, as it deſcribes whilſt the moon goes as often round the earth as the pin does round the nail: and the curve deſcribed by the pin will have ſome reſemblance of the moon's path during ſo many lunations.

Fig. 184.

Let us now ſuppoſe that the radius of the circular curve deſcribed by the nail in the axle is to the radius of the circle which the pin in the nave deſcribes round the axle, as 337½ to 1; (d) which is the proportion of the radius or ſemidiameter of the earth's orbit to that of the moon's, or of the circular curve A 1 2 3 4 5 6 7 B, &c. to the little circle *a*; and then, whilſt the progreſſive nail deſcribes the ſaid curve from A to E, the pin will go once round the nail with regard to the centre of its path, and in ſo doing will deſcribe the curve *a b c d e*. The former will be a true repreſentation of the earth's path for one lunation, and the latter of the moon's for that time. Here we may ſet aſide the inequalities of the moon's motion, and alſo the earth's moving round its common centre of gravity and the moon's: all which, if they were truly copied in this experiment, would not ſenſibly alter the figure of the paths deſcribed by the nail and pin, even though they ſhould rub againſt a plain upright ſurface all the way, and leave their tracts viſible upon it. And if the chariot was driven forward on ſuch a convex piece of ground, ſo as to turn the wheel ſeveral times round, the track of the pin in the nave would ſtill be concave towards the centre of the circular curve deſcribed by the nail in the axle; as the moon's path is always concave to the ſun in the centre of the earth's annual orbit.

In this diagram, the thickeſt curve line ABCDE, with the numeral figures ſet to it, repreſents as much of the earth's annual orbit as it deſcribes in 32 days from weſt to eaſt; the little circles at A, B, C, D, E, ſhow the moon's orbit in due proportion to the earth's; and the ſmalleſt curve *a* C *f* repreſents the line of the moon's path in the heavens for 32 days, accounted from any particular new moon at *a*. The ſun is ſuppoſed to be in the centre of the curve A 1 2 3 4 5 6 7 B, &c. and the ſmall dotted circles upon it repreſent the moon's orbit, of which the radius is in the ſame proportion to the earth's path in this ſcheme, that the radius of the moon's orbit in the heavens was ſuppoſed to bear to the radius of the earth's annual path round the ſun; that is, as 240,000, to 81,000,000, or as 1 to 337½.

When the earth is at A, the new moon is at *a;* and in the ſeven days that the earth deſcribes the curve 1 2 3 4 5 6 7, the moon in accompanying the earth deſcribes the curve *a b;* and is in her firſt quarter at *b* when the earth is at B. As the earth deſcribes the curve B 8 9 10 11 12 13 14, the moon deſcribes the curve *b c;* and is at *c*, oppoſite to the ſun, when the earth is at C. Whilſt the earth deſcribes the curve C 15 16 17 18 19 20 21 22, the moon deſcribes the curve *c d*; and is in her third quarter at *d* when the earth is at D. And laſtly, whilſt the earth deſcribes the curve D 23 24 25 26 27 28 29, the moon deſcribes the curve *d e;* and is again in conjunction at *e* with the ſun when the earth is at E, between the 29th and 30th day of the moon's age, accounted by the numeral figures from the new moon at A. In deſcribing the curve *a* C *e*, the moon goes round the progreſſive earth as really as if ſhe had kept in the dotted circle A, and the earth continued immoveable in the centre of that circle.

360 Her path always concave to the ſun.

And thus we ſee, that although the moon goes round the earth in a circle, with reſpect to the earth's centre, her real path in the heavens is not very different in appearance from the earth's path. To ſhow that the moon's path is concave to the ſun, even at the time of change, it is carried on a little farther into a ſecond lunation as to *f*.

The curves which Jupiter's ſatellites deſcribe, are all of different ſorts from the path deſcribed by our moon, although theſe ſatellites go round Jupiter as the moon goes round the earth. Let ABCDE, &c. be as much of Jupiter's orbit as he deſcribes in 18 days from A to T; and the curves *a*, *b*, *c*, *d*, will be the paths of his four moons going round him in his progreſſive motion. Now let us ſuppoſe all theſe moons to ſet out from a conjunction with the ſun, as ſeen from Jupiter at A; then, his firſt or neareſt moon will be at *a*, his ſecond at *b*, his third at *c*, and his fourth at *d*. At the end of 24 terreſtrial hours after this con-

Fig. 185.

(c) In this place, we may conſider the orbits of all the ſatellites as circular, with reſpect to their primary planets; becauſe the eccentricities of their orbits are too ſmall to affect the phenomena here deſcribed.

(d) The figure by which this is illuſtrated is borrowed from Mr Ferguſon. Later obſervations have determined the proportions to be different: but we cannot find that any delineation of this kind hath been given by aſtronomers, according to the new proportions.

Particular Explication of the Celeſtial Phenomena.

conjunction, Jupiter has moved to B, his firſt moon or ſatellite has deſcribed the curve *a* 1, his ſecond the curve *b* 1, his third *c* 1, and his fourth *d* 1. The next day, when Jupiter is at C, his firſt ſatellite has deſcribed the curve *a* 2, from its conjunction, his ſecond the curve *b* 2, his third the curve *c* 2, and his fourth the curve *d* 2, and ſo on. The numeral figures under the capital letters ſhow Jupiter's place in his path every day for 18 days, accounted from A to T; and the like figures ſet to the paths of his ſatellites, ſhow where they are at the like times. The firſt ſatellite, almoſt under C, is ſtationary at + as ſeen from the ſun, and retrograde from + to 2: at 2 it appears ſtationary again, and thence it moves forward until it has paſt 3, and is twice ſtationary and once retrograde between 3 and 4. The path of this ſatellite interſects itſelf every $42\frac{1}{2}$ hours, making ſuch loops as in the diagram at 2. 3. 5. 9. 10. 12. 14. 16. 18. a little after every conjunction. The ſecond ſatellite *b*, moving ſlower, barely croſſes its path every 3 days 13 hours; as at 4. 7. 11. 14. 18, making only five loops and as many conjunctions in the time that the firſt makes ten. The third ſatellite *c* moving ſtill ſlower, and having deſcribed the curve *c* 1. 2. 3. 4. 5. 6. 7. comes to an angle at 7 in conjunction with the ſun at the end of 7 days 4 hours; and ſo goes on to deſcribe ſuch another curve 7. 8. 9. 10. 11. 12. 13. 14. and is at 14 in its next conjunction. The fourth ſatellite *d* is always progreſſive, making neither loops nor angles in the heavens; but comes to its next conjunction at *e* between the numeral figures 16 and 17, or in 16 days 18 hours.

The method uſed by Mr Ferguſon to delineate the paths of theſe ſatellites was the following. Having drawn their orbits on a card, in proportion to their relative diſtances from Jupiter, he meaſured the radius of the orbit of the fourth ſatellite, which was an inch and $\frac{14}{100}$ parts of an inch; then multiplied this by 424 for the radius of Jupiter's orbit, becauſe Jupiter is 424 times as far from the ſun's centre as his fourth ſatellite is from his centre; and the product thence ariſing was $483\frac{36}{100}$ inches. Then taking a ſmall cord of this length, and fixing one end of it to the floor of a long room by a nail, with a black-lead pencil at the other end, he drew the curve ABCD, &c. and ſet off a degree and half thereon from A to T; becauſe Jupiter moves only ſo much, whilſt his outermoſt ſatellite goes once round him, and ſomewhat more; ſo that this ſmall portion of ſo large a circle differs but very little from a ſtraight line. This done, he divided the ſpace AT into 18 equal parts, as AB, BC, &c. for the daily progreſs of Jupiter; and each part into 24 for his hourly progreſs. The orbit of each ſatellite was alſo divided into as many equal parts as the ſatellite is hours in finiſhing its ſynodical period round Jupiter. Then drawing a right line through the centre of the card, as a diameter to all the four orbits upon it, he put the card upon the line of Jupiter's motion, and transferred it to every horary diviſion thereon, keeping always the ſaid diameter-line on the line of Jupiter's path; and running a pin through each horary diviſion in the orbit of each ſatellite as the card was gradually transferred along the line ABCD, &c. of Jupiter's motion, he marked points for every hour through the card for the curves deſcribed by the ſatellites, as the primary planet in the centre of the card was carried forward on the line; and ſo finiſhed the figure, by drawing the lines of each ſatellite's motion through thoſe (almoſt innumerable) points: by which means, this is perhaps as true a figure of the paths of the ſatellites as can be deſired. And in the ſame manner might thoſe of Saturn's ſatellites be delineated.

Particular Explication of the Celeſtial Phenomena.

It appears by the ſcheme, that the three firſt ſatellites come almoſt into the ſame line or poſition every ſeventh day; the firſt being only a little behind with the ſecond, and the ſecond behind with the third. But the period of the fourth ſatellite is ſo incommenſurate to the periods of the other three, that it cannot be gueſſed at by the diagram when it would fall again into a line of conjunction with them, between Jupiter and the ſun. And no wonder; for ſuppoſing them all to have been once in conjunction, it will require 3,087,043,493,260 years to bring them in conjunction again.

The moon's abſolute motion from her change to her firſt quarter, or from *a* to *b*, is ſo much ſlower than the earth's that ſhe falls 240,000 miles (equal to the ſemidiameter of her orbit) behind the earth at her firſt quarter in *b*, when the earth is in B; that is, ſhe falls back a ſpace equal to her diſtance from the earth. From that time her motion is gradually accelerated to her oppoſition or full at *c*; and then ſhe is come up as far as the earth, having regained what ſhe loſt in her firſt quarter from *a* to *b*. From the full to the laſt quarter at *d*, her motion continues accelerated ſo as to be juſt as far before the earth at *d* as ſhe was behind it at her firſt quarter in *b*. But from *d* to *e* her motion is retarded ſo, that ſhe loſes as much with reſpect to the earth as is equal to her diſtance from it, or to the ſemidiameter of her orbit; and by that means ſhe comes to *e*, and is then in conjunction with the ſun as ſeen from the earth at E. Hence we find, that the moon's abſolute motion is ſlower than the earth's from her third quarter to her firſt, and ſwifter than the earth's from her firſt quarter to her third; her path being leſs curved than the earth's in the former caſe and more in the latter. Yet it is ſtill bent the ſame way towards the ſun; for if we imagine the concavity of the earth's orbit to be meaſured by the length of a perpendicular line G *g*, let down from the earth's place upon the ſtraight line *b g d* at the full of the moon, and connecting the places of the earth at the end of the moon's firſt and third quarters, that length will be about 640,000 miles; and the moon when new only approaching nearer to the ſun by 240,000 miles than the earth is, the length of the perpendicular let down from her place at that time upon the ſame ſtraight line, and which ſhows the concavity of that part of her path, will be about 400,000 miles.

561 A difficulty concerning attraction ſolved.

The moon's path being concave to the ſun throughout, demonſtrates that her gravity towards the ſun, at her conjunction, exceeds her gravity towards the earth; and if we conſider that the quantity of matter in the ſun is vaſtly greater than the quantity of matter in the earth, and that the attraction of each body diminiſhes as the ſquare of the diſtance from it increaſes, we ſhall ſoon find, that the point of equal attraction between the earth and the ſun, is much nearer the earth than the moon is at her change. It may then appear ſurpriſing that the moon does not abandon the earth when ſhe is between it and the ſun, becauſe ſhe is conſiderably more attracted by the ſun than by the earth at that time. But this difficulty vaniſhes when we conſider, that a common impulſe on any ſyſtem of bodies affects not their relative motions; but that they will continue to attract, impel, or circulate round one another, in the ſame manner as if there was no ſuch impulſe. The moon is ſo near the earth, and both of them ſo far from the ſun, that the attractive power of the ſun may be conſidered as equal on both; and therefore the moon will continue to circulate round the earth in the ſame manner as if the ſun did not attract them at all: like bodies in the cabin of a ſhip, which may move round or impel one another in the ſame manner when the ſhip is under ſail as when it is at reſt; becauſe they are all equally affected by the common motion of the ſhip. If by any other cauſe, ſuch as the near approach of a comet, the moon's diſtance from the earth ſhould happen to be ſo much increaſed, that the difference of their gravitating forces towards the ſun ſhould exceed that of the moon towards the earth; in that caſe, the moon, when in conjunction, would abandon the earth, and be either drawn into the ſun, or comet, or circulate round about it.

The ruggedneſs of the moon's ſurface mentioned nº 146, 147. is of great uſe to us, by reflecting the ſun's light to all ſides: for if the moon were ſmooth and poliſhed like a looking-glaſs, or covered with water, ſhe could never diſtribute the ſun's light all round; only in ſome poſitions ſhe would ſhow us his image, no bigger than a point, but with ſuch a luſtre as would be hurtful to our eyes.

362 Why her edge appears always even.

The moon's ſurface being ſo uneven, many have wondered why her edge appears not jagged, as well as the curve bounding the light and dark places. But if we conſider, that what we call the *edge* of the moon's diſk is not a ſingle line ſet round with mountains, in which caſe it would appear irregularly indented, but a large zone having many mountains lying behind one another from the obſerver's eye, we ſhall find that the mountains in ſome rows will be oppoſite to the vales in others; and ſo fill up the inequalities as to make her appear quite round: juſt as when one looks at an orange, although its roughneſs be very diſcernible on the ſide next the eye, eſpecially if the ſun or a candle ſhines obliquely upon that ſide, yet the line terminating the viſible part ſtill appears ſmooth and even.

Having ſaid thus much of the moon's Period, Phaſes, Path, &c. it may not be amiſs to deſcribe, in a ſummary manner, the irregularities of her motion; and though theſe have been already treated of on the principles of the Newtonian ſyſtem, yet as the ſubject has much embarraſſed the aſtronomical world, it is hoped, that the following explanation of the planetary irregularities upon common mechanical principles, from Mr Nicholſon's Natural Philoſophy, may not appear ſuperfluous to uninformed readers.

Philadelphia Edition, 184 *et ſeq.*

“ If the ſun were at reſt, and the planets did not mutually gravitate towards each other, they would deſcribe ellipſes, having the ſun in the common focus: But ſince they mutually act on the ſun and on each other, it muſt follow that the ſun is perpetually moved about the centre of gravity of all the planets; which centre is the common focus of all their orbits. This centre, by reaſon of the ſun's very great bulk, can in no ſituation exceed the diſtance of its ſemidiameter from its ſurface. Some ſmall irregularities ariſe from theſe mutual actions, but much leſs would enſue if the ſun were at reſt, or not ſubject to the reaction of the other planets. The irregularities in the motions of the primary planets are ſcarcely conſiderable enough to come under obſervation in the courſe of many revolutions; but thoſe of the moon are very perceptible on account of its nearneſs to us, and from other cauſes. It will therefore be ſufficient to explain the latter, and apply the explanation to the former, being effects of the ſame kind.

“ If the actions of the ſun upon the earth and moon were equal upon each, according to their maſſes, and tended to produce motions in parallel directions, their relative motions would be the ſame as if no ſuch force acted upon them. But theſe forces vary both in quantity and direction according to the various relative ſituations of the earth and moon.

“ Let the point S (fig. 162.) repreſent the ſun, and ADBC the orbit of the moon. Then if the moon be at the quadrature A, the diſtances ES and AS of the earth and moon from the ſun being equal, their gravities towards S will alſo be equal, and may be repreſented by thoſe lines ES and AS. Draw the line A parallel and equal to ES, and join LS, which will be parallel to AE. The force AS may be reſolved (from *principles of compound motion*) into the two forces AL and AE; of which AL, by reaſon of its parallelïſm and equality to ES, will not diſturb their relative motions or ſituation: but the force AE conſpiring with that of gravity, will cauſe the moon to fall farther below the tangent of its orbit than it would have done if no ſuch diſturbing force had exiſted. Therefore, at or near the quadratures, the moon's gravity towards the earth is increaſed more than according to the regular courſe, and its orbit is rendered more curve.

“ When the moon is at the conjunction C, the diſtances ES and CS not being equal, the moon's gravitation towards the ſun exceeds that of the earth in the ſame proportion as the ſquare of ES exceeds the ſquare of CS. And becauſe the exceſs acts contrary to the direction of the moon's gravity towards the earth, it diminiſhes the effect thereof, and cauſes the moon to fall leſs below the tangent of its orbit than it would if no ſuch diſturbing force exiſted. A like and very nearly equal effect follows, when the moon is at the oppoſition D, by the earth's gravitation towards the ſun being greater than that of the moon; whence their mutual gravitation is diminiſhed as in the former caſe. Therefore, at or near the conjunction or oppoſition, the moon's gravity is diminiſhed, and its orbit rendered leſs curve.

“ It is found that the force added to the moon's gravity at the quadratures, is to the gravity with which it would revolve about the earth in a circle, at its preſent mean diſtance, if the ſun had no effect on its motion, as 1 to 190; and that the force ſubducted from its gravity at the conjunction or oppoſition is about double this quantity. The influence of the ſun, then, on the whole, increaſes the moon's diſtance from the earth, and augments its periodical time: and ſince this influence is moſt conſiderable when the earth is neareſt the ſun, or in its perihelium, its periodical time muſt then be the greateſt;” and it is ſo found by obſervation.

“ To ſhow the effect of the ſun in diſturbing the moon's motion at any ſituation between the conjunction and one of the quadratures, ſuppoſe at M, let ES repreſent the earth's gravity towards the ſun, draw the line MS, which continue towards G; from M ſet off MG, ſo that MG may be to ES as the ſquare of the earth's diſtance ES is to the ſquare of the moon's diſtance MS; and MG will repreſent the moon's gravity towards the ſun. From M draw MF parallel and equal to ES; join FG, and draw MH parallel and equal to FG. The force MG may be reſolved into MF and MH; of which MF, by reaſon of its paralleliſm and equality to ES, will not diſturb the relative motions or ſituations of the moon and earth: MH then is the diſturbing force. Draw the tangent MK to the moon's orbit, and continue the radius EM towards I; draw HI parallel to KM, and interſecting MI in I, and complete the parallelogram by drawing HK parallel to IM, and interſecting MK in K. The force MH may be reſolved into MI and MK; of which MI affects the gravity, and MK the velocity, of the moon. When the force MH coincides with the tangent, that is, when the moon is 35° 16′ diſtant from the quadrature, the force MI which affects the gravity, vaniſhes; and when the force MH coincides with the radius, that is, when the moon is either in the conjunction or quadrature, the force MK vaniſhes. Between the quadrature and the diſtance of 35° 16′ from it, the line or force MH falls within the tangent, and conſequently the force MI is directed towards E, and the moon's gravity is increaſed: but, at any greater diſtance from the quadrature, the line MH falls without the tangent, and the force MI is directed from E, the moon's gravity being diminiſhed. It is evident that the force MK is always directed to ſome point in the line which paſſes through the ſun and earth; therefore it will accelerate the moon's motion while it is approaching towards that line, or the conjunction, and ſimilarly retard it as it recedes from it, or approaches towards the quadrature, by conſpiring with the motion in one caſe, and ſubducting from it in the other.

“ As the moon's gravity towards the ſun, at the conjunction, is diminiſhed by a quantity which is as the difference of the ſquares of their diſtances; and as this difference, on account of the very great diſtance of the ſun, is nearly the ſame when the moon is at the oppoſition, the mutual tendency to ſeparate, or diminution of gravity, will be very nearly the ſame. Whence it eaſily follows, that all the irregularities which have been explained as happening between the quadratures and conjunction, muſt, in like circumſtances, take place between the quadratures and oppoſition.

“ If the moon revolved about the earth in a circular orbit, the ſun's diſturbing influence being ſuppoſed not to act, then this influence being ſuppoſed to act would convert the orbit into an ellipſis. For the increaſe of gravity renders it more curve at the quadratures, by cauſing the moon to fall further below the tangent; and the diminution of gravity, as well as the increaſed velocity, render the orbit leſs curve at the conjunction and oppoſition, by cauſing the moon to fall leſs below the tangent in a given time. Therefore, an ellipſis would be deſcribed whoſe leſs or more convex parts would be at the quadratures, and whoſe longeſt diameter would paſs through them: Conſequently the moon would be fartheſt from the earth at the quadratures, and neareſt at the conjunction and oppoſition. Neither is it ſtrange that the moon ſhould approach or come nearer to the earth at the time when its gravity is the leaſt, ſince that approach is not the immediate conſequence of the decreaſe of gravity, but of the curvity of its orbit near the quadratures; and in like manner, its receſs from the earth does not ariſe immediately from its diminiſhed gravity, from the velocity and direction acquired at the conjunction or oppoſition. But as the moon's orbit is, independent of the ſun's action, an ellipſis, then effects take place only as far as circumſtances permit. The moon's gravity towards the earth being thus ſubject to a continual change in its ratio, its orbit is of no conſtant form. The law of its gravity being nearly in the inverſe proportion of the ſquares of the diſtances, its orbit is nearly a quieſcent ellipſis; but the deviation from this law occaſions its apſides to move direct or retrograde, according as thoſe deviations are in defect or in exceſs. Aſtronomers, to reduce the motion of the apſides to computation, ſuppoſe the revolving body to move in an ellipſis, whoſe tranſverſe diameter, or line of the apſides, revolves at the ſame time about the focus of the orbit. When the moon is in the conjunction or oppoſition, the ſun ſubducts from its gravity, and that the more the greater its diſtance is from the earth; ſo that its gravity follows a greater proportion than the inverted ratio of the ſquare of the diſtance, and conſequently the apſides of its orbit muſt then move in conſequentia or direct. In the quadratures the ſun adds to the moon's gravity; and that the more the greater its diſtance is from the earth: ſo that its gravity follows a leſs proportion than the inverted ratio of the ſquare of her diſtance, and conſequently the apſides of its orbit muſt then move in antecedentia or retrograde. But becauſe the action of the ſun ſubducts more from the moon's gravity in the conjunction and oppoſition than it adds to it in the quadratures, the direct motion exceeds the retrograde, and at the end of each revolution the apſides are found to be advanced according to the order of the ſigns.

“ If the plane of the moon's orbit coincided with that of the ecliptic, theſe would be the only irregularities ariſing from the ſun's action; but becauſe it is inclined to the plane of the ecliptic in an angle of about 5 degrees, the whole diſturbing force does not act upon the moon's motion in its orbit; a ſmall part of the force being employed to draw it out of the plane of the orbit into that of the ecliptic.

“ Of the forces MK and MI (fig. 162.) which diſturb the moon's motion, MI, being always in the direction of the radius, can have no effect in drawing it out of the plane of its orbit: and if the force MK really coincided with the tangent, as we, neglecting the ſmall deviation ariſing from the obliquity of the moon's orbit, have hitherto ſuppoſed, it is evident that its only effect would be that of accelerating or retarding the moon's motion, without affecting the plane of its orbit: But becauſe that force is always directed to ſome point in the line which paſſes through the centres of the ſun and earth, it is evident that it can coincide with the tangent only when that line is in the plane of the moon's orbit; that is to ſay, when the nodes are in the conjunction and oppoſition. At all other times

Particular Explication of the Celeſtial Phenomena.

times the force MK muſt decline to the northward or ſouthward of the tangent, and, compounding itſelf with the moon's motion, will not only accelerate or retard it, according to the circumſtances before explained, but will likewiſe alter its direction, deflecting it towards that ſide of the orbit on which the point, the force MK, tends to is ſituated. This deflection cauſes the moon to arrive at the ecliptic either ſooner or later than it would otherwiſe have done; or, in other words, it occaſions the interſection of its orbit with the ecliptic to happen in a point of the ecliptic, either nearer to or farther from the moon, than that in which it would have happened if ſuch deflection had not taken place.

“ To illuſtrate this, let the elliptical projection COQN (fig. 163.) repreſent a circle in the plane of the ecliptic, MOPN the moon's orbit interſecting the ecliptic in the nodes N and O. Suppoſe the moon to be in the northern part of its orbit at M and moving towards the node O; the diſturbing force MK, which tends towards a point in the line SE to the ſouthward of the tangent MT, will be compounded with the tangental force, and will cauſe the moon to deſcribe the arc Mm, to which MR is tangent, inſtead of the arc MO; whence the node O is ſaid to be moved to m. In this manner the motion of the nodes may be explained for any other ſituation.

“ This motion evidently depends on a twofold circumſtance; namely, the quantity and direction of the force MK. If the force MK be increaſed, its direction remaining the ſame, it will deflect the curve of the moon's path from its orbit in a greater degree; and, on the other hand, if its direction be altered ſo as to approach nearer to a right angle with the tangent, it will cauſe a greater deflection, though its quantity remain the ſame. When the moon is in the quadratures, the force MK vaniſhes, conſequently the nodes are then ſtationary. When the moon is at the octant, or 45 degrees from the quadrature, the force MK is the greateſt of all; and therefore the motion of the nodes is then moſt conſiderable, as far as it depends on the quantity of MK: But the direction of this force in like circumſtances depends on the ſituation of the line of the nodes. If the line of the nodes coincides with the line paſſing through the centres of the ſun and earth, the force MK coincides with the tangent of the moon's orbit, and the nodes are ſtationary; and the farther the node is removed from that line, the farther is that line removed from the plane of the moon's orbit, till the line of the nodes is in the quadratures; at which time the line paſſing through the centres of the ſun and earth, makes an angle with the plane of the moon's orbit equal to its whole inclination, or 5 degrees; conſequently the angle formed between MK and the tangent, in like circumſtances, is then greateſt, MK being directed to a point in a line which is further from the plane of the moon's orbit than at any other time, and of courſe the motion of the nodes is then moſt conſiderable.

“ To determine the quantity and direction of the motion of the nodes, ſuppoſe the moon in the quarter preceding the conjunction, and the node towards which it is moving to be between it and the conjunction; in this caſe its motion is directed to a point in the ecliptic which is leſs diſtant than the point towards which the force MK is directed: the force MK then compounding with the moon's motion, cauſes it to be directed to a point more diſtant than it would otherwiſe have been; that is to ſay, the node towards which the moon moves is moved towards the conjunction. When the moon has paſſed the node, its courſe is directed to the other node, which is a point in the ecliptic more diſtant than the point to which MK is directed, and therefore MK compounding with its motion cauſes it to be directed to a point leſs diſtant than it would otherwiſe have been; ſo that in this caſe, likewiſe, the enſuing node is moved towards the conjunction. After the moon has paſſed the conjunction, the force MK ſtill continues to deflect its courſe towards the ecliptic; and conſequently the motion of the node is the ſame way till its arrival at the quadrature. Suppoſe, again, the moon to be at the conjunction, and the node towards which it is moving to be between it and the quadrature; in this caſe, the force MK compounding with the moon's motion, cauſes it to move towards a point in the ecliptic leſs diſtant than it would otherwiſe have done; ſo that the enſuing node is brought towards the conjunction.

Particular Explication of the Celeſtial Phenomena.

“ When the moon has paſſed the node, the force MK ſtill continuing to deflect its courſe towards the ſame ſide of its orbit, produces a contrary effect; namely, as it before occaſioned it to converge to the ecliptic, ſo it now cauſes it to diverge from it; and its motion, in conſequence, tends continually to a point in the ecliptic more diſtant than it would otherwiſe have done; the enſuing node in this inſtance being alſo brought towards the conjunction.

“ As the diſturbing forces are very nearly the ſame in the half of the moon's orbit which is fartheſt from the ſun, this laſt paragraph is true when it moves in that part of its orbit, if the word *oppoſition* be every where inſerted inſtead of the word *conjunction*.

“ Whence it is eaſy to deduce this general rule: That when the moon is in the part of its orbit neareſt the ſun, the node towards which it is moving is made to move towards the conjunction; and when it is in the part of its orbit fartheſt from the ſun, the node towards which it is moving is made to move towards the oppoſition.

“ Suppoſe the moon at Q (fig. 176.), or the quadrature preceding the conjunction, then the enſuing node, if at 90° diſtance, or at the conjunction C, will be ſtationary (as before obſerved); but if it be at a greater or leſs diſtance it will be brought towards C. Thus, if the nodes be in the poſition MN, the enſuing node M, being at a leſs diſtance from Q than 90°, will move towards C, or direct, while the moon moves through the arc QM; after which N becomes the enſuing node and likewiſe moves towards the conjunction C, or retrograde during the moon's motion through the arc MR; and becauſe the arc MR exceeds QM, the retrograde motion exceeds the direct. Again, if the nodes be in the poſition *nm*, the enſuing node *n* being at a greater diſtance from Q than 90°, will move towards C, or retrograde during the moon's motion through the arc Q*n*; after which the node *m* becomes the enſuing node, and likewiſe moves towards the conjunction C, or direct, during the moon's motion through the arc *n*R; and becauſe the arc Q*n* exceeds NR, the retrograde motion here alſo exceeds the

Particular Explication of the Celeſtial Phenomena.

the direct. If the nodes be in the quadratures QR, the enſuing node R removes towards C, or retrograde, during the moon's motion through the arc QR, or almoſt the whole ſemiorbit. The ſame may be ſhown in the other half of the orbit ROQ with reſpect to the oppoſition O; and therefore in every revolution of the moon, the retrograde motion of the nodes exceeds the direct; and, on the whole, the nodes are carried round contrary to the order of the ſigns.

"The line of the conjunction is by the earth's annual motion brought into every poſſible ſituation with reſpect to the nodes in the courſe of a year, independent of their own proper motion; which laſt occaſions the change of ſituation to be performed in about nineteen days leſs.

"The inclination of the moon's orbit being the angle which its courſe makes with the plane of the ecliptic, it is evident from what has been ſaid, that this angle is almoſt continually changing. Suppoſe the line of the nodes, by its retrograde motion, to leave the conjunction C (fig. 175.) and become in the ſecond and fourth quarters as in the poſition MN, and the moon to move from the node M to the node N; then, becauſe the enſuing node N moves towards the conjunction C, while the moon is in the nearer half of its orbit, the moon's courſe muſt be continually more and more inflected towards the ecliptic till its arrival at R. This inflection in the firſt 90°, or MA from M, prevents its diverging ſo much from the ecliptic, as it would otherwiſe have done; that is to ſay, it diminiſhes the angle of the moon's inclination. From A to R its courſe begins to converge towards the ecliptic; and this convergence is increaſed by the inflection which, in the preceding 90°, prevented its divergence: in the arc AR, then, their inclination is increaſed. During the moon's motion from R to N, the node is moved towards the oppoſition O, and conſequently the angle of its courſe to N, is rendered leſs than it would have been if the node has not moved; or, in other words, the inclination is diminiſhed. And becauſe the arc MA added to the arc RN is greater than the arc AR, the inclination at the ſubſequent node is leſs than at the precedent node; and the ſame may be ſhown in the other half revolution NQM.

"Therefore, while the nodes are moving from the conjunction and oppoſition to the quadratures, the inclination of the moon's orbit on the whole diminiſhes in every revolution till they arrive in the quadratures, at which time it is leaſt of all. When the line of the nodes has paſſed the quadratures, and is in the firſt and third quarters, as in the poſition *mn*, it is eaſily ſhown by the ſame kind of argument, that the inclination is increaſed while the moon paſſes from *m* to Q, then diminiſhes for the remainder of the firſt 90°, or Q*a*, and is afterwards increaſed for the other 90°, or *an*; and the ſame may be proved for the other half revolution *n*R*m*. Conſequently, while the nodes are moving from the quadratures to the conjunction and oppoſition, the inclination is increaſed by the ſame degrees as it before was diminiſhed, till they arrive at the conjunction and oppoſition; at which time it returns to its firſt quantity, being then greateſt of all.

"The line of the nodes in the courſe of one entire revolution with reſpect to the ſun, is twice in the quadratures and twice in the conjunction and oppoſition. Therefore the inclination of the moon's orbit to the ecliptic is diminiſhed and increaſed by turns twice in every revolution of the nodes.

"All the irregularities of the moon's motion are a little greater when in the half of its orbit neareſt the ſun, than when it is in the other half; the chief reaſon of which is, that the difference between the ſquares of the moon's and earth's diſtances from the ſun is greater in proportion to the ſquares themſelves, in the former than in the latter caſe at equal elongations from the quadrature; and conſequently the diſturbing forces muſt be more conſiderable.

"Although the moon in reality revolves about the common centre of gravity between her and the earth, and not about the earth itſelf, and conſequently their motions and irregularities are ſimilar, and not confined to the moon alone; yet it may be eaſily conceived, that the concluſions are not affected in any degree that may be here regarded, when, for the ſake of conciſeneſs, we ſuppoſe one of the two bodies to be quieſcent, and the other to revolve about it.

"Irregularities of the ſame kind take place among the primary planets, by their mutual actions on each other; but the quantities are not conſiderable. Hence the apſides of the planets are found to move in conſequentia, but ſo very ſlowly that ſome have doubted whether they move at all. The motions of the aphelia of Saturn, Jupiter, Mars, the Earth, Venus, and Mercury, as deduced from the compariſon of diſtant obſervations, are reſpectively 2° 30′, 1° 43′ 20″, 1° 51′ 40″, 1° 49′ 10″, 4° 10′, 1° 57′ 40″, in a century.

"The actions of the inferior planets on each other are very minute, on account of the ſmallneſs of their bulks; but thoſe of Jupiter and Saturn are not altogether inſenſible. When Jupiter is between the Sun and Saturn, its whole attraction acts upon the latter and increaſes the gravity of that planet towards the ſun. This is found by comparing the reſpective maſſes of Jupiter and the Sun; and the reſpective ſquares of their diſtances from Saturn, to be equal to $\frac{1}{211}$ of the Sun's action upon Saturn. That planet, on the other hand, at the conjunction, acts upon Jupiter and the Sun in the ſame direction; and therefore diſturbs their relative poſition only ſo far as its actions on each are not equal. The difference of theſe actions is found, by the ſame principles, to be $\frac{1}{1923}$ of Jupiter's whole gravity."

SECT. VI. *Of the Ebbing and Flowing of the Sea, and the Phenomena of the Harveſt and Horizontal Moon.*

336
Cauſe of the tides diſcovered by Kepler

THE cauſe of the tides was diſcovered by Kepler, who, in his *Introduction to the Phyſic of the Heavens*, thus explains it: "The orb of the attracting power, which is in the moon, is extended as far as the earth; and draws the waters under the torrid zone, acting upon places where it is vertical, inſenſibly on confined ſeas and bays, but ſenſibly on the ocean whoſe beds are large and where the waters have the liberty of reciprocation, that is, of riſing and falling." And in the 70th page of his *Lunar Aſtronomy*—"But the cauſe of the tides of the ſea appears to be the bodies of the ſun and moon drawing the waters of the ſea." This hint being given, the immortal Sir Iſaac Newton improved it, ASTRONOMY Plate LXXIX

Fig. 177

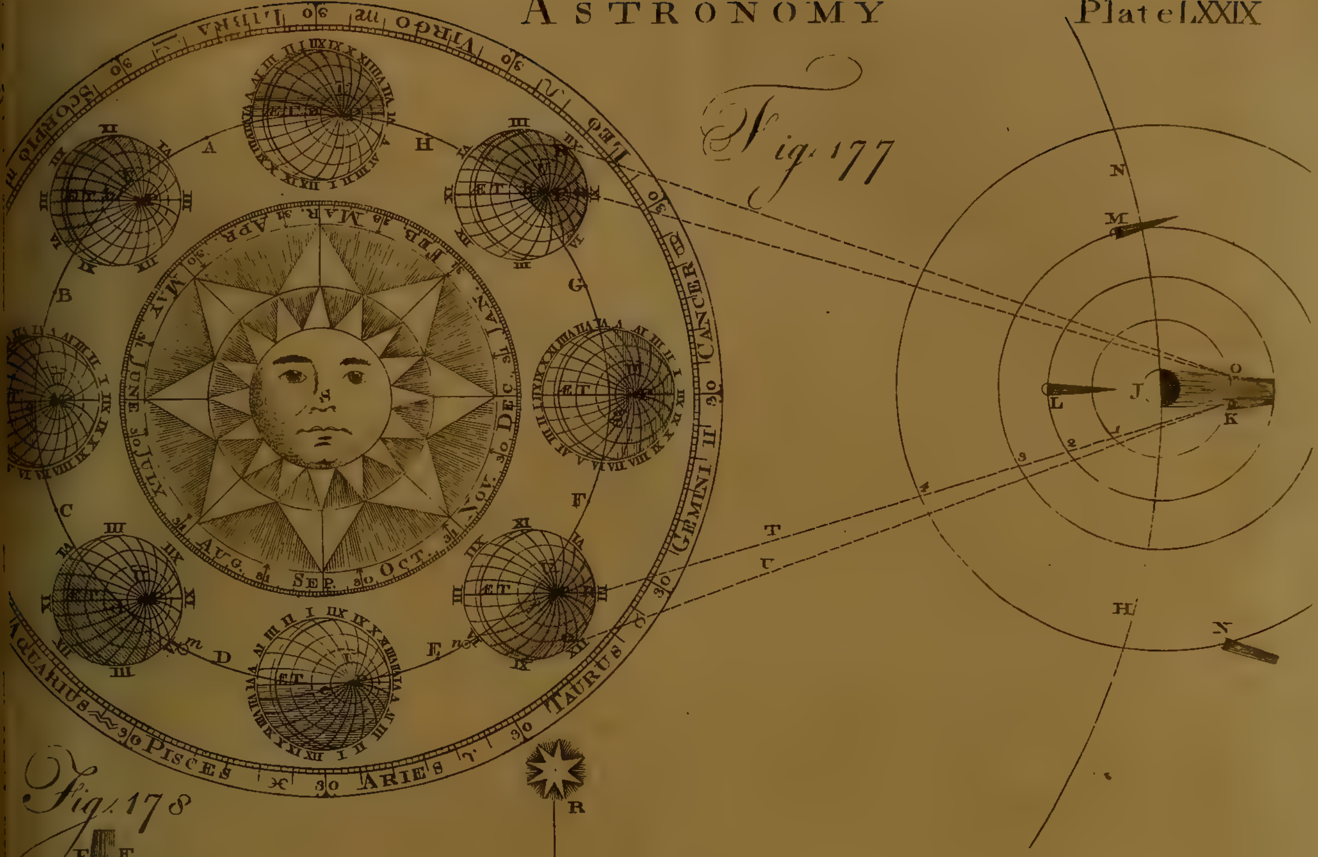


Fig. 178

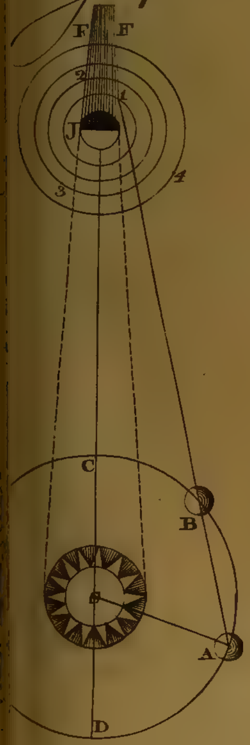


Fig. 179

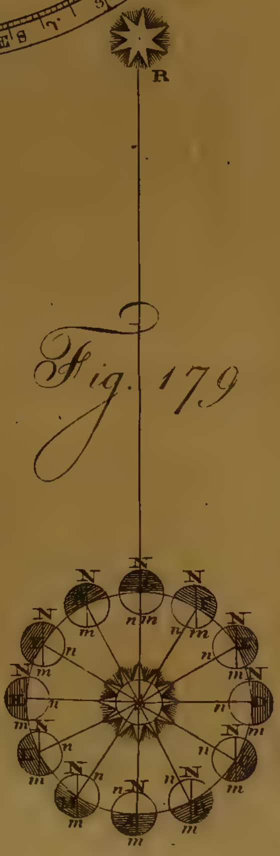
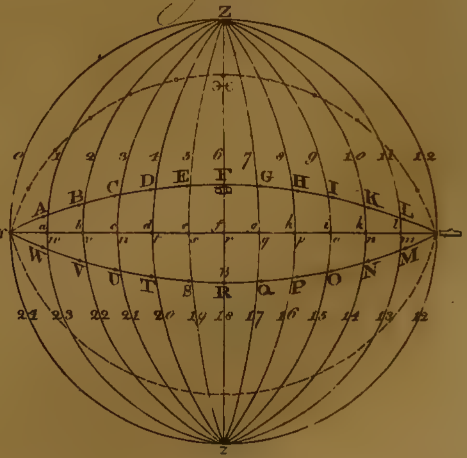


Fig. 180



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and wrote ſo amply on the ſubject, as to make the theory of the tides in a manner quite his own, by diſcovering the cauſe of their riſing on the ſide of the earth oppoſite to the moon. For Kepler believed that the preſence of the moon occaſioned an impulſe which cauſed another in her abſence.

Fig. 189.

It has been already obſerved, that the power of gravity diminiſhes as the ſquare of the diſtance increaſes; and therefore the waters at Z on the ſide of the earth ABCDEFGH next the moon M are more attracted than the central parts of the earth O by the moon, and the central parts are more attracted by her than the waters on the oppoſite ſide of the earth at *n*: and therefore the diſtance between the earth's centre and the waters on its ſurface under and oppoſite to the moon will be increaſed. For, let there be three bodies at H, O, and D: if they are all equally attracted by the body M, they will all move equally faſt toward it, their mutual diſtances from each other continuing the ſame. If the attraction of M is unequal, then that body which is moſt ſtrongly attracted will move faſteſt, and this will increaſe its diſtance from the other body. Therefore, by the law of gravitation, M will attract H more ſtrongly than it does O, by which the diſtance between H and O will be increaſed; and a ſpectator on O will perceive H riſing higher toward Z. In like manner, O being more ſtrongly attracted than D, it will move farther towards M than D does: conſequently, the diſtance between O and D will be increaſed; and a ſpectator on O, not perceiving his own motion, will ſee D receding farther from him towards *n*: all effects and appearances being the ſame, whether D recedes from O, or O from D.

Suppoſe now there is a number of bodies, as A, B, C, D, E, F, G, H, placed round O, ſo as to form a flexible or fluid ring: then, as the whole is attracted towards M, the parts at H and D will have their diſtance from O increaſed; whilſt the parts at B and F being nearly at the ſame diſtance from M as O is, theſe parts will not recede from one another; but rather, by the oblique attraction of M, they will approach nearer to O. Hence, the fluid ring will form itſelf into an ellipſe ZIBL*n*KFNZ, whoſe longer axis *n* OZ produced will paſs through M, and its ſhorter axis BOF will terminate in B and F. Let the ring be filled with fluid particles, ſo as to form a ſphere round O; then, as the whole moves towards M, the fluid ſphere being lengthened at Z and *n*, will aſſume an oblong or oval form. If M is the moon, O the earth's centre, ABCDEFGH the ſea covering the earth's ſurface, it is evident, by the above reaſoning, that whilſt the earth by its gravity falls toward the moon, the water directly below her at B will ſwell and riſe gradually towards her, alſo the water at D will recede from the centre [ſtrictly ſpeaking, the centre recedes from D], and riſe on the oppoſite ſide of the earth; whilſt the water at B and F is depreſſed, and falls below the former level. Hence as the earth turns round its axis from the moon to the moon again in 24⅘ hours, there will be two tides of flood and two of ebb in that time, as we find by experience.

364 Why the tides are high at full moon.

As this explanation of the ebbing and flowing of the ſea is deduced from the earth's conſtantly falling towards the moon by the power of gravity, ſome may find a difficulty in conceiving how this is poſſible, when the moon is full, or in oppoſition to the ſun; ſince the earth revolves about the ſun, and muſt continually fall towards it, and therefore cannot fall contrary ways at the ſame time: or if the earth is conſtantly falling towards the moon, they muſt come together at laſt. To remove this difficulty, let it be conſidered, that it is not the centre of the earth that deſcribes the annual orbit round the ſun, but the (E) common centre of gravity of the earth and moon together: and that whilſt the earth is moving round the ſun, it alſo deſcribes a circle round that centre of gravity; going as many times round it in one revolution about the ſun as there are lunations or courſes of the moon round the earth in a year: and therefore the earth is conſtantly falling towards the moon from a tangent to the circle it deſcribes round the ſaid common centre of gravity. Let M be the moon, TW part of the moon's orbit, and C the centre of gravity of the earth and moon; whilſt the moon goes round her orbit, the centre of the earth deſcribes the circle *d g e* round C, to which circle *g a k* is a tangent; and therefore when the moon has gone from M to a little paſt W, the earth has moved from *g* to *e*; and in that time has fallen towards the moon, from the tangent at *a* to *e*: and ſo on, round the whole circle.

Fig. 190.

365 Influence of the ſun in raiſing tides.

The ſun's influence in raiſing the tides is but ſmall in compariſon of the moon's; for though the earth's diameter bears a conſiderable proportion to its diſtance from the moon, it is next to nothing when compared to its diſtance from the ſun. And therefore the difference of the ſun's attraction on the ſides of the earth under and oppoſite to him, is much leſs than the difference of the moon's attraction on the ſides of the earth under and oppoſite to her; and therefore the moon muſt raiſe the tides much higher than they can be raiſed by the ſun.

366 Why they are not higheſt when the moon is in the meridian.

On this theory, the tides ought to be higheſt directly under and oppoſite to the moon; that is, when the moon is due north and ſouth. But we find, that in open ſeas, where the water flows freely, the Moon M is generally paſt the north and ſouth meridian, as at *p*, when it is high water at Z and at *n*. The reaſon is obvious: for though the moon's attraction was to ceaſe altogether when ſhe was paſt the meridian, yet the motion of aſcent communicated to the water before that time would make it continue to riſe for ſome time after; much more muſt it do ſo when the attraction is only diminiſhed; as a little impulſe given to a moving ball will cauſe it ſtill to move farther than otherwiſe it

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(E) This centre is as much nearer the earth's centre than the moon's as the earth is heavier, or contains a greater quantity of matter than the moon, namely, about 40 times. If both bodies were ſuſpended on it, they would hang *in æquilibrio*. So that dividing 240,000 miles, the moon's diſtance from the earth's centre, by 40, the exceſs of the earth's weight above the moon's the quotient will be 6000 miles, which is the diſtance of the common centre of gravity of the earth and moon from the earth's centre.

Ebbing and flowing of the Sea.

could have done; and as experience ſhows, that the day is hotter about three in the afternoon, than when the ſun is on the meridian, becauſe of the increaſe made to the heat already imparted.

The tides anſwer not always to the ſame diſtance of the moon from the meridian at the ſame places; but are variouſly affected by the action of the ſun, which brings them on ſooner when the moon is in her firſt and third quarters, and keeps them back later when ſhe is in her ſecond and fourth: becauſe, in the former caſe, the tide raiſed by the ſun alone would be earlier than the tide raiſed by the moon; and, in the latter caſe, later.

The moon goes round the earth in an elliptic orbit; and therefore, in every lunar month, ſhe approaches nearer to the earth than her mean diſtance, and recedes farther from it. When ſhe is neareſt, ſhe attracts ſtrongeſt, and ſo raiſes the tides moſt; the contrary happens when ſhe is fartheſt, becauſe of her weaker attraction. When both luminaries are in the equator, and the moon in perigee, or at her leaſt diſtance from the earth, ſhe raiſes the tides higheſt of all, eſpecially at her conjunction and oppoſition; both becauſe the equatorial parts have the greateſt centrifugal force from their deſcribing the largeſt circle, and from the concurring actions of the ſun and moon. At the change, the attractive forces of the ſun and moon being united, they diminiſh the gravity of the waters under the moon, and their gravity on the oppoſite ſide is diminiſhed by means of a greater centrifugal force. At the full, whilſt the moon raiſes the tide under and oppoſite to her, the ſun, acting in the ſame line, raiſes the tide under and oppoſite to him; whence their conjoint effect is the ſame as at the change; and, in both caſes, occaſion what we call the *Spring Tides*. But at the quarters the ſun's action on the waters at O and H diminiſhes the effect of the moon's action on the water at Z and N; ſo that they riſe a little under and oppoſite to the ſun at O and H, and fall as much under and oppoſite to the moon at Z and N; making what we call the *Neap Tides*, becauſe the ſun and moon then act croſs-wiſe to each other. But theſe tides happen not till ſome time after; becauſe in this, as in other caſes, the actions do not produce the greateſt effect when they are at the ſtrongeſt, but ſome time afterwards.

The ſun, being nearer the earth in winter than in ſummer, is of courſe nearer to it in February and October than in March and September; and therefore the greateſt tides happen not till ſome time after the autumnal equinox, and return a little before the vernal.

The ſea, being thus put into motion, would continue to ebb and flow for ſeveral times, even though the ſun and moon were annihilated, or their influence ſhould ceaſe; as, if a baſon of water were agitated, the water would continue to move for ſome time after the baſon was left to ſtand ſtill; or like a pendulum, which, having been put in motion by the hand, continues to make ſeveral vibrations without any new impulſe.

When the moon is in the equator, the tides are equally high in both parts of the lunar day, or time of the moon's revolving from the meridian to the meridian again, which is 24 hours 50 minutes. But as the moon declines from the equator towards either pole, the tides are alternately higher and lower at places having north or ſouth latitude. For one of the higheſt elevations, which is that under the moon, follows her towards the pole to which ſhe is neareſt, and the other declines towards the oppoſite pole; each elevation deſcribing parallels as far diſtant from the equator, on oppoſite ſides, as the moon declines from it to either ſide; and conſequently the parallels deſcribed by theſe elevations of the water are twice as many degrees from one another as the moon is from the equator; increaſing their diſtance as the moon increaſes her declination, till it be at the greateſt, when the ſaid parallels are, at a mean ſtate, 47 degrees from one another: and on that day, the tides are moſt unequal in their heights. As the moon returns towards the equator, the parallels deſcribed by the oppoſite elevations approach towards each other, until the moon comes to the equator, and then they coincide. As the moon declines towards the oppoſite pole, at equal diſtances, each elevation deſcribes the ſame parallel in the other part of the lunar day, which its oppoſite elevation deſcribed before. Whilſt the moon has north declination, the greateſt tides in the northern hemiſphere are when ſhe is above the horizon; and the reverſe whilſt her declination is ſouth. Let NESQ be the earth, NSC its axis, EQ Fig. 192, 193, 194. the equator, T ♋ the tropic of Cancer, *t* ♑ the tropic of Capricorn, *a b* the arctic circle, *cd* the antarctic, N the north pole, S the ſouth pole, M the moon, F and G the two eminences of water, whoſe loweſt parts are at *a* and *d*, at N and S, and at *b* and *c*, always 90 degrees from the higheſt. Now, when the moon is in her greateſt north declination at M, the higheſt elevation G under her is on the tropic of Cancer T ♋, and the oppoſite elevation F on the tropic of Capricorn *t* ♑; and theſe two elevations deſcribe the tropics by the earth's diurnal rotation. All places in the northern hemiſphere ENQ have the higheſt tides when they come into the poſition *b* ♋ Q, under the moon: and the loweſt tides when the earth's diurnal rotation carries them into the poſition *a* TE, on the ſide oppoſite to the moon; the reverſe happens at the ſame time in the ſouthern hemiſphere ESQ, as is evident to ſight. The axis of the tides *a* C *d* has now its poles *a* and *d* (being always 90 degrees from the higheſt elevations) in the arctic and antarctic circles; and therefore it is plain, that at theſe circles there is but one tide of flood, and one of ebb, in the lunar day. For, when the point *a* revolves half round to *b*, in 12 lunar hours, it has a tide of flood; but when it comes to the ſame point *a* again in 12 hours more, it has the loweſt ebb. In ſeven days afterward, the moon M comes to the equinoctial circle, and is over the equator EQ, when both elevations deſcribe the equator; and in both hemiſpheres, at equal diſtances from the equator, the tides are equally high in both parts of the lunar day. The whole phenomena being reverſed, when the moon has ſouth declination, to what they were when her declination was north, require no farther deſcription.

In the three laſt-mentioned figures, the earth is orthographically projected on the plane of the meridian; but in order to deſcribe a particular phenomenon, we now project it on the plane of the ecliptic. Let HZON be the earth and ſea, FED the equator, T Fig. 191. the tropic of Cancer, C the arctic circle, P the north pole, and the curves, 1, 2, 3, &c. 24 meridians or hour-circles, interſecting each other in the poles; AGM is the moon's orbit, S the ſun, M the moon, Z the water elevated under the moon, and N the oppoſite equal elevation. As the loweſt parts of the water are always 90 degrees from the higheſt, when the moon is in either of the tropics (as at M), the elevation Z is on the tropic of Capricorn, and the oppoſite elevation N on the tropic of Cancer; the low-water circle HCO touches the polar circles at C; and the high-water circle ETP6 goes over the poles at P, and divides every parallel of latitude into two equal ſegments. In this caſe, the tides upon every parallel are alternately higher and lower; but they return in equal times: the point T, for example, on the tropic of Cancer (where the depth of the tide is repreſented by the breadth of the dark ſhade), has a ſhallower tide of flood at T than when it revolves half round from thence to 6, according to the order of the numeral figures; but it revolves as ſoon from 6 to T as it did from T to 6. When the moon is in the equinoctial, the elevations Z and N are tranſferred to the equator at O and H, and the high and low-water circles are got into each other's former places; in which caſe the tides return in unequal times, but are equally high in both parts of the lunar day: for a place at I (under D) revolving as formerly, goes ſooner from I to II (under F) than from II to I, becauſe the parallel it deſcribes is cut into unequal ſegments by the high water circle HCO: but the points I and II being equidiſtant from the pole of the tides at C, which is directly under the pole of the moon's orbit MGA, the elevations are equally high in both parts of the day.

367 Tides turn on the axis of the moon's orbit.

And thus it appears, that as the tides are governed by the moon, they muſt turn on the axis of the moon's orbit, which is inclined 23¼ degrees to the earth's axis at a mean ſtate: and therefore the poles of the tides muſt be ſo many degrees from the poles of the earth, or in oppoſite points of the polar circles, going round theſe circles in every lunar day. It is true, that according to fig. 194. when the moon is vertical to the equator ECQ, the poles of the tides ſeem to fall in with the poles of the world N and S: but when we conſider that FGH is under the moon's orbit, it will appear, that when the moon is over H, in the tropic of Capricorn, the north pole of the tides (which can be no more than 90 degrees from under the moon) muſt be at C in the arctic circle, not at P the north pole of the earth; and as the moon aſcends from H to G in her orbit, the north pole of the tides muſt ſhift from *c* to *a* in the arctic circle, and the ſouth poles as much in the antarctic.

It is not to be doubted, but that the earth's quick rotation brings the poles of the tides nearer to the poles of the world, than they would be if the earth were at reſt and the moon revolved about it only once a month; for otherwiſe the tides would be more unequal in their heights and times of their return, than we find they are. But how near the earth's rotation may bring the poles of its axis and thoſe of the tides together, or how far the preceding tides may affect thoſe which follow, ſo as to make them keep up nearly to the ſame heights and times of ebbing and flowing, is a problem more fit to be ſolved by obſervation than by theory.

Thoſe who have opportunity to make obſervations, and chooſe to ſatisfy themſelves whether the tides are really affected in the above manner by the different poſitions of the moon, eſpecially as to the unequal times of their returns, may take this general rule for knowing when they ought to be ſo affected. When the earth's axis inclines to the moon, the northern tides, if not retarded in their paſſage through ſhoals and channels, nor affected by the winds, ought to be greateſt when the moon is above the horizon, leaſt when ſhe is below it; and quite the reverſe when the earth's axis declines from her: but in both caſes, at equal intervals of time. When the earth's axis inclines ſidewiſe to the moon, both tides are equally high, but they happen at unequal intervals of time. In every lunation the earth's axis inclines once to the moon, once from her, and twice ſidewiſe to her, as it does to the ſun every year; becauſe the moon goes round the ecliptic every month, and the ſun but once in a year. In ſummer, the earth's axis inclines towards the moon when new; and therefore the day-tides in the north ought to be higheſt, and night-tides loweſt, about the change: at the full, the reverſe. At the quarters, they ought to be equally high, but unequal in their returns; becauſe the earth's axis then inclines ſidewiſe to the moon. In winter, the phenomena are the ſame at full moon as in ſummer at new. In autumn, the earth's axis inclines ſidewiſe to the moon when new and full; therefore, the tides ought to be equally high and uneven in their returns at theſe times. At the firſt quarter, the tides of flood ſhould be leaſt when the moon is above the horizon, greateſt when ſhe is below it: and the reverſe at her third quarter. In ſpring, the phenomena of the firſt quarter anſwer to thoſe of the third quarter in autumn; and *vice verſa.* The nearer any time is to either of theſe ſeaſons, the more the tides partake of the phenomena of theſe ſeaſons; and in the middle between any two of them the tides are at a mean ſtate between thoſe of both.

In open ſeas, the tides riſe but to very ſmall heights in proportion to what they do in wide-mouthed rivers, opening in the direction of the ſtream of tide. For in channels growing narrower gradually, the water is accumulated by the oppoſition of the contracting bank: like a gentle wind, little felt on an open plane, but ſtrong and briſk in a ſtreet; eſpecially if the wider end of the ſtreet be next the plain, and in the way of the wind.

368 Irregularities of tides accounted for.

The tides are ſo retarded in their paſſage thro' different ſhoals and channels, and otherwiſe ſo variouſly affected by ſtriking againſt capes and headlands, that to different places they happen at all diſtances of the moon from the meridian, conſequently at all hours of the lunar day. The tide propagated by the moon in the German ocean, when ſhe is three hours paſt the meridian, takes 12 hours to come from thence to London bridge; where it arrives by the time that a new tide is raiſed in the ocean. And therefore, when the moon has north declination, and we ſhould expect the tide at London to be greateſt when the moon is above the horizon, we find it is leaſt; and the contrary when ſhe has ſouth declination. At ſeveral places it is high-water three hours before the moon comes to the meridian; but that tide which the moon puſhes as it were before her, is only the tide oppoſite to that which was raiſed by her when ſhe was nine hours paſt the oppoſite meridian.

There are no tides in lakes, becauſe they are generally

rally ſo ſmall, that when the moon is vertical ſhe attracts every part of them alike, and therefore by rendering all the water equally light, no part of it can be raiſed higher than another. The Mediterranean and Baltic ſeas have very ſmall elevations, becauſe the inlets by which they communicate with the ocean are ſo narrow, that they cannot, in ſo ſhort a time, receive or diſcharge enough to raiſe and ſink their ſurfaces ſenſibly.

369 Why the moon does not affect the barometer.

Air being lighter than water, and the ſurface of the atmoſphere being nearer to the moon than the ſurface of the ſea, it cannot be doubted that the moon raiſes much higher tides in the air than in the ſea. And therefore many have wondered why the mercury does not ſink in the barometer when the moon's action on the particles of air makes them lighter as ſhe paſſes over the meridian. But we muſt conſider, that as theſe particles are rendered lighter, a greater number of them are accumulated, until the deficiency of gravity be made up by the height of the column; and then there is an equilibrium, and conſequently an equal preſſure upon the mercury as before; ſo that it cannot be affected by the aerial tides. It is very probable, however, that the ſtars which are ſeen through an aerial tide of this kind will have their light more refracted than thoſe which are ſeen through the common depth of the atmoſphere; and this may account for the ſuppoſed refractions by the lunar atmoſphere that have been ſometimes obſerved.

370 Of the harveſt moon.

It is generally believed that the moon riſes about 50 minutes later every day than on the preceding; but this is true only with regard to places on the equator. In places of conſiderable latitude there is a remarkable difference, eſpecially in the harveſt time. Here the autumnal full moon riſes very ſoon after ſun-ſet for ſeveral evenings together. At the polar circles, where the mild ſeaſon is of very ſhort duration, the autumnal full moon riſes at ſun-ſet from the firſt to the third quarter. And at the poles, where the ſun is for half a year abſent, the winter full-moons ſhine conſtantly without ſetting from the firſt to the third quarter.

All theſe phenomena are owing to the different angles made by the horizon and different parts of the moon's orbit; and may be explained in the following manner.

The plane of the equinoctial is perpendicular to the earth's axis; and therefore as the earth turns round its axis, all parts of the equinoctial make equal angles with the horizon both at riſing and ſetting: ſo that equal portions of it always riſe or ſet in equal times. Conſequently, if the moon's motions were equable, and in the equinoctial, at the rate of 12 degrees 11 min. from the ſun every day, as it is in her orbit, ſhe would riſe and ſet 50 minutes later every day than on the preceding: for 12 deg. 11 min. of the equinoctial riſe or ſet in 50 minutes of time in all latitudes.

But the moon's motion is ſo nearly in the ecliptic, that we may conſider her at preſent as moving in it. Now the different parts of the ecliptic, on account of its obliquity to the earth's axis, make very different angles with the horizon as they riſe or ſet. Thoſe parts or ſigns which riſe with the ſmalleſt angles ſet with the greateſt, and *vice verſa*. In equal times, whenever this angle is leaſt, a greater portion of the ecliptic riſes than when the angle is larger; as may be ſeen by elevating the pole of a globe to any conſiderable latitude, and then turning it round its axis in the horizon. Conſequently, when the moon is in thoſe ſigns which riſe or ſet with the ſmalleſt angles, ſhe riſes or ſets with the leaſt difference of time; and with the greateſt difference in thoſe ſigns which riſe or ſet with the greateſt angles.

Fig. 187.

Let FUP be the axis of a globe, ♋ TR the tropic of Cancer, L*t* ♑ the tropic of Capricorn, ♋ EU ♑ the ecliptic touching both the tropics, which are 47 degrees from each other, and AB the horizon. The equator, being in the middle between the tropics, is cut by the ecliptic into two oppoſite points, which are the beginnings of Aries and Libra; K is the hour-circle with its index, F the north pole of the globe elevated to a conſiderable latitude, ſuppoſe 40 degrees above the horizon; and P the ſouth pole depreſſed as much below it. Becauſe of the oblique poſition of the ſphere in this latitude, the ecliptic has the high elevation N ♋ above the horizon, making the angle NU ♋ of 73$\frac{1}{2}$ degrees with it when Cancer is on the meridian, at which time Libra riſes in the eaſt. But let the globe be turned half round it axis, till Capricorn comes to the meridian and Aries riſes in the eaſt; and then the ecliptic will have the low elevation NL above the horizon, making only an angle NUL of 26$\frac{1}{2}$ degrees with it; which is 47 degrees leſs than the former angle, equal to the diſtance between the tropics.

In Northern latitudes, the ſmalleſt angle made by the ecliptic and horizon is when Aries riſes, at which time Libra ſets; the greateſt when Libra riſes, at which time Aries ſets. From the riſing of Aries to the riſing of Libra (which is twelve (A) ſidereal hours) the angle increaſes; and from the riſing of Libra to the riſing of Aries, it decreaſes in the ſame proportion. By this article and the preceding, it appears, that the ecliptic riſes faſteſt about Aries, and floweſt about Libra.

On the parallel of London, as much of the ecliptic riſes about Piſces and Aries in two hours as the moon goes through in ſix days: and therefore, whilſt the moon is in theſe ſigns, ſhe differs but two hours in riſing for ſix days together; that is, about 20 minutes later every day or night than on the preceding, at a mean rate, But in 14 days afterwards the moon comes to Virgo and Libra, which are the oppoſite ſigns to Piſces and Aries; and then ſhe differs almoſt four times as much in riſing; namely, one hour and about fifteen minutes later every day or night than the former, whilſt ſhe is in theſe ſigns.

As the moon can never be full but when ſhe is oppoſite to the ſun, and the ſun is never in Virgo and Libra but in our autumnal months, it is plain that the moon

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(A) The ecliptic, together with the fixed ſtars, make 366$\frac{1}{4}$ apparent diurnal revolutions about the earth in a year; the ſun only 365$\frac{1}{4}$. Therefore the ſtars gain 3 minutes 56 ſeconds upon the ſun every day: ſo that a ſidereal day contains only 23 hours 56 minutes of mean ſolar time, and a natural or ſolar day 24 hours. Hence 12 ſidereal hours are 11 minutes 58 ſeconds ſhorter than 12 ſolar.

Fig. 181

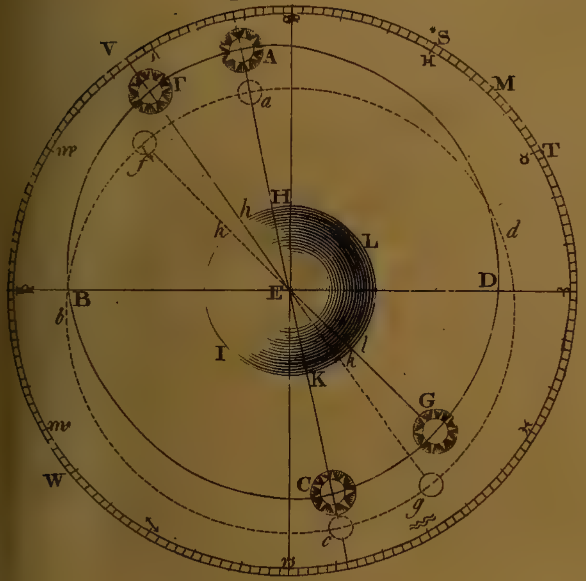


Fig. 182

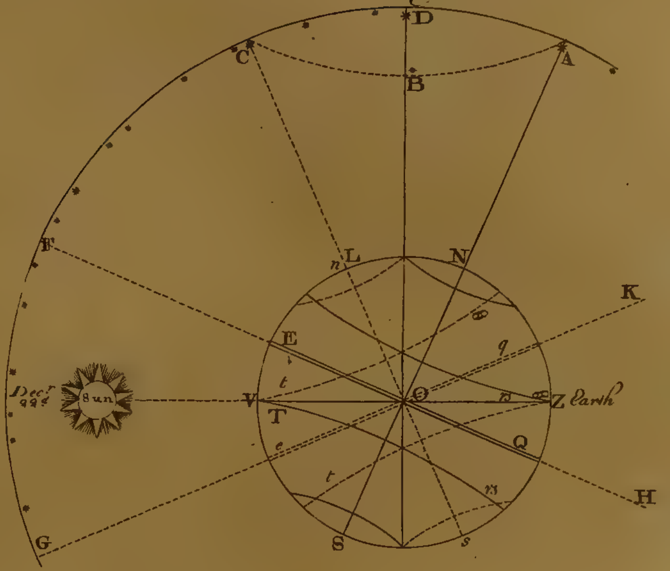


Fig. 183

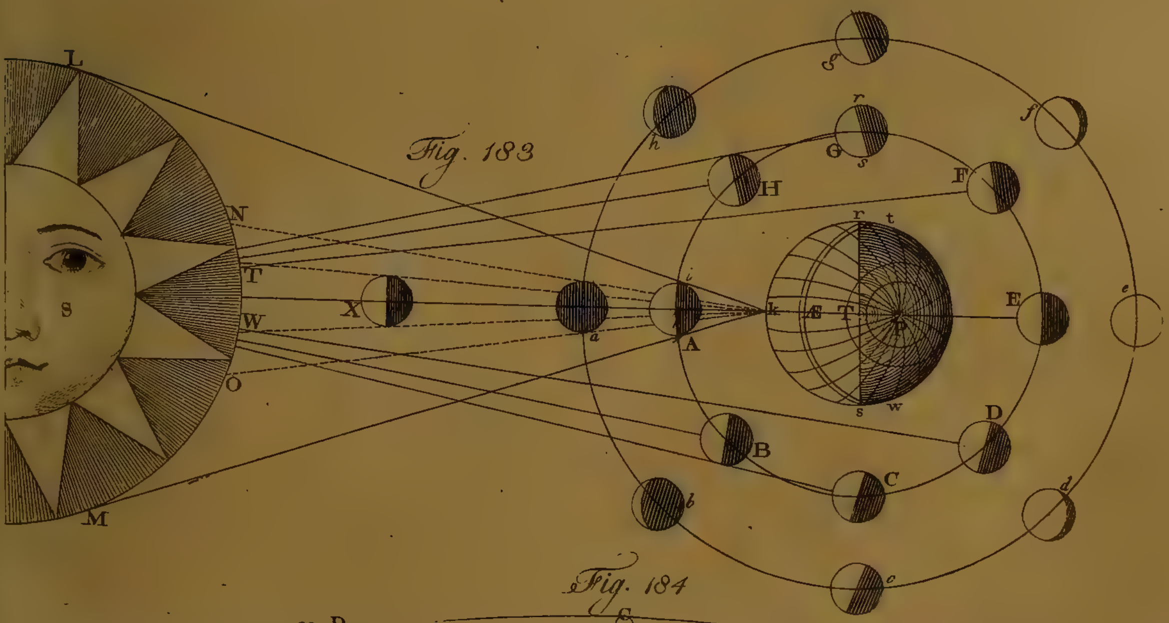


Fig. 184

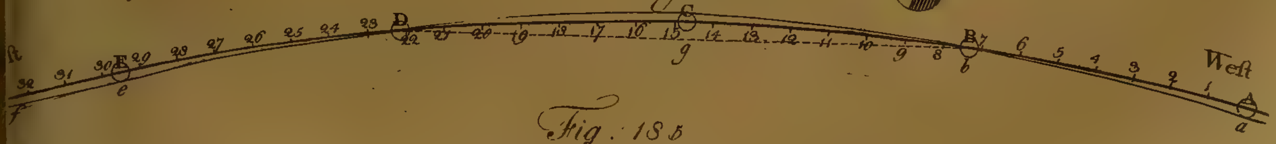
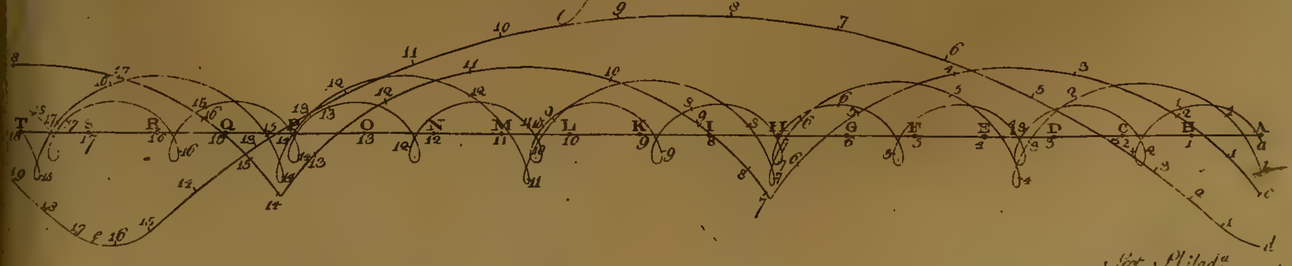


Fig: 185



Scot Philada

moon is never full in the oppoſite ſigns, Piſces and Aries, but in thoſe two months. And therefore we can have only two full moons in the year, which riſe ſo near the time of ſun-ſet for a week together as abovementioned. The former of theſe is called the *harveſt moon*, and the latter the *hunter's moon.*

371 Why the ſame phenomenon is not obſerved at other times.

Here it will probably be aſked, why we never obſerve this remarkable riſing of the moon but in harveſt, ſeeing ſhe is in Piſces and Aries twelve times in the year beſides; and muſt then riſe with as little difference of time as in harveſt? The anſwer is plain; for in winter theſe ſigns riſe at noon; and being then only a quarter of a circle diſtant from the ſun, the moon in them is in her firſt quarter: but when the ſun is above the horizon, the moon's riſing is neither regarded nor perceived. In ſpring, theſe ſigns riſe with the ſun, becauſe he is then in them; and as the moon changeth in them at that time of the year, ſhe is quite inviſible. In ſummer they riſe about midnight; and the ſun being then three ſigns, or a quarter of a circle, before them, the moon is in them about her third quarter; when riſing ſo late, and giving but very little light, her riſing paſſes unobſerved. And in autumn, theſe ſigns, being oppoſite to the ſun, riſe when he ſets, with the moon in oppoſition, or at the full, which makes her riſing very conſpicuous.

At the equator, the north and ſouth poles lie in the horizon; and therefore the ecliptic makes the ſame angle ſouthward with the horizon when Aries riſes, as it does northward when Libra riſes. Conſequently, as the moon riſes and ſets nearly at equal angles with the horizon all the year round, and about 50 minutes later every day or night than on the preceding, there can be no particular harveſt-moon at the equator.

The farther that any place is from the equator, if it be not beyond the polar circle, the more the angle is diminiſhed which the ecliptic and horizon make when Piſces and Aries riſe: and therefore when the moon is in theſe ſigns, ſhe riſes with a nearly proportionable difference later every day than on the former; and is for that reaſon the more remarkable about the full, until we come to the polar circles, or 66 degrees from the equator; in which latitude the ecliptic and horizon become coincident every day for a moment, at the ſame ſidereal hour (or 3 minutes 56 ſeconds ſooner every day than the former), and the very next moment one half of the ecliptic, containing Capricorn, Aquarius, Piſces, Aries, Taurus, and Gemini, riſes, and the oppoſite half ſets. Therefore, whilſt the moon is going from the beginning of Capricorn to the beginning of Cancer, which is almoſt 14 days, ſhe riſes at the ſame ſidereal hour; and in autumn juſt at ſun-ſet, becauſe all that half of the ecliptic, in which the ſun is at that time, ſets at the ſame ſidereal hour, and the oppoſite half riſes; that is, 3 minutes 56 ſeconds of mean ſolar time, ſooner every day than on the day before. So whilſt the moon is going from Capricorn to Cancer, ſhe riſes earlier every day than on the preceding; contrary to what ſhe does at all places between the polar circles. But during the above 14 days, the moon is 24 ſidereal hours later in ſetting: for the ſix ſigns which riſe all at once on the eaſtern ſide of the horizon are 24 hours in ſetting on the weſtern ſide of it.

In northern latitudes the autumnal full moons are in Piſes and Aries, and the vernal full moons in Virgo and Libra; in ſouthern latitudes, juſt the reverſe, becauſe the ſeaſons are contrary. But Virgo and Libra riſe at as ſmall angles with the horizon in ſouthern latitudes, as Piſces and Aries do in the northern; and therefore the harveſt-moons are juſt as regular on one ſide of the equator as on the other.

As theſe ſigns, which riſe with the leaſt angles, ſet with the greateſt, the vernal full moons differ as much in their times of riſing every night as the autumnal full moons differ in their times of ſetting; and ſet with as little difference as the autumnal full moons riſe; the one being in all caſes the reverſe of the other.

Hitherto, for the ſake of plainneſs, we have ſuppoſed the moon to move in the ecliptic, from which the ſun never deviates. But the orbit in which the moon really moves is different from the ecliptic; one half being elevated 5⅓ degrees above it, and the other half as much depreſſed below it. The moon's orbit therefore interſects the ecliptic in two points diametrically oppoſite to each other; and theſe interſections are called the *Moon's Nodes.* So the moon can never be in the ecliptic but when ſhe is in either of her nodes, which is at leaſt twice every courſe from change to change, and ſometimes thrice: For, as the moon goes almoſt a whole ſign more than around her orbit from change to change; if ſhe paſſes by either node about the time of change, ſhe will paſs by the other in about 14 days after, and come round to the former node two days again before the next change. That node from which the moon begins to aſcend northward, or above the ecliptic, in northern latitudes, is called the *Aſcending Node*; and the other the *Deſcending Node*, becauſe the moon, when ſhe paſſes by it, deſcends below the ecliptic ſouthward.

The moon's oblique motion with regard to the ecliptic cauſes ſome difference in the times of her riſing and ſetting from what is already mentioned. For when ſhe is northward of the ecliptic, ſhe riſes ſooner and ſets later than if ſhe moved in the ecliptic: and when ſhe is ſouthward of the ecliptic, ſhe riſes later and ſets ſooner. This difference is variable, even in the ſame ſigns, becauſe the nodes ſhift backward about 19⅓ degrees in the ecliptic every year; and ſo go round it contrary to the order of the ſigns in 18 years 225 days.

When the aſcending node is in Aries, the ſouthern half of the moon's orbit makes an angle of 5⅓ degrees leſs with the horizon than the ecliptic does, when Aries riſes in northern latitudes: for which reaſon the moon riſes with leſs difference of time whilſt ſhe is in Piſces and Aries, than ſhe would do if ſhe kept in the ecliptic. But in 9 years and 112 days afterward, the deſcending node comes to Aries; and then the moon's orbit makes an angle 5⅓ degrees greater with the horizon when Aries riſes, than the ecliptic does at that time; which cauſes the moon to riſe with greater difference of time in Piſces and Aries than if ſhe moved in the ecliptic.

To be a little more particular: When the aſcending node is in Aries, the angle is only 9⅔ degrees on the parallel of London when Aries riſes; but when the deſcending node comes to Aries, the angle is 20⅓ degrees. This occaſions as great a difference of the moon's riſing in the ſame ſigns every nine years, as there would be on two parallels 10⅔ degrees from one another, if the moon's courſe were in the ecliptic.

372 Revolution of the moon's nodes.

As there is a complete revolution of the nodes in 18⅔ years, there muſt be a regular period of all the varieties which can happen in the riſing and ſetting of the moon during that time. But this ſhifting of the nodes never affects the moon's riſing ſo much, even in her quickeſt deſcending latitude, as not to allow us ſtill the benefit of her riſing nearer the time of ſun-ſet for a few days together about the full in harveſt, than when ſhe is full at any other time of the year.

373 Long moon-light in winter at the poles.

At the polar circles, when the ſun touches the ſummer tropic, he continues 24 hours above the horizon; and 24 hours below it, when he touches the winter tropic. For the ſame reaſon, the full moon neither riſes in ſummer nor ſets in winter, conſidering her as moving in the ecliptic. For the winter full moon being as high in the ecliptic as the ſummer ſun, muſt therefore continue as long above the horizon; and the ſummer full moon being as low in the ecliptic as the winter ſun, can no more riſe than he does. But theſe are only the two full moons which happen about the tropics, for all the others riſe and ſet. In ſummer, the full moons are low, and their ſtay is ſhort above the horizon, when the nights are ſhort, and we have leaſt occaſion for moon light: in winter they go high, and ſtay long above the horizon, when the nights are long, and we want the greateſt quantity of moon-light.

At the poles, one half of the ecliptic never ſets, and the other half never riſes: and therefore, as the ſun is always half a year in deſcribing one half of the ecliptic, and as long in going through the other half, it is natural to imagine that the ſun continues half a year together above the horizon of each pole in its turn, and as long below it; riſing to one pole when he ſets to the other. This would be exactly the caſe if there were no refraction: but by the atmoſphere's refracting the ſun's rays, he becomes viſible ſome days ſooner, and continues ſome days longer in ſight, than he would otherwiſe do: ſo that he appears above the horizon of either pole before he has got below the horizon of the other. And, as he never goes more than 23½ degrees below the horizon of the poles, they have very little dark night; it being twilight there, as well as at other places, till the ſun be 18 degrees below the horizon. The full moon, being always oppoſite to the ſun, can never be ſeen while the ſun is above the horizon, except when ſhe is in the northern half of her orbit; for whenever any point of the ecliptic riſes, the oppoſite point ſets. Therefore, as the ſun is above the horizon of the north pole from the 20th of March till 23d of September, it is plain that the moon, when full, being oppoſite to the ſun, muſt be below the horizon during that half of the year. But when the ſun is in the ſouthern half of the ecliptic, he never riſes to the north pole; during which half of the year, every full moon happens in ſome part of the northern half of the ecliptic which never ſets. Conſequently, as the polar inhabitants never ſee the full moon in ſummer, they have her always in the winter, before, at, and after, the full, ſhining for 14 of our days and nights. And when the ſun is at his greateſt depreſſion below the horizon, being then in Capricorn, the moon is at her third quarter in Aries, full in Cancer, and at her firſt quarter in Libra. And as the beginning of Aries is the riſing point of the ecliptic, Cancer the higheſt, and Libra the ſetting point, the moon riſes at her firſt quarter in Aries; is moſt elevated above the horizon, and full, in Cancer; and ſets at the beginning of Libra, in her third quarter, having continued viſible for 14 diurnal rotations of the earth. Thus the poles are ſupplied one-half of the winter-time with conſtant moon-light in the ſun's abſence; and only loſe ſight of the moon from her third to her firſt quarter, while ſhe gives but very little light and could be but of little and ſometimes of no ſervice to them. A bare view of the figure will make this plain: in which let S be the ſun; e, the earth in ſummer, when its north pole *n* inclines towards the ſun; and E the earth in winter, when its north pole declines from him. SEN and NWS is the horizon of the north pole, which is coincident with the equator,; and, in both theſe poſitions of the earth, ♈ ♋ ♎ ♑ is the moon's orbit, in which ſhe goes round the earth, according to the order of the letters *a b c d*, A B C D. When the moon is at *a* ſhe is in her third quarter to the earth at e, and juſt riſing to the north pole *n*; at *b* ſhe changes, and is at the greateſt height above the horizon, as the ſun likewiſe is; at *c* ſhe is in her firſt quarter, ſetting below the horizon; and is loweſt of all under it at *d*, when oppoſite to the ſun, and her enlightened ſide toward the earth. But then ſhe is full in view to the ſouth pole *p*: which is as much turned from the ſun as the north pole inclines toward him. Thus, in our ſummer, the moon is above the horizon of the north pole whilſt ſhe deſcribes the northern half of the ecliptic ♈ ♋ ♎, or from her third quarter to her firſt; and below the horizon during her progreſs through the ſouthern half ♎ ♑ ♈; higheſt at the change, moſt depreſſed at the full. But in winter, when the earth is at E, and its north pole declines from the ſun, the new moon at D is at her greateſt depreſſion below the horizon NWS, and the full moon at B at her greateſt height above it; riſing at her firſt quarter A, and keeping above the horizon till ſhe comes to her third quarter C. At a mean ſtate ſhe is 23½ degrees above the horizon at B and *b*, and as much below it at D and *d*, equal to the inclination of the earth's axis F. S ♋, or S ♑, are, as it were, a ray of light proceeding from the ſun to the earth; and ſhows that when the earth is at e, the ſun is above the horizon, vertical to the tropic of Cancer; and when the earth is at E, he is below the horizon, vertical to the tropic of Capricorn.

Fig. 188.

374 Horizontal moon accounted for by Mr Ferguſon.

The ſun and moon generally appear larger when near the horizon than when at a diſtance from it; for which there have been various reaſons aſſigned. The following account is given by Mr Ferguſon: "Theſe luminaries although at great diſtances from the earth, appear floating as it were on the ſurface of our atmoſphere, HGF*f*cC, a little way beyond the clouds; of which, thoſe about F, directly over our heads at E, are nearer us than thoſe about H or c in the horizon HEc. Therefore, when the ſun or moon appear in the horizon at *c*, they are not only ſeen in a part of the ſky which is really farther from us than if they were at any conſiderable altitude, as about *f*; but they are alſo ſeen through a greater quantity of air and vapours at c than at *f*. Here we have two concurring appearances

Fig. 170.

Harveſt and Horizontal Moon.

ances which deceive our imagination, and cauſe us to refer the ſun and moon to a greater diſtance at their riſing or ſetting about c, than when they are conſiderably high, as at *f*: firſt, their ſeeming to be on a part of the atmoſphere at c, which is really farther than *f* from a ſpectator at E; and, ſecondly, their being ſeen through a groſſer medium when at c than when at *f*, which, by rendering them dimmer, cauſes us to imagine them to be at a yet greater diſtance. And as, in both caſes, they are ſeen much under the ſame angle, we naturally judge them to be largeſt when they ſeem fartheſt from us.

"Any one may ſatisfy himſelf that the moon appears under no greater angle in the horizon than on the meridian, by taking a large ſheet of paper, and rolling it up in the form of a tube, of ſuch a width, that, obſerving the moon through it when ſhe riſes, ſhe may as it were juſt fill the tube; then tie a thread round it to keep it of that ſize; and when the moon comes to the meridian, and appears much leſs to the eye, look at her again through the ſame tube, and ſhe will fill it juſt as much, if not more, than ſhe did at her riſing.

"When the full moon is in her perigee, or at her leaſt diſtance from the earth, ſhe is ſeen under a larger angle, and muſt therefore appear bigger than when ſhe is full at other times: And if that part of the atmoſphere where ſhe riſes be more replete with vapours than uſual, ſhe appears ſo much the dimmer; and therefore we fancy her to be ſtill the bigger, by referring her to an unuſually great diſtance, knowing that no objects which are very far diſtant can appear big unleſs they really be ſo."

375 By Mr Dunn.

To others this ſolution has appeared unſatisfactory; and accordingly Mr Dunn has given the following diſſertation on this phenomenon, Phil. Tranſ. Vol. LXIV.

"1. The ſun and moon, when they are in or near the horizon, appear to the naked eye of the generality of perſons, ſo very large in compariſon with their apparent magnitudes when they are in the zenith, or ſomewhat elevated, that ſeveral learned men have been led to inquire into the cauſe of this phenomenon; and after endeavouring to find certain reaſons, founded on the principles of phyſics, they have at laſt pronounced this phenomenon a mere optical illuſion.

"2. The principal diſſertations which I have ſeen conducing to give any information on this ſubject, or helping to throw any light on the ſame, have been thoſe printed in the Tranſactions of the Royal Society, the Academy of Sciences at Paris, the German Acts, and Dr Smith's Optics; but as all the accounts which I have met with in theſe writings any way relative to this ſubject, have not given me that ſatisfaction which I have deſired, curioſity has induced me to inquire after the cauſe of this ſingular phenomenon in a manner ſomewhat different from that which others have done before me, and by ſuch experiments and obſervations as have appeared to me pertinent; ſome of which have been as follows, viz.

"3. I have obſerved the riſing and ſetting ſun near the viſible horizon, and near riſing grounds elevated above the viſible horizon about half a degree, and found him to appear largeſt when near to the viſible horizon; and particularly a conſiderable alteration of his magnitude and light has always appeared to me from the time of his being in the horizon at riſing, to the time of his being a degree or two above the horizon, and the contrary at his ſetting; which property I have endeavoured to receive as a prejudice, and an impoſition on my ſight and judgment, the uſual reaſons for this appearance.

Harveſt and Horizontal Moon.

"4. I have alſo obſerved that the ſun near the horizon appears to put on the figure of a ſpheroid, having its vertical diameter appearing to the naked eye ſhorter than the horizontal diameter; and, by meaſuring thoſe diameters in a teleſcope, have found the vertical one ſhorter than the other.

"5. I have made frequent obſervations and compariſons of the apparent magnitude of the ſun's diſk, with objects directly under him, when he has been near the horizon, and with ſuch objects as I have found by meaſurement to be of equal breadth with the ſun's diameter; but in the ſudden tranſition of the eye from the ſun to the object, and from the object to the ſun, have always found the ſun to appear leaſt; and that when two right lines have been imaginarily produced by the ſides of thoſe equal magnitudes, they have not appeared to keep parallel, but to meet beyond the ſun.

"6. From theſe and other like circumſtances, I firſt began to ſuſpect that a ſudden dip of the ſun into the horizontal vapours, might ſome how or other be the cauſe of a ſudden apparent change of magnitude; although the horizontal vapours had been diſallowed to be able to produce any other than a refraction in a vertical direction; and, reducing things to calculation, found, that from the time when the ſun is within a diameter or two of the horizon, to the time when he is a ſemidiameter below the horizon, the ſun's rays become paſſable through ſuch a length of medium, reckoning in the direction of the rays, that the total quantity of medium (reckoning both depth and denſity) through which the rays paſs, being compared with the like total depth and denſity through which they paſs at ſeveral elevations, it was proportionable to the difference of apparent magnitude, as appearing to the naked eye.

"7. This circumſtance of ſudden increaſe and decreaſe of apparent magnitude, and as ſudden decreaſe and increaſe of light (for they both go together), ſeemed to me no improbable cauſe of the phenomenon, although I could not then perceive how ſuch vapours might contribute towards enlarging the diameter of the ſun in a horizontal direction.

"8. I therefore examined the ſun's diſk again and again, by the naked eye and by teleſcopes, at different altitudes; and, among ſeveral circumſtances, found the ſolar maculæ to appear larger and plainer to the naked eye, and through a teleſcope, the ſun being near the horizon, than they had appeared the ſame days when the ſun was on the meridian, and to appearance more ſtrongly defined, yet obſcured.

"9. A little before ſun-ſetting, I have often ſeen the edge of the ſun with ſuch protuberances and indentures as have rendered him in appearance a very odd figure; the protuberances ſhooting out far beyond, and the indentures preſſing into the diſk of the ſun; and always, through a teleſcope magnifying 55 times, the the lower limb has appeared with a red glowing arch beneath it, and cloſe to the edge of the ſun, while the other parts have been clear.

Harveſt and Horizontal Moon.

" 10. At ſun-ſetting, theſe protuberances and indentures have appeared to ſlide along the vertical limbs, from the lower limb to the higher, and their vaniſhing, ſo as often to form a ſegment of the ſun's upper limb apparently ſeparated from the diſk for a ſmall ſpace of time.

" 11. At ſun-riſing I have ſeen the like protuberances, indentures and ſlices, above deſcribed; but with this difference of motion, that at ſun-riſing they firſt appear to riſe in the ſun's upper limb, and ſlide or move downward to the lower limb; or which is the ſame thing, they always appear at the riſing and ſetting of the ſun, to keep in the ſame parallels of altitude by the teleſcope. This property has been many times ſo diſcernable, even by the naked eye, that I have obſerved the ſun's upper limb to ſhoot out towards right and left, and move downwards, forming the upper part of the diſk an apparent portion of a leſſer ſpheroid than the lower part at riſing, and the contrary at ſetting. Through the teleſcope this has appeared more plain in proportion to the power of magnifying.

" 11. Theſe protuberances and indentures ſo eaſily meaſurable by the micrometer, whilſt the teleſcope wires appeared ſtrait, enabled me to conclude, that certain ſtrata of the atmoſphere have different refractive powers; and, lying horizontally acroſs the conical or cycloidal ſpace traced out by the rays between the eye and that part of the atmoſphere firſt touched by the rays, muſt have been the cauſe of ſuch apparent protuberances and indentures in an horizontal direction acroſs the ſun's vertical limbs; and alſo that the bottoms of thoſe protuberances and indentures muſt be conſiderably enlarged, and removed to appearance farther from the centre of the diſk than they would have been had there been no ſuch ſtrata to refract.

" 13. Before ſun-riſing, when the ſun has been near the tropic; and the ſky, at the utmoſt extent of the horizon which appeared very clear; and when certain fogs have appeared in ſtrata placed alternately between the hills, and over intervening rivers, valleys, &c. ſo as to admit a ſight of the riſing ſun over thoſe fogs; I have obſerved with admiration the moſt diſtant trees and buſhments, which at other times have appeared ſmall to the naked eye, but while the ſun has been paſſing along a little beneath the horizon obliquely under them, juſt before ſun-riſing, when the ſun has been thus approaching towards trees and buſhments, they have grown apparently very large to the naked eye, and alſo through a teleſcope; and they have loſt that apparent largeneſs as the ſun has been paſſed by them. Thus a few trees ſtanding together on the riſing ground, at the diſtance of a few miles, have appeared to grow up into an apparent mountain. Such apparent mountains formed from trees put on all forms and ſhapes, as ſloping, perpendicular, over-leaning, &c. but ſoon recover their natural appearance when the ſun is paſt by them, or got above the horizon.

" 14. Mountains themſelves, at a diſtance, ſometimes appear larger than at other times. Beaſts and cattle in the midſt of, and being ſurrounded with, water, appear nearer to us than when no water ſurrounds them. Cattle, houſes, trees, all objects on the ſummit of a hill, when ſeen through a fog, and at a proper diſtance, appear enlarged. All bodies admit of larger apparent magnitudes when ſeen through ſome mediums than others.

Harveſt and Horizontal Moon.

" But more particularly,

" 15. I took a cylindrical glaſs-veſſel about two feet high; and having graduated its ſides to inches, I placed it upright on a table, with a piece of paper under the bottom of the glaſs, on which paper were drawn parallel right lines at proper diſtances from each other; and having placed a ſhilling at the bottom of the veſſel, it was nearly as low as the paper. Pouring water into the veſſel, and viewing the ſhilling through the medium of water with one eye, whilſt I beheld with the other eye where the edges of the ſhilling were projected on the paper and its parallels, I found the ſhilling appear larger at every additional inch depth of the water; and this was the caſe if either eye was uſed; and the ſame when the eye was removed far from the ſurface or near to it, or in any proportion thereto.

" 16. I took large veſſels; and, filling them with water, placed different bodies at the bottoms of thoſe veſſels. It always followed, that the greater depth of water I looked through, in a direction from my eye to the objects in the water, the nearer thoſe objects appeared to me. Thus light bodies appeared more mellow and faint, and dark bodies rather better defined, than out of the water, when they were not deeply immerſed. And thus they appeared under whatever directions or poſitions I viewed the bodies.

" 17. I placed different bodies in proper veſſels of fair water, and immerſed my face in the water; viewing the bodies in and through the water. They all appeared to me plain, when not too far from the eye; and altho' a little hazy at the edges, they appeared much enlarged, and always larger through a greater depth of water. Thus a ſhilling appeared nearly as large as half a crown, with a red glowing arch on that ſide oppoſite to the ſun, when the ſun ſhined on the water. From this experiment I concluded, that divers ſee light objects not only larger, but very diſtinctly, in the water."

From theſe experiments he draws a confirmation of his doctrine, that the appearances treated of ariſe from the different ſtrata of the atmoſphere; and then concludes that the rays coming from the ſun are by the horizontal vapours " firſt obſtructed, and many of them totally abſorbed; the reſt proceeding with a retarded motion, are thereby firſt reflected, and then leſs refracted through the humours of the eye; and, laſtly, that hereby the image on the retina becomes enlarged."

Sect. VII. *Of drawing a Meridian Line. Of Solar and Sidereal Time, and of the Equation of Time.*

The foundation of all aſtronomical obſervations is a knowledge of the exact time when the ſun, or any other of the celeſtial bodies, comes to the meridian; and therefore aſtronomers have been very attentive to the moſt proper methods of drawing a meridian line, by which only this can be exactly known. The eaſieſt method of doing this is the following, recommended by Mr Ferguſon, and is found a very good method of placing a ſun-dial horizontally on its pedeſtal.

376 Ferguſon's method of drawing a meridian line.

Make four or five concentric circles (fig. 5.) about a quarter of an inch from one another, on a flat board about a foot in breadth; and let the utmoſt circle be but little leſs than the board will contain. Fix a pin perpendicularly in the centre, and of ſuch a length that its whole ſhadow may fall within the innermoſt circle for at leaſt four hours in the middle of the day. The pin ought to be about an eighth part of an inch thick, and to have a round blunt point. The board being ſet exactly level in the place where the ſun ſhines, ſuppoſe from eight in the morning till four in the afternoon, about which hours the end of the ſhadow ſhould fall without all the circles; watch the times in the forenoon when the extremity of the ſhortening ſhadow juſt touches the ſeveral circles, and there make marks. Then, in the afternoon of the ſame day, watch the lengthening ſhadow; and where its end touches the ſeveral circles in going over them, make marks alſo. Laſtly, with a pair of compaſſes, find exactly the middle point between the two marks on any circle, and draw a ſtraight line from the centre to that point; which line will be covered at noon by the ſhadow of a ſmall upright wire, which ſhould be put in the place of the pin. The reaſon for drawing ſeveral circles is that in caſe one part of the day ſhould prove clear, and the other part ſomewhat cloudy, if you miſs the time when the point of the ſhadow ſhould touch one circle, you may perhaps catch it in touching another. The pin is uſually about five inches in length. The beſt time for drawing a meridian line in this manner is about the ſummer ſolſtice; becauſe the ſun changes his declination ſloweſt, and his altitude faſteſt, in the longeſt days.

If the caſement of a window on which the ſun ſhines at noon be quite upright, you may draw a line along the edge of its ſhadow on the floor, when the ſhadow of the pin is exactly on the meridian line of the board: and as the motion of the ſhadow of the caſement will be much more ſenſible on the floor than that of the ſhadow of the pin on the board, you may know to a few ſeconds when it touches the meridian line on the floor.

377 Another from the Phil. Tranſ.

This method may ſuffice for ordinary purpoſes, but for aſtronomers the following is preferable. Take the gnomon of an horizontal dial for the latitude of the place, and to the hypotenuſa fix two ſights, whoſe centres may be parallel to the ſame: let the eye-ſight be a ſmall hole, but the other's diameter muſt be equal to the tangent of the double diſtance of the north-ſtar from the pole; the diſtance of the ſights being made radius, let the ſtile be rivetted to the end of a ſtraight ruler; then when you would make uſe of it, lay the ruler on an horizontal plane, ſo that the end to which the ſtile is fixed may overhang; then look through the eye-ſight, moving the inſtrument till the north-ſtar appears to touch the circumference of the hole in the other ſight, on the ſame hand with the girdle of Caſſiopeia, or on the oppoſite ſide to that whereon the ſtar in the Great Bear's rump is at that time; then draw a line by the edge of the ruler, and it will be a true meridian line.

378 To find the exact time of noon.

A meridian line being by either of theſe methods exactly drawn, the time when the ſun or any other of the celeſtial bodies is exactly in the meridian may be found by a common quadrant, placing the edge of it along the line, and obſerving when the ſun or other luminary can be ſeen exactly through its two ſights, and noting exactly the time; which, ſuppoſing the luminary viewed to be the ſun, will be exactly noon, or 12 o'clock; but as the apparent diameter of the ſun is pretty large, it ought to be known exactly when his centre is in the meridian, which will be ſome ſhort ſpace after his weſtern limb has arrived at it, and before his eaſtern limb come thither. It will be proper, therefore, to obſerve exactly the time of the two limbs being ſeen through the ſights of the quadrant; and the half of the difference between theſe times added to the one or ſubtracted from the other, will give the exact time when the ſun's centre is in the meridian. What we ſay with regard to the ſun, is alſo applicable to the moon; but not to the ſtars, which have no ſenſible diameter. To render this more intelligible, the following ſhort deſcription of the quadrant, and method of taking the altitudes of celeſtial bodies by it, is ſubjoined.

379 To take the altitudes of the celeſtial bodies.

Let HOX (fig. 195.) be a horizontal line, ſuppoſed to be extended from the eye at A to X, where the ſky and earth ſeem to meet at the end of a long and level plain: and let S be the ſun. The arc XY will be the ſun's height above the horizon at X, and is found by the inſtrument EDC, which is a quadrantal board, or plate of metal, divided into 90 equal parts or degrees on its limb DPC; and has a couple of little braſs plates, as *a* and *b*, with a ſmall hole in each of them, called *ſight-holes*, for looking through, parallel to the edge of the quadrant whereon they ſtand. To the centre E is fixed one end of a thread F, called the *plumb-line*, which has a ſmall weight or plummet P fixed to its other end. Now, if an obſerver holds the quadrant upright, without inclining it to either ſide, and ſo that the horizon at X is ſeen through the ſight-holes *a* and *b*, the plumb-line will cut or hang over the beginning of the degrees at 0, in the edge EC; but if he elevates the quadrant ſo as to look through the ſight-holes at any part of the heavens, ſuppoſe to the ſun at S; juſt ſo many degrees as he elevates the ſight-hole *b* above the horizontal line HOX, ſo many degrees will the plumb-line cut in the limb CP of the quadrant. For, let the obſerver's eye at A be in the centre of the celeſtial arc XYV (and he may be ſaid to be in the centre of the ſun's apparent and diurnal orbit, let him be on what part of the earth he will), in which arc the ſun is at that time, ſuppoſe 25 degrees high, and let the obſerver hold the quadrant ſo that he may ſee the ſun through the ſight-holes; the plumb-line freely playing on the quadrant will cut the 25th degree in the limb CP, equal to the number of degrees of the ſun's altitude at the time of obſervation. (N. B. Whoever looks at the ſun, muſt have a ſmoked glaſs before his eyes, to ſave them from hurt. The better way is, not to look at the ſun through the ſight-holes, but to hold the quadrant facing the eye, at a little diſtance, and ſo that, the ſun ſhining through one hole, the ray may be ſeen to fall on the other.)

380 Difference between ſolar and ſidereal days.

By obſervation made in the manner above directed, it is found, that the ſtars appear to go round the earth in 23 hours 56 minutes 5 ſeconds, and the ſun in 24 hours: ſo that the ſtars gain three minutes 56 ſeconds upon the ſun every day, which amounts to one diurnal revolution in a year; and therefore, in 365 days as meaſured by the returns of the ſun to the meridian, there are 366 days as meaſured by the ſtars returning to it: the former are called *ſolar days*, and the latter *ſidereal*.

If the earth had only a diurnal motion, without an annual, any given meridian would revolve from the ſun to the ſun again in the ſame quantity of time as from any ſtar to the ſame ſtar again; becauſe the ſun would never change his place with reſpect to the ſtars. But, as the earth advances almoſt a degree eaſtward in its orbit in the time that it turns eaſtward round its axis, whatever ſtar paſſes over the meridian on any day with the ſun, will paſs over the ſame meridian on the next day when the ſun is almoſt a degree ſhort of it; that is, 3 minutes 56 ſeconds ſooner. If the year contained only 360 days, as the ecliptic does 360 degrees, the ſun's apparent place, ſo far as his motion is equable, would change a degree every day; and then the ſidereal days would be juſt 4 minutes ſhorter than the ſolar.

Let ABCDEFGHIKLM (fig. 179.) be the earth's orbit, in which it goes round the ſun every year, according to the order of the letters, that is, from weſt to eaſt; and turns round its axis in the ſame way from the ſun to the ſun again in every 24 hours. Let S be the ſun, and R a fixed ſtar at ſuch an immenſe diſtance, that the diameter of the earth's orbit bears no ſenſible proportion to that diſtance. Let N*m* be any particular meridian of the earth, and N a given point or place upon that meridian when the earth is at A, the ſun S hides the ſtar R, which would always be hid if the earth never removed from A; and conſequently, as the earth turns round its axis, the point N would always come round to the ſun and ſtar at the ſame time. But when the earth has advanced, ſuppoſe a twelfth part of its orbit, from A to B, its motion round its axis will bring the point N a twelfth part of a natural day, or two hours, ſooner to the ſtar than to the ſun; for the angle of NB*n* is equal to the angle ASB: and therefore any ſtar, which comes to the meridian at noon with the ſun when the earth is at A, will come to the meridian at 10 in the forenoon when the earth is at B. When the earth comes to C, the point N will have the ſtar on its meridian at 8 in the morning, or four hours ſooner than it comes round to the ſun: for it muſt revolve from N to *n*, before it has the ſun in its meridian. When the earth comes to D, the point N will have the ſtar on its meridian at 6 in the morning; but that point muſt revolve ſix hours more from N to *n*, before it has mid-day by the ſun; for now the angle ASD is a right angle, and ſo is ND*n*; that is, the earth has advanced 90 degrees in its orbit, and muſt turn 90 degrees on its axis to carry the point N from the ſtar to the ſun: for the ſtar always comes to the meridian when N*m* is parallel to RSA; becauſe DS is but a point in reſpect of RS. When the earth is at E, the ſtar comes to the meridian at 4 in the morning; at F, at two in the morning; and at G, the earth having gone half round its orbit, N points to the ſtar R at midnight, it being then directly oppoſite to the ſun; and therefore, by the earth's diurnal motion, the ſtar comes to the meridian 12 hours before the ſun. When the earth is at H, the ſtar comes to the meridian at 10 in the evening; at I, it comes to the meridian at 8, that is, 16 hours before the ſun; at K, 18 hours before him; at L, 20 hours; at M, 22; and at A, equally with the ſun again.

381 Sidereal year contains 366 days.

Thus it is plain, than an abſolute turn of the earth on its axis (which is always completed when any particular meridian comes to be parallel to its ſituation at any time of the day before) never brings the ſame meridian round from the ſun to the ſun again; but that the earth requires as much more than one turn on its axis to finiſh a natural day, as it has gone forward in that time; which, at a mean ſtate, is a 365th part of a circle. Hence, in 365 days, the earth turns 366 times round its axis; and therefore, as a turn of the earth on its axis completes a ſidereal day, there muſt be one ſidereal day more in a year than the number of ſolar days, be the number what it will, on the earth or any other planet. One turn being loſt with reſpect to the number of ſolar days in a year, by the planet's going round the ſun; juſt as it would be loſt to a traveller, who, in going round the earth, would loſe one day by following the apparent diurnal motion of the ſun; and conſequently would reckon one day leſs at his return (let him take what time he would to go round the earth) than thoſe who remained all the while at the place from which he ſet out. So if there were two earths revolving equally on their axes, and if one remained at A until the other had gone round the ſun from A to A again, that earth which kept its place at A would have its ſolar and ſidereal days always of the ſame length; and ſo would have one ſolar day more than the other at its return. Hence, if the earth turned but once round its axis in a year, and if that turn was made the ſame way as the earth goes round the ſun, there would be continual day on one ſide of the earth, and continual night on the other.

382 Inequality of ſolar time.

The earth's motion on its axis being perfectly uniform, and equal at all times of the year, the ſidereal days are always preciſely of an equal length; and ſo would the ſolar or natural days be, if the earth's orbit were a perfect circle, and its axis perpendicular to its orbit. But the earth's diurnal motion on an inclined axis, and its annual motion in an elliptic orbit, cauſe the ſun's apparent motion in the heavens to be unequal: for ſometimes he revolves from the meridian to the meridian again in ſomewhat leſs than 24 hours, ſhown by a well-regulated clock; and at other times in ſomewhat more: ſo that the time ſhown by an equal going clock and a true ſun-dial is never the ſame but on the 15th of April, the 16th of June, the 31ſt of Auguſt, and the 24th of December. The clock, if it goes equably and true all the year round, will be before the ſun from the 24th of December till the 15th of April; from that time till the 16th of June, the ſun will be before the clock; from the 16th of June till the 31ſt of Auguſt, the clock will be again before the ſun; and from thence to the 24th of December, the ſun will be faſter than the clock.

393 Equation of time explained.

As the equation of time, or difference between the time ſhown by a well-regulated clock and a true ſun-dial, depends upon two cauſes, namely, the obliquity of the ecliptic, and the unequal motion of the earth in it, we ſhall firſt explain the effects of theſe cauſes ſeparately conſidered, and then the united effects reſulting from their combination.

The earth's motion on its axis being perfectly equable, or always at the ſame rate, and the plane of the equator being perpendicular to its axis, it is evident that in equal times equal portions of the equator paſs over the meridian; and ſo would equal portions of the ecliptic, if it were parallel to, or coincident with, the equator. But, as the ecliptic is oblique to the equator, the equable motion of the earth carries unequal portions of the ecliptic over the meridian in equal times, the difference being proportionate to the obliquity; and as ſome parts of the ecliptic are much more oblique than others, thoſe differences are unequal among themſelves. Therefore, if two ſuns ſhould ſtart from the beginning either of Aries or Libra, and continue to move through equal arcs in equal times, one in the equator and the other in the ecliptic, the equatorial ſun would always return to the meridian in 24 hours time, as meaſured by a well regulated clock: but the ſun in the ecliptic would return to the meridian ſometimes ſooner and ſometimes later than the equatorial ſun; and only at the ſame moments with him on four days of the year; namely, the 20th of March, when the ſun enters Aries; the 21ſt of June, when he enters Cancer; the 23d of September, when he enters Libra; and the 21ſt of December, when he enters Capricorn; and to this fictitious ſun the motion of a well-regulated clock always anſwers.

Fig. 180. Let Z ♈ z ♎ be the earth; ZFRz, its axis; *abcde*, &c. the equator; ABCDE, &c. the northern half of the ecliptic from ♈ to ♎ on the ſide of the globe next the eye; and MNOP, &c. the ſouthern half on the oppoſite ſide from ♎ to ♈. Let the points at A, B, C, D, E, F, &c quite round from ♈ to ♈ again bound equal portions of the ecliptic, gone through in equal times by the real ſun; and thoſe at *a*, *b*, *c*, *d*, *e*, *f*, &c. equal portions of the equator deſcribed in equal times by the fictitious ſun; and let Z ♈ z be the meridian.

As the real ſun moves obliquely in the ecliptic, and the fictitious ſun directly in the equator, with reſpect to the meridian; a degree, or any number of degrees, between ♈ and F on the ecliptic, muſt be nearer the meridian Z ♈ z, than a degree or any correſponding number of degrees, on the equator from ♈ to *f*; and the more ſo, as they are the more oblique: and therefore the true ſun comes ſooner to the meridian every day whilſt he is in the quadrant ♈ F, than the fictitious ſun does in the quadrant ♈ *f*; for which reaſon, the ſolar noon precedes noon by the clock, until the real ſun comes to F, and the fictitious to *f*; which two points, being equidiſtant from the meridian, both ſuns will come to it preciſely at noon by the clock.

Whilſt the real ſun deſcribes the ſecond quadrant of the ecliptic FGHIKL from Cancer to ♎, he comes later to the meridian every day than the fictitious ſun moving through the ſecond quadrant of the equator from *f* to ♎; for the points at G H, I, K, and L, being farther from the meridian, their correſponding points at *g*, *h*, *i*, and *l*, muſt be later of coming to it: and as both ſuns come at the ſame moment to the point ♎, they come to the meridian at the moment of noon by the clock.

In departing from Libra, through the third quadrant, the real ſun going through MNOPQ towards ♑ at R, and the fictitious ſun through *mnopq* towards *r*, the former comes to the meridian every day ſooner than the latter, until the real ſun comes to ♑, and the fictitious to *r*, and then they come both to the meridian at the ſame time.

Laſtly, as the real ſun moves equably thro' STUVW, from ♑ towards ♈; and the fictitious ſun thro' *stuvw*, from *r* towards ♈, the former comes later every day to the meridian than the latter, until they both arrive at the point ♈, and then they make it noon at the ſame time with the clock.

Having explained one cauſe of the difference of time ſhown by a well-regulated clock and a true ſun-dial, and conſidered the ſun, not the earth, as moving in the ecliptic; we now proceed to explain the other cauſe of this difference, namely, the inequality of the ſun's apparent motion, which is ſhowed in ſummer, when the ſun is fartheſt from the earth, and ſwifteſt in winter when he is neareſt to it. But the earth's motion on its axis is equable all the year round, and is performed from weſt to eaſt; which is the way that the ſun appears to change his place in the ecliptic.

If the ſun's motion were equable in the ecliptic, the whole difference between the equal time as ſhown by the clock, and the unequal time as ſhown by the ſun, would ariſe from the obliquity of the ecliptic. But the ſun's motion ſometimes exceeds a degree in 24 hours, though generally it is leſs: and when his motion is ſloweſt, any particular meridian will revolve ſooner to him than when his motion is quickeſt; for it will overtake him in leſs time when he advances a leſs ſpace than when he moves through a larger.

Now, if there were two ſuns moving in the plane of the ecliptic, ſo as to go round it in a year; the one deſcribing an equal arc every 24 hours, and the other deſcribing ſometimes a leſs arc in 24 hours, and at other times a larger, gaining at one time of the year what is loſt at the oppoſite; it is evident, that either of theſe ſuns would come ſooner or later to the meridian than the other, as it happened to be behind or before the other; and when they were both in conjunction, they would come to the meridian at the ſame moment.

As the real ſun moves unequably in the ecliptic, let us ſuppoſe a fictitious ſun to move equably in a circle coincident with the plane of the ecliptic. Let ABCD (fig. 181.) be the ecliptic or orbit in which the real ſun moves, and the dotted circle *abcd* the imaginary orbit of the fictitious ſun: each going round in a year according to the order of letters, or from weſt to eaſt. Let HIKL be the earth turning round its axis the ſame way every 24 hours; and ſuppoſe both ſuns to ſtart from A and *a*, in a right line with the plane of the meridian EH, at the ſame moment: the real ſun at A, being then at his greateſt diſtance from the earth, at which time his motion is ſloweſt; and the fictitious ſun at *a*, whoſe motion is always equable, becauſe his diſtance from the earth is ſuppoſed to be always the ſame. In the time that the meridian revolves from H to H again, according to the order of the letters HIKL, the real ſun has moved from A to F; and the fictitious with a quicker motion from *a* to *f*, through a large arc: therefore the meridian EH will revolve ſooner from H to *h* under the real ſun at F, than from H E to *k* under the fictitious ſun at *f*; and conſequently it will then be noon by the ſun-dial ſooner than by the clock.

As the real ſun moves from A towards C, the ſwiftneſs of his motion increaſes all the way to C, where it is at the quickeſt. But notwithſtanding this, the fictitious ſun gains ſo much upon the real, ſoon after his departing from A, that the increaſing velocity of the real ſun does not bring him up with the equally moving fictitious ſun till the former comes to C, and the latter to *c*, when each has gone half round its reſpective orbit; and then being in conjunction, the meridian EH, revolving to EK, comes to both ſuns at the ſame time, and therefore it is noon by them both at the ſame moment.

But the increaſed velocity of the real ſun, now being at the quickeſt, carries him before the fictitious one; and therefore, the ſame meridian will come to the fictitious ſun ſooner than to the real: for whilſt the fictitious ſun moves from *c* to *g*, the real ſun moves through a greater arc from C to G: conſequently the point K has its noon by the clock when it comes to *k*, but not its noon by the ſun till it comes to *l*. And although the velocity of the real ſun diminiſhes all the way from C to A, and the fictitious ſun by an equable motion is ſtill coming nearer to the real ſun, yet they are not in conjunction till the one comes to A and the other to *a*, and then it is noon by them both at the ſame moment.

Thus it appears, that the ſolar noon is always later than noon by the clock whilſt the ſun goes from C to A; ſooner, whilſt he goes from A to C; and at theſe two points the ſun and clock being equal, it is noon by them both at the ſame moment.

The point A is called the ſun's *apogee*, becauſe when he is there he is at his greateſt diſtance from the earth; the point C his *perigee*, becauſe when in it he is at his leaſt diſtance from the earth: and a right line, as AEC, drawn through the earth's centre, from one of the points to the other, is called the *line of the Apſides.*

The diſtance that the ſun has gone in any time from his apogee (not the diſtance he has to go to it, though ever ſo little) is called his *mean anomaly*, and is reckoned in ſigns and degrees, allowing 30 degrees to a ſign. Thus, when the ſun has gone ſuppoſe 174 degrees from his apogee at A, he is ſaid to be 5 ſigns 14 degrees from it, which is his mean anomaly; and when he is gone ſuppoſe 355 degrees from his apogee, he is ſaid to be 11 ſigns 25 degrees from it, although he be but 5 degrees ſhort of A in coming round to it again.

From what was ſaid above, it appears, that when the ſun's anomaly is leſs than 6 ſigns, that is, when he is any where between A and C, in the half ABC of his orbit, the ſolar noon precedes the clock noon; but when his anomaly is more than 6 ſigns, that is, when he is any where between C and A, in the half CDA of his orbit, the clock noon precedes the ſolar. When his anomaly is 0 ſigns 0 degrees, that is, when he is in his apogee at A; or 6 ſigns 0 degrees, which is when he is in his perigee at C; he comes to the meridian at the moment that the fictitious ſun does, and then it is noon by them both at the ſame inſtant.

Sect. VIII. *Of calculating the Diſtances, Magnitudes, &c. of the Sun, Moon, and Planets.*

384 To find the moon's horizontal parallax.

This is accompliſhed by finding out the horizontal parallax of the body whoſe diſtance you deſire to know; that is, the angle under which the ſemidiameter of the earth would appear provided we could ſee it from that body; and this is to be found out in the following manner.

Let BAG (fig. 171.) be one half of the earth, AC its ſemidiameter, S the ſun, *m* the moon, and EKOL a quarter of the circle deſcribed by the moon in revolving from the meridian to the meridian again. Let CRS be the rational horizon of an obſerver at A, extended to the ſun in the heavens; and HAO, his ſenſible horizon extended to the moon's orbit. ALC is the angle under which the earth's ſemidiameter AC is ſeen from the moon at L; which is equal to the angle OAL, becauſe the right lines AO and CL which include both theſe angles are parallel. ASC is the angle under which the earth's ſemidiameter AC is ſeen from the ſun at S: and is equal to the angle OA*f*, becauſe the lines AO and CRS are parallel. Now, it is found by obſervation, that the angle OAL is much greater than the angle OA*f*; but OAL is equal to ALC, and OA*f* is equal to ASC. Now as ASC is much leſs than ALC, it proves that the earth's ſemidiameter AC appears much greater as ſeen from the moon at L than from the ſun at S; and therefore the earth is much farther from the ſun than from the moon. The quantities of theſe angles may be determined by obſervation in the following manner.

Let a graduated inſtrument, as DAE (the larger the better), having a moveable index with ſight-holes, be fixed in ſuch a manner, that its plane ſurface may be parallel to the plane of the equator, and its edge AD in the meridian: ſo that when the moon is in the equinoctial, and on the meridian ADE, ſhe may be ſeen through the ſight-holes when the edge of the moveable index cuts the beginning of the diviſions at 0, on the graduated limb DE; and when ſhe is ſo ſeen, let the preciſe time be noted. Now as the moon revolves about the earth from the meridian to the meridian again in about 24 hours 48 minutes, ſhe will go a fourth part round it in a fourth part of that time, viz. in 6 hours 12 minutes, as ſeen from C, that is, from the earth's centre or pole. But as ſeen from A, the obſerver's place on the earth's ſurface, the moon will ſeem to have gone a quarter round the earth when ſhe comes to the ſenſible horizon at O; for the index through the ſights of which ſhe is then viewed will be at *d*, 90 degrees from D, where it was when ſhe was ſeen at E. Now let the exact moment when the moon is ſeen at O (which will be when ſhe is in or near the ſenſible horizon) be carefully noted (G), that it may be known in what time ſhe has gone from E to O; which time ſubtracted from ſix hours 12 minutes (the time of her going from E to L) leaves the time of her going from O to L, and affords an eaſy method for finding the angle OAL (called *the moon's horizontal parallax*, which is equal to the angle ALC) by the following analogy: As the time of the moon's deſcribing the arc EO is to 90 degrees, ſo is 6 hours 12 minutes to the degrees of the arc D *d* E, which meaſures the angle EAL; from which ſubtract 90 degrees, and there remains the angle OAL, equal to the angle ALC, under which the earth's ſemidiameter AC is ſeen from the the moon. Now, ſince all the angles of a right-lined triangle are equal to 180 degrees, or to two right angles,

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(G) Here proper allowance muſt be made for the refraction, which being about 34 minutes of a degree in the horizon, will cauſe the moon's centre to appear 34 minutes above the horizon when her centre is really in it.

angles, and the ſides of a triangle are always proportional to the ſines of the oppoſite angles, ſay, by the Rule of Three, as the ſine of the angle ALC at the moon L, is to its oppoſite ſide AC, the earth's ſemidiameter, which is known to be 3985 miles; ſo is radius, viz. the ſine of 90 degrees, or of the right angle ACL to its oppoſite ſide AL, which is the moon's diſtance at L from the obſerver's place at A on the earth's ſurface; or, ſo is the ſine of the angle CAL to its oppoſite ſide CL, which is the moon's diſtance from the earth's centre, and comes out at a mean rate to be 240,000 miles. The angle CAL is equal to what OAL wants of 90 degrees.

385
Another method.

Other methods have been fallen upon for determining the moon's parallax; of which the following is recommended as the beſt, by Mr Ferguſon, though hitherto it has not been put in practice. Let two obſervers be placed under the ſame meridian, one in the northern hemiſphere and the other in the ſouthern, at ſuch a diſtance from each other, that the arc of the celeſtial meridian included between their two zenith's may be at leaſt 80 or 90 degrees. Let each obſerver take the diſtance of the moon's centre from his zenith, by means of an exceeding good inſtrument, at the moment of her paſſing the meridian: and theſe two zenith diſtances of the moon together, and their exceſs above the diſtance between the two zeniths, will be the diſtance between the two apparent places of the moon. Then, as the ſum of the natural ſines of the two zenith-diſtances of the moon is to radius, ſo is the diſtance between her two apparent places to her horizontal parallax: which being found, her diſtance from the earth's centre may be found by the analogy mentioned above.

Thus, in fig. 199. let VECQ be the earth, M the moon, and *Zbaz* an arc of the celeſtial meridian. Let V be Vienna, whoſe latitude EV is 48° 20′ north; and C the Cape of Good Hope, whoſe latitude EC is 34° 30′ ſouth: both which latitudes we ſuppoſe to be accurately determined beforehand by the obſervers. As theſe two places are on the ſame meridian *n*VEC*s*, and in different hemiſpheres, the ſum of their latitudes 82° 50′ is their diſtance from each other. Z is the zenith of Vienna, and z the zenith of the Cape of Good Hope; which two zeniths are alſo 82° 50′ diſtant from each other, in the common celeſtial meridian Zz. To the obſerver at Vienna, the moon's centre will appear at *a* in the celeſtial meridian; and at the ſame inſtant, to the obſerver at the Cape, it will appear at *b*. Now ſuppoſe the moon's diſtance Z *a* from the zenith of Vienna to be 38° 1′ 53″, and her diſtance *z b* from the zenith of the Cape of Good Hope to be 46° 4′ 41″: the ſum of theſe two zenith diſtances (*Za*+*zb*) is 84° 6′ 34″; from which ſubtract 82° 50″, the diſtance of Zz between the zeniths of theſe two places, and there will remain 1° 16′ 34″ for the arc *ba*, or diſtance between the two apparent places of the moon's centre, as ſeen from V and from C. Then, ſuppoſing the tabular radius to be 10,000,000, the natural ſine of 38° 1. 53″ (the arc *Za*) is 6,160,816, and the natural ſine of 46′ 4′ 41″ the arc *zb*) is 7,202,821: the ſum of both theſe ſines is 13,363,637. Say therefore, As 13,363,637 is to 10,000,000, ſo is 1° 16′ 34″ to 57′ 18″, which is the moon's horizontal parallax.

If the two places of obſervation be not exactly under the ſame meridian, their difference of longitude muſt be accurately taken, that proper allowance may be made for the moon's declination whilſt ſhe is paſſing from the meridian of the one to the meridian of the other.

The parallax, and conſequently the diſtance and bulk, of any primary planet, might be found in the above manner, if the planet was near enough to the earth, ſo as to make the difference of its two apparent places ſufficiently ſenſible: but the neareſt planet is too remote for the accuracy required.

386
Parallax of the ſun difficult to be found.

The ſun's diſtance from the earth might be found the ſame way, though with more difficulty, if his horizontal parallax, or the angle OAS equal to the angle ASC (fig. 171.), were not ſmall ſo as to be hardly perceptible, being found in this way to be ſcarce 10 ſeconds of a minute, or the 360th part of a degree. Hence all aſtronomers, both ancient and modern have failed in taking the ſun's parallax to a ſufficient degree of exactneſs; but as ſome of the methods uſed are very ingenious, and ſhow the great acuteneſs and ſagacity of the ancient aſtronomers, we ſhall here give an account of them.

387
Hipparchus's method of finding it.

The firſt method was invented by Hipparchus; and has been made uſe of by Ptolemy and his followers, and many other aſtronomers. It depends on an obſervation of an eclipſe of the moon: And the principles on which it is founded, are, 1*ſt*, In a lunar eclipſe, the horizontal parallax of the ſun is equal to the difference between the apparent ſemidiameter of the ſun, and half the angle of the conical ſhadow; which is eaſily made out in this manner. Let the circle AFG (fig. 87.) repreſent the ſun, and DHC the earth; let DHM be the ſhadow, and DMC the half angle of the cone. Draw from the centre of the ſun the right line SD touching the earth, and the angle DS is the apparent ſemidiameter of the earth, ſeen from the ſun, which is equal to the horizontal parallax of the ſun; and the angle ADS is the apparent ſemidiameter of the ſun ſeen from the earth: The external angle ADS is equal to the two internals DMS and DSM, by the 32d Prop. Elem. I. And therefore the angle DSM, or DSC, is equal to the difference of the angles ADS and DMS. 2*dly*, Half the angle of the cone is equal to the difference of the horizontal parallax of the moon and the apparent ſemidiameter of the ſhadow, ſeen from the earth at the diſtance of the moon. For let CTE be the earth, CME the ſhadow, which at the diſtance of the moon being cut by a plane, the ſection will be the circle FLK, whoſe ſemidiameter is FG, and is ſeen from the centre of the earth under the angle FTG. But by the 32d Prop. Elem. I. the angle CFT is equal to the two internals FMT and FTM. Wherefore the angle FMT is the difference of the two angles CFT and GTF: But the angle CFT is the angle under which the ſemidiameter of the earth is ſeen from the moon, and this is equal to the horizontal parallax of the moon; and the angle GTF is the apparent ſemidiameter of the ſhadow ſeen from the earth's centre. It is therefore evident that the half angle of the cone is equal to the difference of the horizontal parallax of the moon, and the apparent ſemidiameter of the ſhadow ſeen from the earth. Wherefore, if to the apparent ſemidiameter of the ſun there be added the apparent ſemidiameter of the ſhadow, from the ſum you take away the horizontal parallax of the moon, there will

Fig. 89.

Fig. 173.

will remain the horizontal parallax of the ſun; which therefore, if theſe were accurately known, would be likewiſe known accurately: But none of them can be ſo exactly and nicely obtained, as to be ſufficient for 388 This method inſufficient. determining the parallax of the ſun; for very ſmall errors, which cannot be eaſily avoided in meaſuring theſe angles will produce very great errors in the parallax; and there will be a prodigious difference in the diſtances of the ſun when drawn from theſe parallaxes. For example, Suppoſe the horizontal parallax of the moon to be 60′ 15″, the ſemidiameter of the ſun 16′, and the ſemidiameter of the ſhadow 44′ 30″, we ſhall conclude from thence, that the parallax of the ſun was 15″, and his diſtance from the earth about 13,700 ſemidiameters of the earth. But if there be an error committed in determining the ſemidiameter of the ſhadow, of 12″ in defect (and certainly the ſemidiameter of the ſhadow cannot be had ſo preciſely as not to be liable to ſuch an error), that is, if inſtead of 44′ 30″ we put 44′ 18″ for the apparent diameter of the ſhadow, all the others remaining as before, we ſhall have the parallax of the ſun 3″, and its diſtance from the earth almoſt 70,000 ſemidiameters of the earth, which is five times more than what it was by the firſt poſition. But if the fault were in exceſs, or the diameter of the ſhadow exceeded the true by 12″, ſo that we ſhould put in 44′ 42″, the parallax would ariſe to 27″, and the diſtance of the ſun only 7700 of the earth's ſemidiameters; which is nine times leſs than what it comes to by a like error in defect. If an error in defect was committed of 15″, which is ſtill but a ſmall miſtake, the ſun's parallax would be equal to nothing, and his diſtance infinite. Wherefore, ſince from ſo ſmall miſtakes the parallax and diſtance of the ſun vary ſo much, it is plain that the diſtance of the ſun cannot be obtained by this method.

389 Ariſtarchus's method. Since therefore, the angle that the earth's ſemidiameter ſubtends at the ſun is ſo ſmall that it cannot be determined by any obſervation, Ariſtarchus Samius, an ancient and great philoſopher and aſtronomer, contrived a very ingenious way for finding the angle which the ſemidiameter of the moon's orbit ſubtends when ſeen from the ſun: This angle is about 60 times bigger than the former, ſubtended only to the earth's ſemidiameter. To find this angle, he lays down the following principles.

From the phaſes of the moon, it hath been demonſtrated, that if a plane paſſed through the moon's centre, to which the line joining the ſun and moon's centre was perpendicular, this plane would divide the illuminated hemiſphere of the moon from the dark one: And therefore, if this plane ſhould likewiſe paſs through the eye of a ſpectator on the earth, the moon would appear biſected, or like half a circle; and a right line, drawn from the earth to the centre of the moon, would be in the plane of illumination, and conſequently would be perpendicular to the right line which joins Fig. 90. the centres of the ſun and moon. Let S be be the ſun, and T the earth, ALq a quadrant of the moon's orbit; and let the line SL, drawn from the ſun, touch the orbit of the moon in L; the angle TLS will be a right angle: And therefore, when the moon is ſeen in L, it will appear biſected, or juſt half a circle. At the ſame time take the angle LTS, the elongation of the moon from the ſun, and then we ſhall have the angle LST, its complement to a right angle. But we have the ſide TL, by which we can find the ſide ST, the diſtance of the ſun from the earth.

But the difficult point is to determine exactly the 390 This method inſufficient. moment of time when the moon is biſected, or in its true dichotomy; for there is a conſiderable ſpace of time both before and after the dichotomy, nay even in the quadrature, when the moon will appear biſected, or half a circle; ſo that the exact moment of biſection cannot be known by obſervation, as experience tells us: And conſequently, the true diſtance of the ſun from the earth cannot be obtained by this method.

Since the moment in which the true dichotomy happens is uncertain, but it is certain that it happens be- 391 Ricciolus's method. fore the quadrature; Ricciolus takes that point of time which is in the middle, between the time that the phaſis begins to be doubtful whether it be biſected or not, and the time of quadrature: but he had done better, if he had taken the middle point between the time when it becomes doubtful whether the moon's ſide is concave or ſtraight, and the time again when it is doubtful whether it is ſtraight or convex; which point of time is after the quadrature: and if he had done this, he would have found the ſun's diſtance a great deal more than he has made it.

392 Another by Dr Keil. There is no need to confine this method to the phaſis of a dichotomy, or biſection, for it can be as well performed when the moon has any other phaſis bigger or leſs than a dichotomy: for obſerve by a very good teleſcope, with a micrometer, the phaſis of the moon, that is, the proportion of the illuminated part of the diameter to the whole; and at the ſame moment of time take her elongation from the ſun: The illuminated part of the diameter, if it be leſs than the ſemidiameter, is to be ſubducted from the ſemidiameter; but if it be greater, the ſemidiameter is to be ſubducted from it, and mark the reſidue: then ſay, As the ſemidiameter of the moon is to the reſidue, ſo is the radius to the ſine of an angle, which is therefore found: this angle added to, or ſubtracted from, a right angle, gives the exterior angle of the triangle at the moon: but we have the angle at the earth, which is the elongation obſerved; which therefore being ſubducted from the exterior angle, leaves the angle at the ſun. And in the triangle SLT, having all the angles and one ſide LT, we can find the other ſide ST, the diſtance of the ſun from the earth. 393 All theſe methods inſufficient. But it is almoſt impoſſible to determine accurately the quantity of the lunar phaſis, ſo that there may not be an error of a few ſeconds committed; and conſequently, we cannot by this method find preciſely enough the true diſtance of the ſun. However, from ſuch obſervations, we are ſure, that the ſun is above 7000 ſemidiameters of the earth diſtant from us. Since therefore the true diſtance of the ſun can neither be found by eclipſes nor by the phaſes of the moon, the aſtronomers are forced to have recourſe to the parallaxes of the planets that are next to us, as Mars and Venus, which are ſometimes much nearer to us than the ſun is. Their parallaxes they endeavour to find by ſome of the methods above explained; and if theſe parallaxes were known, then the parallax and diſtance of the ſun, which cannot directly by any obſervations be attained, would eaſily be deduced from them. For from the theory of the motions of the earth and planets, we know at any time the proportion of

Calculating the Diſtances, &c. of the Planets.

of the diſtances of the ſun and planets from us; and the horizontal parallaxes are in a reciprocal proportion to theſe diſtances. Wherefore, knowing the parallax of a planet we may from thence find the parallax of the ſun.

394 Another method from the parallax of Mars.

Mars, when he is in an achronycal poſition, that is oppoſite to the ſun, is twice as near to us as the ſun is; and therefore his parallax will be twice as great. But Venus, when ſhe is in her inferior conjunction with the ſun, is four times nearer to us than he is, and her parallax is greater in the ſame proportion: Therefore, though the extreme ſmallneſs of the ſun's parallax renders it unobſervable by our ſenſes, yet the parallaxes of Mars or Venus, which are twice or four times greater, may become ſenſible. The aſtronomers have beſtowed much pains in finding out the parallax of Mars; but ſome time ago Mars was in his oppoſition to the ſun, and alſo in his perihelion; and conſequently in his neareſt approach to the earth: And then he was moſt accurately obſerved by two of the moſt eminent aſtronomers of our age, who have determined his parallax to have been ſcarce 30 ſeconds; from whence it was inferred, that the parallax of the ſun is ſcarce 11 ſeconds, and his diſtance about 19,000 ſemidiameters of the earth.

395 From that of Venus.

As the parallax of Venus is ſtill greater than that of Mars, Dr Halley propoſed a method by it of finding the diſtance of the ſun to within a 500th part of the whole. The times of obſervation were at her tranſits over the ſun in 1761 and 1769. At theſe times the greateſt attention was given by aſtronomers, but it was found impoſſible to obſerve the exact times of immerſion and emerſion with ſuch accuracy as had been expected; ſo that the matter is not yet determined ſo exactly as could be wiſhed. The method of calculating the ſun's diſtance by means of theſe tranſits is as follows.

In fig. 91. let DBA be the earth, V Venus, and TSR the eaſtern limb of the ſun. To an obſerver at B, the point *t* of that limb will be on the meridian, its place referred to the heaven will be at E, and Venus will appear juſt within it at S. But at the ſame inſtant, to an obſerver at A, Venus is eaſt of the ſun, in the right line AVF; the point *t* of the ſun's limb appears at *e* in the heaven; and if Venus were then viſible ſhe would appear at F. The angle CVA is the horizontal parallax of Venus, which we ſeek; and is equal to the oppoſite angle FVE, whoſe meaſure is the arc FE. ASC is the ſun's horizontal parallax, equal to the oppoſite angle *e* SE, whoſe meaſure is the arc *e* E; and FA*e* (the ſame as VA*v*) is Venus's horizontal parallax from the ſun, which may be found by obſerving how much later in abſolute time her total ingreſs on the ſun is, as ſeen from A than as ſeen from B, which is the time ſhe takes to move from V to *v* in her orbit OV*v*.

Fig. 6.

It appears by the tables of Venus's motion and the ſun's, that at the time of her tranſit in 1761 ſhe moved 4′ of a degree on the ſun's diſk in 60 minutes of time: and conſequently 4″ of a degree in one minute of time.

Now, let us ſuppoſe that A is 90° weſt of B, ſo that when it is noon at B it will be ſix in the morning at A; that the total ingreſs as ſeen from B is at one minute paſt 12, but that as ſeen from A it is at ſeven minutes 30 ſeconds paſt ſix; deduct ſix hours for the difference of meridians of A and B, and the remainder will be ſix minutes 30 ſeconds for the time by which the total ingreſs of Venus on the ſun at S, is later as ſeen from A than as ſeen from B; which time being converted into parts of a degree is 26″, or the arc F*e* of Venus's horizontal parallax from the ſun; for, as 1 minute of time is to 4 ſeconds of a degree, ſo is 6½ minutes of time to 26 ſeconds of a degree.

Calculating the Diſtances, &c. of the Planets.

The times in which the planets perform their annual revolutions about the ſun are already known by obſervation.—From theſe times, and the univerſal power of gravity by which the planets are retained in their orbits, it is demonſtrable, that if the earth's mean diſtance from the ſun be divided into 100,000 equal parts, Mercury's mean diſtance from the ſun muſt be equal to 38,710 of theſe parts—Venus's mean diſtance from the ſun to 72,333——Mars's mean diſtance, 152,369—Jupiter's, 520,096—and Saturn's 954,006. Therefore when the number of miles contained in the mean diſtance of any planet from the ſun is known, we can by theſe proportions find the mean diſtance in miles of all the reſt.

At the time of the abovementioned tranſit, the earth's diſtance from the ſun was 1015 (the mean diſtance being here conſidered as 1000), and Venus's diſtance from the ſun 726 (the mean diſtance being conſidered as 723), which differences from the mean diſtances ariſe from the elliptical figure of the planets orbits—Subtracting 726 parts from 1015, there remain 289 parts for Venus's diſtance from the earth at that time.

Now, ſince the horizontal parallaxes of the planets are inverſely as their diſtances from the earth's centre; it is plain, that as Venus was between the earth and the ſun on the day of her tranſit, and conſequently her parallax at that time greater than the ſun's, if her horizontal parallax was then aſcertained by obſervation, the ſun's horizontal parallax might be found, and conſequently his diſtance from the earth.—Thus, ſuppoſe Venus's horizontal parallax was found to be 36″.3480, then, As the ſun's diſtance 1015 is to Venus's diſtance 289, ſo is Venus's horizontal parallax 36″.3480 to the ſun's horizontal parallax 10″.3493 on the day of her tranſit. And the difference of theſe two parallaxes, viz. 25″.9987 (which may be eſteemed 26″), will be the quantity of Venus's horizontal parallax from the ſun.

To find the ſun's horizontal parallax at the time of his mean diſtance from the earth, ſay, As 1000 parts of the ſun's mean diſtance from the earth's centre, is to 1015, his diſtance therefrom on the day the tranſit, ſo is 10″.3493, his horizontal parallax on that day, to 10″.5045, his horizontal parallax at the time of his mean diſtance from the earth's centre.

396 Method of computing the ſun's diſtance from his parallax.

The ſun's parallax being thus (or any other way ſuppoſed to be) found, at the time of his mean diſtance from the earth, we may find his true diſtance therefrom, in ſemidiameters of the earth, by the following analogy. As the ſine (or tangent of ſo ſmall an arc as that) of the ſun's parallax 10″.5045 is to radius, ſo is unity or the earth's ſemidiameter to the number of ſemidiameters of the earth that the ſun is diſtant from its centre; which number, being multiplied by 3985, the number of miles contained in the earth's ſemidiameter, will give the number of miles by which the ſun is diſtant from the earth's center.

Then, As 100,000, the earth's mean diſtance from the ſun in parts, is to 38,710, Mercury's mean diſtance from the ſun in parts, ſo is the earth's mean diſtance from the ſun in miles to Mercury's mean diſtance from the ſun in miles.—And,

397 Diſtances of the other planets, how found.

As 100,000 is to 72,333, ſo is the earth's mean diſtance from the ſun in miles to Venus's mean diſtance from the ſun in miles.—Likewiſe,

As 100,000 is to 152,369, ſo is the earth's mean diſtance from the ſun in miles to Mars's mean diſtance from the ſun in miles.—Again.

As 100,000 is to 520,096, ſo is the earth's mean diſtance from the ſun in miles to Jupiter's mean diſtance from the ſun in miles. Laſtly,

As 100,000 is to 954,006, ſo is the earth's mean diſtance from the ſun in miles to Saturn's mean diſtance from the ſun in miles.

And thus, by having found the diſtance of any one of the planets from the ſun, we have ſufficient data for finding the diſtances of all the reſt. And then from their apparent diameters at theſe known diſtances, their real diameters and bulks may be found. According to the calculations made from the tranſit in 1769, we have given the diſtance of each of the primary and ſecondary planets from one another, and from the ſun, in fig. 119. In fig. 153. their proportional bulks are ſhown, according to former culculations by Mr Ferguſon; and in fig. 18. their relative magnitudes according to the lateſt calculations by Mr Dunn. The proportional diſtances of the ſatellites of Jupiter and Saturn, with the magnitudes of the ſun, and orbit of our moon, by Mr Ferguſon, are repreſented fig. 186.

398 Diſtances of the fixed ſtars immeaſurable.

With regard to the fixed ſtars, no method of aſcertaining their diſtance hath hitherto been found out. Thoſe who have formed conjectures concerning them, have thought that they were at leaſt 400,000 times farther from us than we are from the ſun.

399 Why they ſeem ſo big to our naked eye.

They are ſaid to be fixed, becauſe they have been generally obſerved to keep at the ſame diſtances from each other; their apparent diurnal revolutions being cauſed ſolely by the earth's turning on its axis. They appear of a ſenſible magnitude to the bare eye, becauſe the retina is affected not only by the rays of light which are emitted directly from them, but by many thouſands more, which falling upon our eye-lids, and upon the aerial particles about us, are reflected in our eyes ſo ſtrongly as to excite vibrations not only in thoſe points of the retina where the real images of the ſtars are formed, but alſo in other points at ſome diſtance round about. This makes us imagine the ſtars to be much bigger than they would appear if we ſaw them only by the few rays which come directly from them, ſo as to enter our eyes without being intermixed with others. Any one may be ſenſible of this, by looking at a ſtar of the firſt magnitude through a long narrow tube; which, though it takes in as much of the ſky as would hold 1000 ſuch ſtars, yet ſcarce renders that one viſible.

The more a teleſcope magnifies, the leſs is the aperture through which the ſtar is ſeen; and conſequently the fewer rays it admits into the eye. Now, ſince the ſtars appear leſs in a teleſcope which magnifies 200 times, than they do to the bare eye, inſomuch that they ſeem to be only indiviſible points, it proves at once that the ſtars are at immenſe diſtances from us, and that they ſhine by their own proper light. If they ſhone by borrowed light, they would be as inviſible without teleſcopes as the ſatellites of Jupiter are; for theſe ſatellites appear bigger when viewed with a good teleſcope than the largeſt fixed ſtars do.

Dr. Herſchel has propoſed a method of aſcertaining the parallax of the fixed ſtars, ſomething ſimilar, but more complete, than that mentioned by by Galileo and others; for it is by the parallax of the fixed ſtars that we ſhould be beſt able to determine their diſtance. The method pointed out by Galileo; and firſt attempted by Hook, Flamſtead, Mollineux and Bradley, of taking diſtances of ſtars from the zenith that paſs very near it, has given us a much juſter idea of the immenſe diſtance of the ſtars, and furniſhed us with an approximation to the knowledge of their parallax, that is much nearer the truth than we ever had before. But Dr Herſchel mentions the inſufficiency of their inſtruments, which were ſimilar to the preſent zenith ſectors, the method of zenith diſtances being liable to conſiderable errors on account of refraction, the change of poſition of the earth's axis ariſing from nutation, preceſſion of the equinoxes, and other cauſes, and the aberration of light. The method of his own is by means of double ſtars; which is exempted from theſe errors, and of ſuch a nature that the annual parallax, even if it ſhould not exceed the tenth part of a ſecond, may ſtill become more viſible, and be aſcertained, at leaſt to a much greater degree of approximation than it has ever been done. This method is capable of every improvement which the teleſcope and mechaniſm of micrometers can furniſh. The method and its theory will be ſeen by the following inveſtigation, extracted from his paper on the ſubject. Let O, E. (fig. 164.) be two oppoſite points in the annual orbit, taken in the ſame plane with two ſtars *a*, *b*, of unequal magnitudes. Let the angle *a*O*b* be obſerved when the earth is at O, and *a*E*b* be obſerved when the earth is at E. From the difference of theſe angles, if there ſhould be any, we may calculate the parallax of the ſtars, according to the theory ſubjoined. Theſe two ſtars ought to be as near each other as poſſible, and alſo to differ as much in magnitude as we can find them.

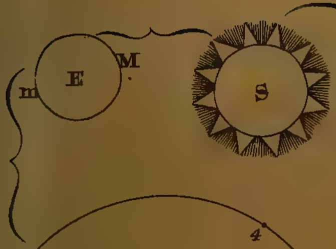
Phil. Tranſ. vol. lxxii. p. 82.

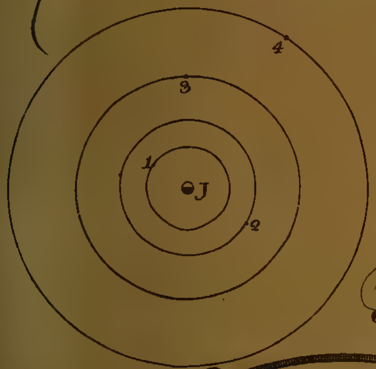
Dr Herſchel's theory of the annual parallax of double ſtars, with the method of computing from thence what is generally called the parallax of the fixed ſtars, or of ſingle ſtars of the firſt magnitude, ſuch are neareſt to us, ſuppoſes, *firſt*, that the ſtars, one with another, are about the ſize of the ſun; and, *ſecondly*, that the difference of their apparent magnitude is owing to their different diſtances; ſo that the ſtar of the ſecond, third, or fourth magnitude, is two, three, or four times as far off as one of the firſt. Theſe principles, which he premiſes as poſtulata, have ſo great a probability in their favour, that they will hardly be objected to by thoſe who are in the leaſt acquainted with the doctrine of chances. Accordingly, let OE (fig. 165.) be the whole diameter of the earth's annual orbit; and let *a*, *b*, *c*, be three ſtars ſituated in the ecliptic, in ſuch a manner that they may be ſeen all in one line O *a*, *b*, *c*, when the earth is at O. Let the line O *a b c* be perpendicular to OE, and draw PE parallel to *c*O: then, if O *a*, *a b*, *b c*, are equal to each other, *a* will be a ſtar of the firſt magnitude, *b* of the ſecond, and

ASTRONOMY

Plate LXXXI

Fig. 186





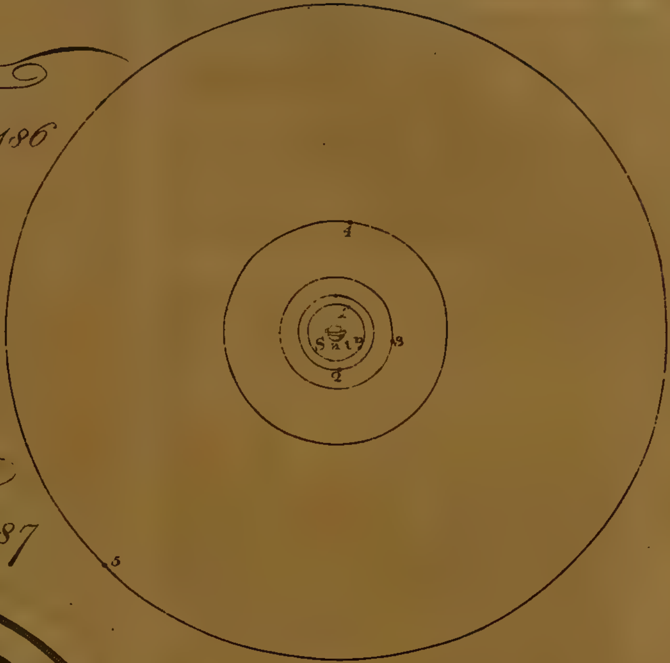


Fig. 187

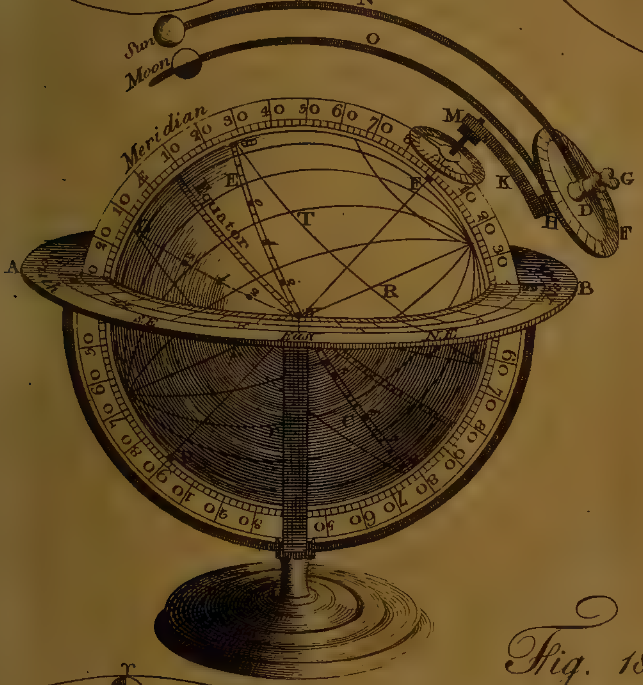


Fig. 188

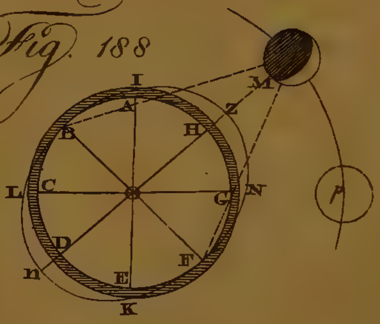
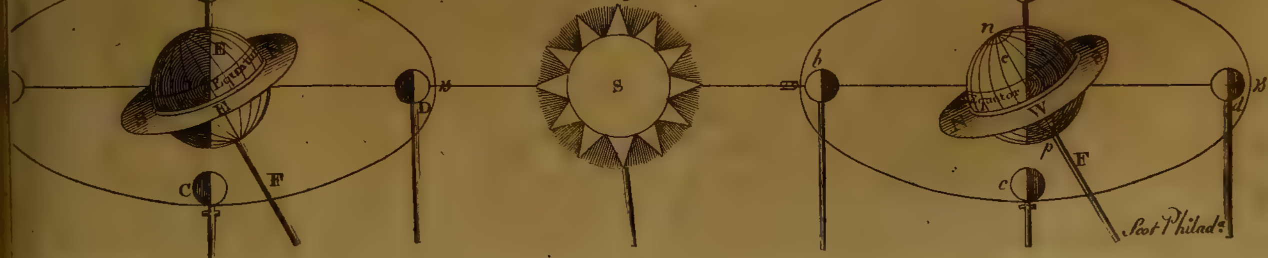


Fig. 189



Scot Philad^s

Calculating the Diſtances, &c. of the Planets.

c of the third. Let us now ſuppoſe the angle O a E, or parallax of the whole orbit of the earth, to be 1″ of a degree; then we have P E a = O a E = 1″: and becauſe very ſmall angles, having the ſame ſubtenſe OE, may be taken to be in the inverſe ratio of the lines O a, O b, O c, &c. we ſhall have O b E = $\frac{1}{2}''$, O c E = $\frac{1}{3}''$, &c. Now when the earth is removed to E, we ſhall have P E b = E b o = $\frac{1}{2}''$, and P E a — P E b = a E b = $\frac{1}{2}''$: i. e. the ſtars a, b, will appear to be $\frac{1}{2}''$ diſtant. We alſo have P E c = E c O = $\frac{1}{3}''$, and P E a — P E c = a E c = $\frac{2}{3}''$; i. e. the ſtars a, c, will appear to be $\frac{2}{3}''$ diſtant when the earth is at E. Now, ſince we have b E P = $\frac{1}{2}''$, and c E P = $\frac{1}{3}''$, therefore b E P — c E P = b E c = $\frac{1}{2}''$ — $\frac{1}{3}''$ = $\frac{1}{6}''$; i. e. the ſtars b, c, will appear to be only $\frac{1}{6}''$ removed from each other when the earth is at E. Whence we may deduce the following expreſſion, to denote the parallax that will become viſible in the change of diſtance between the two ſtars, by the removal of the earth from one extreme of its orbit to the other. Let P expreſs the total parallax of a fixed ſtar of the firſt magnitude, M the magnitude of the largeſt of the two ſtars, m the magnitude of the ſmalleſt, and p the partial parallax to be obſerved by the change in the diſtance of a double ſtar; then will $p = \frac{m-M}{Mm}P$; and p, being found by obſervation, will give us $P = \frac{pMm}{m-M}$. *E. G.* Suppoſe a ſtar of the firſt magnitude ſhould have a ſmall ſtar of the twelfth magnitude near it; then will the partial parallax we are to expect to ſee be $\frac{12 \times 1\,P}{12-1}$, or $\frac{11}{12}$ of the total parallax of a fixed ſtar of the firſt magnitude; and if we ſhould, by obſervation, find the partial parallax between two ſuch ſtars to amount to 1″, we ſhall have the total parallax $P = \frac{1 \times 1 \times 12}{12-1} = 1''.0909$. If the ſtars are of the third and twenty-fourth magnitude, the partial parallax will be $\frac{24-3}{3 \times 24} = \frac{21}{72}P$; and if, by obſervation, p is found to be a tenth of a ſecond, the whole parallax will come out $\frac{.1 \times 3 \times 24}{24-3} = 0''.3428$.

Farther, ſuppoſe the ſtars being ſtill in the ecliptic, to appear in one line, when the earth is in any other part of its orbit between O and E; then will the parallax ſtill be expreſſed by the ſame algebraic formula, and one of the maxima will ſtill lie at O, the other at E; but the whole effect will be divided into two parts, which will be in proportion to each other as radius — ſine to radius + ſine of the ſtars diſtance from the neareſt conjunction or oppoſition.

When the ſtars are any where out of the ecliptic, ſituated ſo as to appear in one line O a b c perpendicular to O E, the maximum of parallax will ſtill be expreſſed by $\frac{m-M}{Mm}P$; but there will ariſe another additional parallax in the conjunction and oppoſition, which will be to that which is found 90° before or after the ſun, as the ſine (S) of the latitude of the ſtars ſeen at O is to the radius (R); and the effect of this parallax will be divided into two parts; half of it lying on one ſide of the large ſtar, the other half on the other ſide of it. This latter parallax, moreover, will be compounded with the former, ſo that the diſtance of the ſtars in the conjunction and oppoſition will then be repreſented by the diagonal of a parallelogram, whereof the two ſemiparallaxes are the ſides; a general expreſſion for which will be $\sqrt{\left.\overline{\frac{m-M}{2mM}P}\right|^{2} \times \overline{\frac{SS}{RR}+1}}$; for the ſtars will apparently deſcribe two ellipſes in the heavens, whoſe tranſverſe axis will be to each other in the ratio of M to m (fig. 167.), and A a, B b, C c, D d, will be the cotemporary ſituations. Now, if b Q be drawn parallel to A C, and the parallelogram b q B Q be completed, we ſhall have b Q = $\frac{1}{2}$ C A — $\frac{1}{2}$ c a = $\frac{1}{2}$ C c = $\frac{1}{2}$ p, or ſemiparallax 90° before or after the ſun, and B b may be reſolved into, or is compounded of, b Q and b q; but b q = $\frac{1}{2}$ B D — $\frac{1}{2}$ b d = the ſemiparallax in the conjunction or oppoſition. We alſo have R : S : : b Q : b $q = \frac{pS}{2R}$; therefore the diſtance B b (or D d) $= \sqrt{\left.\overline{\frac{p}{2}}\right|^{2} + \left.\overline{\frac{pS}{2R}}\right|^{2}}$; and by ſubſtituting the value of p into this expreſſion, we obtain $\sqrt{\left.\overline{\frac{m-M}{2Mm}P}\right|^{2} \times \overline{\frac{SS}{RR}+1}}$, as above. When the ſtars are in the pole of the ecliptic, b q will become equal to b Q, and B b will be 7071 P$\frac{m-M}{Mm}$. Again, let the ſtars be at ſome diſtance, *e. g.* 5″ from each other, and let them both be in the ecliptic. This caſe is reſolvable into the firſt; for imagine the ſtar a (fig. 166.) to ſtand at x, and in that ſituation the ſtars x, b, c, will be in one line, and their parallax expreſſed by $\frac{m-M}{Mm}P$. But the angle a E x may be taken to be equal to a O x; and as the foregoing formula gives us the angles x E b, x E c, we are to add a E x or 5″ to x E b, and we ſhall have a E b. In general, let the diſtance of the ſtars be d, and let the obſerved diſtance at E be D, then will $D = d + p$, and therefore the whole parallax of the annual orbit will be expreſſed by $\frac{DMm - dMm}{m-M} = P$.

Suppoſe the two ſtars now to differ only in latitude, one being in the ecliptic, the other, *e. g.* 5 north, when ſeen at O. This caſe may alſo be reſolved by the former; for imagine the ſtars b, c, (fig. 165.) to be elevated at right angles above the plane of the figure, ſo that a O b, or a O c. may make an angle of 5″ at O; then, inſtead of the lines O a b c, E a, E b, E c, E P, imagine them all to be planes at right angles to the figure; and it will appear that the parallax of the ſtars in longitude muſt be the ſame as if the ſmall ſtar had been without latitude. And ſince the ſtars b, c, by the motion of the earth from O to E, will not change their latitude, we ſhall have the following conſtruction for finding the diſtance of the ſtars a b, a c, at E, and from thence the parallax P. Let the triangle a b β (fig. 168.) repreſent the ſituation of the ſtars; a b is the ſubtenſe of 5″, the angle under which they are ſuppoſed to be ſeen at O. The quantity b β by the former theorem is found, $\frac{m-M}{Mm}P$, which is the partial parallax that would have been ſeen by the earth's

Calculating the Diſtances, &c. of the Planets.

Calculating the Diſtances, &c. of the Planets.

earth's moving from O to E, if both ſtars had been in the ecliptic; but on account of the difference in latitude, it will be now repreſented by $a\beta$, the hypotheneuſe of the triangle $a\,b\,\beta$: therefore, in general, putting $a\,b=d$, and $a\,\beta=D$, we have $\sqrt{\frac{\overline{DD-dd}\times Mm}{m-M}}=P$. Hence D being taken by obſervation, and d, M, and m, given, we obtain the total parallax.

If the ſituation of the ſtars differs in longitude as well as latitude, we may reſolve this caſe by the following method. Let the triangle $a\,b\,\beta$ (fig. 169.) repreſent the ſituation of the ſtars, $a\,b=d$ being their diſtance ſeen at O, $a\,\beta=D$ their diſtance ſeen at E. That the change $b\,\beta$, which is produced by the earth's motion will be truly expreſſed by $\frac{m-M}{Mm}P$ may be proved as before, by ſuppoſing the ſtar a to have been placed at α. Now let the angle of poſition $b\,a\,\alpha$ be taken by a micrometer, or by any other method ſufficiently exact; then, by ſolving the triangle $a\,b\,\alpha$, we ſhall have the longitudinal and latitudinal differences $a\,\alpha$ and $b\,\alpha$ of the two ſtars, Put $a\,\alpha=x$, $b\,\alpha=y$, and it will be $x+b\,\beta=aq$, whence $D=\sqrt{\left.\overline{x+\frac{m-M}{Mm}P}\,\right|^{2}+yy}$; and $\frac{\sqrt{\overline{D^2-y^2}\times M^2m}-xMm}{m-M}=P$.

If neither of the ſtars ſhould be in the ecliptic, nor have the ſame longitude or latitude, the laſt theorem will ſtill ſerve to calculate the total parallax whoſe maximum will lie in E. There will, moreover, ariſe another parallax, whoſe maximum will be in the conjunction and oppoſition, which will be divided, and lie on different ſides of the large ſtar; but as we know the whole parallax to be exceedingly ſmall, it will not be neceſſary to inveſtigate every particular caſe of this kind; for by reaſon of the diviſion of the parallax, which renders obſervations taken at any other times, except where it is greateſt, very unfavourable, the formulæ would be of little uſe. Dr Herſchel cloſes his account of this theory with a general obſervation on the time and place where the maxima of parallax will happen.

When two unequal ſtars are both in the ecliptic, or, not being in the ecliptic, have equal latitudes, north or ſouth; and the largeſt ſtar has moſt longitude, the maximum of the apparent diſtance will be when the ſun's longitude is 90 degrees more than the ſtars, or when obſerved in the morning; and the maximum when the longitude of the ſun is 90 degrees leſs than that of the ſtars, or when obſerved in the evening. When the ſmall ſtar has moſt longitude, the maximum and minimum, as well as the time of obſervation, will be the reverſe of the former. When the ſtars differ in latitudes, this makes no alteration in the place of the maximum or minimum, nor in the time of obſervation; i. e. it is immaterial whether the largeſt ſtar has the leaſt or the greateſt diſtance of the two ſtars.

400 Different magnitudes of the ſtars.

The ſtars, on account of their apparently various magnitudes, have been diſtributed into ſeveral claſſes, or orders. Thoſe which appear largeſt are called *ſtars of the firſt magnitude*; the next to them in luſtre, *ſtars of the ſecond magnitude*; and ſo on to the *ſixth*, which are the ſmalleſt that are viſible to the bare eye. This diſtribution having been made long before the invention of teleſcopes, the ſtars which cannot be ſeen without the aſſiſtance of theſe inſtruments are diſtinguiſhed by the name of *teleſcopic ſtars*.

401 Teleſcopic ſtars.

The ancients divided the ſtarry ſphere into particular conſtellations, or ſyſtems of ſtars, according as they lay near one another, ſo as to occupy thoſe ſpaces which the figures of different ſorts of animals or things would take up, if they were there delineated. And thoſe ſtars which could not be brought into any particular conſtellation were called *unformed ſtars*.

402 Unformed ſtars.

403 Uſe of their diviſion into conſtellations.

This diviſion of the ſtars into different conſtellations, or aſteriſms, ſerves to diſtinguiſh them from one another, ſo that any particular ſtar may be readily found in the heavens by means of a celeſtial globe; on which the conſtellations are ſo delineated as to put the moſt remarkable ſtars into ſuch parts of the figures as are moſt eaſily diſtinguiſhed. The number of the ancient conſtellations is 48, and upon our preſent globes about 70. On Senex's globes are inſerted Bayer's letters; the firſt in the Greek alphabet being put to the biggeſt ſtar in each conſtellation, the ſecond to the next, and ſo on: by which means, every ſtar is as eaſily found as if a name were given to it. Thus, if the ſtar γ in the conſtellation of the ram be mentioned, every aſtronomer knows as well what ſtar is meant as if it were pointed out to him in the heavens. See fig. 205, 206. where the ſtars are repreſented with the figures of the animals from whence the conſtellations are marked.

404 Diviſion of the heavens. Fig. 26, 29.

There is alſo a diviſion of the heavens into three parts. 1. The zodiac (ζωδιακος), from ζωδιον *zodion*, "an animal," becauſe moſt of the conſtellations in it, which are 12 in number, have the names of animals: As *Aries* the ram, *Taurus* the bull, *Gemini* the twins, *Cancer* the crab, *Libra* the balance, *Scorpio* the ſcorpion, *Sagittarius* the archer, *Capricornus* the goat, *Aquarius* the water-bearer, and *Piſces* the fiſhes. The zodiac goes quite round the heavens: it is about 16 degrees broad, ſo that it takes in the orbits of all the planets, and likewiſe the orbit of the moon. Along the middle of this zone or belt is the ecliptic, or circle which the earth deſcribes annually as ſeen from the ſun, and which the ſun appears to deſcribe as ſeen from the earth. 2. All that region of the heavens which is on the north ſide of the zodiac, containing 21 conſtellations. And, 3. That on the ſouth ſide, containing 15.

405 Zodiac how divided.

The ancients divided the zodiac into the above 12 conſtellations or ſigns in the following manner. They took a veſſel with a ſmall hole in the bottom, and, having filled it with water, ſuffered the ſame to diſtil drop by drop into another veſſel ſet beneath to receive it; beginning at the moment when ſome ſtar roſe, and continuing till it roſe the next following night. The water falling down into the receiver, they divided into twelve equal parts; and having two other ſmall veſſels in readineſs, each of them fit to contain one part, they again poured all the water into the upper veſſel; and, obſerving the riſing of ſome ſtar in the zodiac, they at the ſame time ſuffered the water to drop into one of the ſmall veſſels; and as ſoon as it was full, they ſhifted it, and ſet an empty one in its place. When each veſſel was full, they took notice what ſtar of the zodiac roſe; and though this could not be done in one night, yet in many they obſerved the riſing of 12 ſtars or points, by which they divided the zodiac into 12 parts.

The name of the conſtellations, and the number of ſtars obſerved in each of them by different aſtronomers, are as follow.

406 Catalogue of the conſtellations.

The ancient Conſtellations.		*Ptolemy.*	*Tycho.*	*Hevelius.*	*Flamſtead.*
Urſa minor	The Little Bear	8	7	12	24
Urſa major	The Great Bear	35	29	73	87
Draco	The Dragon	31	32	40	80
Cepheus	Cepheus	13	4	51	35
Bootes, *Arctophilax*		23	18	52	54
Corona Borealis	The Northern Crown	8	8	8	21
Hercules, *Engonaſin*	Hercules kneeling	29	28	45	113
Lyra	The Harp	10	11	17	21
Cygnus, *Gallina*	The Swan	10	18	47	81
Caſſiopeia	The Lady in her Chair	13	26	37	55
Perſeus	Perſeus	29	29	46	59
Auriga	The Waggoner	14	9	40	66
Serpentarius, *Opiuchus*	Serpentarius	29	15	40	74
Serpens	The Serpent	18	13	22	64
Sagitta	The Arrow	5	5	5	18
Aquila, *Vultur*	The Eagle	15	12	23	71
Antinous	Antinous		3	19	
Delphinus	The Dolphin	10	10	14	18
Equulus, *Equi ſectio*	The Horſe's Head	4	4	6	10
Pegaſus, *Equus*	The Flying Horſe	20	19	38	89
Andromeda	Andromeda	23	23	47	66
Triangulum	The Triangle	4	4	12	16
Aries	The Ram	18	21	27	66
Taurus	The Bull	44	43	51	141
Gemini	The Twins	25	25	38	85
Cancer	The Crab	23	15	29	83
Leo	The Lion	35	30	49	95
Coma Berenices	Berenice's Hair		14	21	43
Virgo	The Virgin	32	33	50	110
Libra, *Chelæ*	The Scales	17	10	20	51
Scorpius	The Scorpion	24	10	20	44
Sagittarius	The Archer	31	14	22	69
Capricornus	The Goat	28	28	29	51
Aquarius	The Water-bearer	45	41	47	108
Piſces	The Fiſhes	38	36	39	113
Cetus	The Whale	22	21	45	97
Orion	Orion	38	42	62	78
Eridanus, *Fluvius*	Eridanus, *the River*	34	10	27	84
Lepus	The Hare	12	13	16	19
Canis major	The Great Dog	29	13	21	31
Canis minor	The Little Dog	2	2	13	14
Argo Navis	The Ship	45	3	4	64
Hydra	The Hydra	27	19	31	60
Crater	The Cup	7	8	10	31
Corvus	The Crow	7	4		9
Centaurus	The Centaur	37			35
Lupus	The Wolf	19			24
Ara	The Altar	7			9
Corona Auſtralis	The Southern Crown	13			12
Piſces Auſtralis	The Southern Fiſh	18			24

The new Southern Conſtellations.

Columba Noachi	Noah's Dove	10
Robur Carolinum	The Royal Oak	12
Grus	The Crane	13
Phœnix	The Phenix	13
Indus	The Indian	12
Pavo	The Peacock	14
Apus, *Avis Indica*	The Bird of Paradiſe	11
Apis, *Muſca*	The Bee or Fly	4
Chamæleon	The Chameleon	10
Triangulum Auſtralis	The South Triangle	5
Piſcis volans, *Paſſer*	The Flying Fiſh	8
Dorado, *Xiphias*	The Sword Fiſh	6
Toucan	The American Gooſe	9
Hydrus	The Water Snake	10

Calculating the Diſtances, &c. of the Planets.

Hevelius's Conſtellations made out of the unformed Stars.

		Hevel.	*Flamſt.*
Lynx	The Lynx	19	44
Leo minor	The Little Lion		53
Aſterion & Chara	The Greyhounds	23	25
Cerberus	Cerberus	4	
Vulpecula & Anſer	The Fox and Gooſe	27	35
Scutum Sobieſki	Sobieſki's Shield	7	
Larcerta	The Lizard	10	16
Camelopardalus	The Camelopard	32	58
Monocerns	The Unicorn	19	31
Sextans	The Sextant	11	41

407 Change in the obliquity of the ecliptic.

The obliquity of the ecliptic to the equinoctial is found at preſent to be above the third part of a degree leſs than Ptolemy found it. And moſt of the obſervers after him found it to decreaſe gradually down to Tycho's time. If it be objected, that we cannot depend on the obſervations of the ancients, becauſe of the incorrectneſs of their inſtruments; we have to anſwer, that both Tycho and Flamſtead are allowed to have been very good obſervers; and yet we find that Flamſtead makes this obliquity 2½ minutes of a degree leſs than Tycho did about 100 years before him; and as Ptolemy was 1324 years before Tycho, ſo the gradual decreaſe anſwers nearly to the difference of time between theſe three aſtronomers. If we conſider, that the earth is not a perfect ſphere, but an oblate ſpheroid, having its axis ſhorter than its equatorial diameter; and that the ſun and moon are conſtantly acting obliquely upon the greater quantity of matter about the equator, pulling it, as it were, towards a nearer and nearer coincidence with the ecliptic; it will not appear improbable that theſe actions ſhould gradually diminiſh the angle between thoſe planes. Nor is it leſs probable that the mutual attractions of all the planets ſhould have a tendency to bring their orbits to a coincidence: but this change is too ſmall to become ſenſible in many ages.

SECT. IX. *Of calculating the periodical Times, Places, &c. of the Sun, Moon, and Planets: Delineation of the Phaſes of the Moon for any particular Time; and the Conſtruction of Aſtronomical Tables.*

THIS title includes almoſt all of what may be called the *Practical part of Aſtronomy*; and as it is by far the moſt difficult and abſtruſe, ſo the thorough inveſtigation of it would neceſſarily lead us into very deep geometrical demonſtrations. The great labours of former aſtronomers have left little for ſucceeding ones to do in this reſpect: tables of the motions of all the celeſtial bodies have been made long ago, the periodical times, eccentricities, &c. of the planets determined; and as we ſuppoſe few will deſire to repeat theſe laborious operations, we ſhall here content ourſelves with giving ſome general hints of the methods by which theſe things have been originally accompliſhed, that ſo the operations of the young aſtronomer who makes uſe of tables already formed to his hand may not be merely mechanical.

Of calculating the periodical Times of the Planets, &c.

308 Latitude of any place how found.

It hath been already obſerved, that the foundation of all aſtronomical operations was the drawing a meridian line. This being done, the next thing is to find out the latitude of the place where the obſervations are to be made, and for which the meridian line is drawn. From what hath been ſaid, n° 39. it will eaſily be underſtood that the latitude of a place muſt always be equal to the elevation either of the north or ſouth pole above the horizon; becauſe when we are exactly on the equator, both poles appear on the horizon. There is, however, no ſtar exactly in either of the celeſtial poles; therefore, to find the altitude of that inviſible point called the *Pole of the heavens*, we muſt choſe ſome ſtar near it which does not ſet; and having by ſeveral obſervations, according to the directions given n° 377, found its greateſt and leaſt altitudes, divide their difference by 2; and half that difference added to the leaſt, or ſubtracted from the greateſt, altitude of the ſtar, gives the exact altitude of the pole or latitude of the place. Thus, ſuppoſe the greateſt altitude of the ſtar obſerved is 60° and its leaſt 50°, we then know that the altitude of the place where the obſervation was made is exactly 55°.

409 Obliquity of the ecliptic found.

The latitude being once found, the obliquity of the ecliptic, or the angle made by the ſun's annual path with the earth's equator, is eaſily obtained by the following method. Obſerve, about the ſummer ſolſtice, the ſun's meridian diſtance from the zenith, which is eaſily done by a quadrant with a moveable index furniſhed with ſights; if this diſtance is ſubtracted from the latitude of the place, provided the ſun is nearer the equator than the place of obſervation, the remainder will be the obliquity of the ecliptic: But if the place of obſervation is nearer the equator than the ſun at that time, the zenith diſtance muſt be added. By this method, the obliquity of the ecliptic hath been determined to be 23° 29′.

410 Sun's declination.

By the ſame method the declination of the ſun from the equator for any day may be found; and thus a table of his declination for every day in the year might be conſtructed: thus alſo the declination of the ſtars might be found.

411 His place in the ecliptic how found. Fig. 156.

Having the declination of the ſun, his right aſcenſion and place in the ecliptic may be geometrically found by the ſolution of a caſe in ſpherical trigonometry. For let EQ repreſent the celeſtial equator, y the ſun, and y X the ecliptic; then, in the right-angled ſpherical triangle ECy, we have the ſide Ey, equal to the ſun's declination: the angle ECy is always 23° 29′, being the angle of the ecliptic with the equator; and the angle yEC is 90°, or a right angle. From theſe data we can find the ſide EC the right aſcenſion; and Cy the ſun's place in the ecliptic, or his diſtance from the equinoctial point; and thus a table of the ſun's place for every day in the year, anſwerable to his declination, may be formed.

412 To find the right aſcenſion of the ſtars.

Having the ſun's place in the ecliptic, the right aſcenſion of the ſtars may be found by the help of it and a good pendulum clock: For which purpoſe, the motion of the clock muſt be ſo adjuſted that the hand may run through the 24 hours in the ſame time that a ſtar leaving the meridian will arrive at it again; which time is ſomewhat ſhorter than the natural day, becauſe of the ſpace the ſun moves through in the mean time eaſtward.

Of Calculating the periodical Times of the Planets, &c.

ward. The clock being thus adjuſted, when the ſun is in the meridian, fix the hand to the point from whence we are to begin to reckon our time; and then obſerve when the ſtar comes to the meridian, and mark the hour and minute that the hand then ſhows: The hours and minutes deſcribed by the index, turned into degrees and minutes of the equator, will give the difference between the right aſcenſion of the ſun and ſtars; which difference, being added to the right aſcenſion of the ſun will give the right aſcenſion of the ſtar. Now, if we know the right aſcenſion of any one ſtar, we may from it find the right aſcenſions of all the others which we ſee, by marking the time upon the clock between the arrival of the ſtar whoſe right aſcenſion we know to the meridian, and another ſtar whoſe aſcenſion is to be found. This time converted into hours and minutes of the equator, will give the difference of right aſcenſions; from whence, by addition, we collect the right aſcenſion of the ſtar which was to be found out.

413 Their longitudes and latitudes found.

The right aſcenſion and declination of a ſtar being known, its longitude and latitude, or diſtance from the firſt ſtar of Aries, and north or ſouth from the ecliptic, may thence be eaſily found, from the ſolution of a caſe in ſpherical trigonometry, ſimilar to that already mentioned concerning the ſun's place; and the places of the fixed ſtars being all marked in a catalogue according to their longitudes and latitudes, it may thence be conceived how the longitude and latitude of a planet or a comet may be found for any particular time by comparing its diſtances from them, and it apparent path may thus be traced; and thus the paths of Mercury and Venus were traced by M. Caſſini, though Mr Ferguſon made uſe of an orrery for that purpoſe.

414 To find the periodical times of the planets.

With regard to the planets, the firſt thing to be done is to find out their periodical times, which is done by obſerving when they have no latitude. At that time the planet is in the ecliptic, and conſequently in one of its nodes; ſo that by waiting till it returns to the ſame node again, and keeping an exact account of the time, the periodical time of its revolution round the ſun may be known pretty exactly. By the ſame obſervations, from the theory of the earth's motion we can find the poſition of the line of the nodes; and when once the poſition of this line is found, the angle of inclination of that planet's orbit to the earth may alſo be known.

415 Eccentricity of the earth's orbit how determined.

The eccentricity of the earth's orbit may be determined by obſerving the apparent diameters of the ſun at different times: when the ſun's diameter is leaſt, the earth is at the greateſt diſtance; and when this diameter is greateſt, the earth is at its leaſt diſtance from him. But as this method muſt neceſſarily be precarious, another is recommended by Dr Keil, by obſerving the velocity of the earth in its orbit, or the apparent velocity of the ſun, which is demonſtrated to be always reciprocally as the ſquare of the diſtance.

416 Of the other planets.

The eccentricities of the orbits of the other planets may be likewiſe found by obſerving their velocities at different times; for all of them obſerve the ſame proportions with regard to the increaſe or decreaſe of their velocity that the earth does; only, in this caſe, care muſt be taken to obſerve the real, not the apparent, velocities of the planets, the laſt depending on the motion of the earth at the ſame time. Their aphelia, or points of their orbits where they are fartheſt from the ſun, may be known by making ſeveral obſervations of their diſtances from him, and thus perceiving when theſe diſtances ceaſe to increaſe.

Of calculating the periodical Times of the Planets, &c.

417 To find their places in their orbits.

The poſition of the aphelion being determined, the planet's diſtance from it at any time may alſo be found by obſervation, which is called its *true* or *coequated* anomaly; but by ſuppoſing the motion of the planet to be regular and uniform, tables of that motion may be eaſily conſtructed. From thence the planet's mean place in its orbit may be found for any moment of time; and one of theſe moments being fixed upon as an epocha or beginning of the table, it is eaſy to underſtand, that from thence tables of the planet's place in its orbit for any number of years either preceding or conſequent to that period may be conſtructed. Theſe tables are to be conſtructed according to the meridian of equal time, and not true or apparent time, becauſe of the inequalities of the earth's motion as well as that of the planet, and equations muſt be made to be added to or ſubtracted from the mean motion of the planet as occaſion requires; which will be readily underſtood from what we have already mentioned concerning the unequal motion of the earth in its orbit. When all the neceſſary tables are conſtructed by this or ſimilar methods, the calculating of the planetary places becomes a mere matter of mechaniſm, and conſiſts only in the proper additions and ſubtractions according to the directions always given along with ſuch tables.

418 Inaccuracies from the mutual attraction of the planets.

It muſt be obſerved, however, that the accidental interference of the planets with one another by their mutual attractions render it impoſſible to conſtruct any tables that ſhall remain equally perfect; and therefore frequent actual obſervations and corrections of the tables will be neceſſary. This diſturbance, however, is inconſiderable, except in the planets Jupiter and Saturn, and they are in conjunction only once in 800 years.

419 Difficulties with regard to the moon.

What hath been already mentioned with regard to the planets, is alſo applicable to the moon; but with more difficulty, on account of the greater inequalities of her motions, the cauſe of which has been already explained. She indeed moves in an ellipſe as the reſt do, and its eccentricity may be better computed from obſerving her diameter at different times than that of the earth's orbit; but that eccentricity is not always the ſame. The reaſon of this, and indeed of all the other lunar inequalities, is, that the ſun has a ſenſible effect upon her by his attraction, as well as the earth. Conſequently, when the earth is at its leaſt diſtance from the ſun, her orbit is dilated, and ſhe moves more ſlowly; and, on the contrary, when the earth is in its aphelion, her orbit contracts, and ſhe moves more ſwiftly. The eccentricity is always greateſt when the line of the apſides coincides with that of the ſyzygies, and the earth at its leaſt diſtance from the ſun. When the moon is in her ſyzygies, i. e. in the line that joins the centres of the earth and ſun, which is either in her conjunction or oppoſition, ſhe moves ſwifter, *cæteris paribus*, than in the quadratures. According to the different diſtances of the moon from the ſyzygies, ſhe changes her motion: from the conjunction to her firſt quadrature, ſhe moves ſomewhat ſlower; but recovers her velocity in the ſecond quarter. In the third quarter ſhe again loſes, and in the laſt again recovers it. The

420 Moves equably on her axis.

The apogeon of the moon is alſo irregular; being found to move forward when it coincides with the line of the ſyzygies, and backwards whent it cuts that line at right angles. Nor is this motion in any degree equal: in the conjunction or oppoſition, it goes briſkly forwards, and in the quadratures moves either ſlowly forwards, ſtands ſtill, or goes backward. The motion of the nodes has been already taken notice of: but this motion is not uniform more than the reſt; for when the line of the nodes coincides with that of the ſyzygies, they ſtand ſtill; when their line cuts that at right angles, they go backwards with the velocity, as Sir Iſaac Newton hath ſhown, of $16'' 19''' 24''''$ an hour. The only equable motion the moon has, is her revolution on her axis, which ſhe always performs exactly in the ſpace of time in which ſhe moves round the earth. From hence ariſes what is called the *moon's libration*; for as the motion round her axis is equable, and that in her orbit unequal, it follows, that when the moon is in her perigee, where ſhe moves ſwifteſt, that part of her ſurface, which on account of the motion in her orbit would be turned from the earth, is not ſo, by reaſon of the motion on her axis. Thus ſome parts in the limb or margin of the moon ſometimes recede from, and ſometimes approach towards, the centre of the diſk. Yet this equable rotation produces an apparent irregularity; for the axis of the moon not being perpendicular but a little inclined to its orbit, and this axis maintaining its parallelism round the earth, it muſt neceſſarily change its ſituation with reſpect to an obſerver on the earth, to whom ſometimes the one and ſometimes the other pole of the moon becomes viſible; whence it appears to have a kind of wavering or vacillatory motion.

421 Lunar irregularities accounted for by Sir Iſaac Newton.

422 Her periodical time determined by Copernicus.

From all theſe irregularities it may well be concluded, that the calculation of the moon's place in her orbit is a very difficult matter; and indeed, before Sir Iſaac Newton, aſtronomers in vain laboured to ſubject the lunar irregularities to any rule. By his labours, however, and thoſe of other aſtronomers, theſe difficulties are in a great meaſure overcome; and calculations with regard to this luminary may be made with as great certainty as concerning any other. Her periodical time may be determined from the obſervation of two lunar eclipſes, at as great a diſtance from one another as poſſible; for in the middle of every lunar eclipſe, the moon is exactly in oppoſition to the ſun. Compute the time between theſe two eclipſes or oppoſitions, and divide this by the number of lunations that have intervened, and the quotient will be the ſynodical month, or time the moon takes to paſs from one conjunction to another, or from one oppoſition to another. Compute the ſun's mean motion in the time of the ſynodical month, and add this to the entire circle deſcribed by the moon. Then, As that ſum is to 360°, ſo is the quantity of the ſynodical month to the periodical, or time that the moon takes to move from one point of her orbit to the ſame point again. Thus, Copernicus, in the year 1500, November 6th, at 2 hours 20 minutes, obſerved an eclipſe of the moon at Rome; and Auguſt 1ſt 1523, at 4 hours 25 minutes, another at Cracow: hence the quantity of the ſynodical month is thus determined

	Y.	D.	H.	M.
Obſerv. 2d	1523	237	4	25
Obſerv. 1ſt	1500	310	2	20
Interval of time	22	292	2	5
Add the intercalary days for leap years.		5		
Exact interval	22	297	2	5, or 11991005′.

This interval divided by 282, the number of months elapſed in that time, gives 29 days 12 hours 41 minutes for the length of the ſynodical month. But from the obſervations of two other eclipſes, the ſame author more accurately determined the quantity of the ſynodical month to be 29 degrees 11 hours 45 minutes 3 ſeconds: from whence the mean periodical time of the moon comes to be 27 degrees 7 hours 43 minutes 5 ſeconds, which exactly agrees with the obſervations of later aſtronomers.

423 Her diurnal and horary motion.

The quantity of the periodical month being given, by the Rule of Three, we may find the moon's diurnal and horary motion; and thus may tables of the moon's mean motion be conſtructed; and if from the moon's mean diurnal motion that of the ſun be ſubtracted, the remainder will be the moon's mean diurnal motion from the ſun.

424 Her phaſes delineated. Fig. 30. 31.

Having the moon's diſtance from the ſun, her phaſes for that time may be eaſily delineated by the following method laid down by Dr Keil. "Let the circle COBP repreſent the diſk of the moon, which is turned towards the earth; and let OP be the line in which the ſemicircle OMP is projected, which ſuppoſe to be cut by the diameter BC, at right angles; and making LP the radius, take LF equal to the coſine of the elongation of the moon from the ſun: And then upon BC, as the great axis, and LF the leſſer axis, deſcribe the ſemi-ellipſe BFC. This ellipſe will cut off from the diſk of the moon the portion BFCP of the illuminated face, which is viſible to us from the earth."

425 Place of the nodes how found.

Since in the middle of a total eclipſe the moon is exactly in the node, if the ſun's place be found for that time, and ſix ſigns added to it, if the eclipſe is a lunar one the ſun will give the place of the node, or if the eclipſe obſerved is a ſolar one, the place of the node and of the ſun are the ſame. From comparing two eclipſes together, the mean motion of the nodes will thus be found out. The apogee of the moon may be known from her apparent diameter, as already obſerved; and by comparing her place when in the apogee at different times, the motion of the apogee itſelf may alſo be determined.

Theſe ſhort hints will be ſufficient to give a general knowledge of the methods uſed for the ſolution of ſome of the moſt difficult problems in aſtronomy. As for the proper equations to be added or ſubtracted, in order to find out the true motion and place of the moon, together with the particular methods of conſtructing tables for calculating eclipſes, they are given from Mr Ferguſon, in the following ſection.

SECT. X. *Of Eclipſes: With Tables for their Calculation: the Method of conſtructing them: Rules for Calculation, and Directions for the Delineation of Solar and Lunar Eclipſes.*

EVERY planet and ſatellite is illuminated by the ſun; and caſts a ſhadow towards that point of the heavens which is oppoſite to the ſun. This ſhadow is nothing but a privation of light in the ſpace hid from the ſun by the opaque body that intercepts his rays.

426 Eclipſe defined.

When the ſun's light is ſo intercepted by the moon, that to any place of the earth the ſun appears partly or wholly covered, he is ſaid to *undergo an eclipſe*; though, properly ſpeaking, it is only an eclipſe of that part of the earth where the moon's ſhadow or penumbra falls. When the earth comes between the ſun and moon, the moon falls into the earth's ſhadow; and having no light of her own, ſhe ſuffers a real eclipſe from the interception of the ſun's rays. When the ſun is eclipſed to us, the moon's inhabitants, on the ſide next the earth, ſee her ſhadow like a dark ſpot travelling over the earth, about twice as faſt as its equatorial parts move, and the ſame way as they move. When the moon is in an eclipſe, the ſun appears eclipſed to her, total to all thoſe parts on which the earth's ſhadow falls, and of as long continuance as they are in the ſhadow.

427 Figure of the earth ſpherical.

That the earth is ſpherical (for the hills take off no more from the roundneſs of the earth, than grains of duſt do from the roundneſs of a common globe) is evident from the figure of its ſhadow on the moon; which is always bounded by a circular line, although the earth is inceſſantly turning its different ſides to the moon, and very ſeldom ſhows the ſame ſide to her in different eclipſes, becauſe they ſeldom happen at the ſame hours. Were the earth ſhaped like a round flat plate, its ſhadow would only be circular when either of its ſides directly faced the moon, and more or leſs elliptical as the earth happened to be turned more or leſs obliquely towards the moon when ſhe is eclipſed.

428 Moon's figure the ſame.

The moon's different phaſes prove her to be round; for as ſhe keeps ſtill the ſame ſide towards the earth, if that ſide were flat, as it appears to be, ſhe would never be viſible from the third quarter to the firſt; and from the firſt quarter to the third, ſhe would appear as round as when we ſay *ſhe is full*; becauſe, at the end of her firſt quarter, the ſun's light would come as ſuddenly on all her ſide next the earth, as it does on a flat wall, and go off as abruptly at the end of her third quarter.

429 Shadows of the earth and moon conical.

If the earth and ſun were equally large, the earth's ſhadow would be infinitely extended, and all of the ſame bulk; and the planet Mars, in either of its nodes and oppoſite to the ſun, would be eclipſed in the earth's ſhadow. Were the earth larger than the ſun, its ſhadow would increaſe in bulk the farther it extended, and would eclipſe the great planets Jupiter and Saturn, with all their moons, when they were oppoſite to the ſun. But as Mars, in oppoſition, never falls into the earth's ſhadow, altho' he is not then above 42,000,000 miles from the earth, it is plain that the earth is much leſs than the ſun; for otherwiſe its ſhadow could not end in a point at ſo ſmall a diſtance. If the ſun and moon were equally large, the moon's ſhadow would go on to the earth with an equal breadth, and cover a portion of the earth's ſurface more than 2000 miles broad, even if it fell directly againſt the earth's centre, as ſeen from the moon; and much more if it fell obliquely on the earth: But the moon's ſhadow is ſeldom 150 miles broad at the earth, unleſs when it falls very obliquely on the earth, in total eclipſes of the ſun. In annular eclipſes, the moon's real ſhadow ends in a point at ſome diſtance from the earth. The moon's ſmall diſtance from the earth, and the ſhortneſs of her ſhadow, prove her to be leſs than the ſun. And, as the earth's ſhadow is large enough to cover the moon, if her diameter were three times as large as it is (which is evident from her long continuance in the ſhadow when ſhe goes through its centre), it is plain that the earth is much bigger than the moon.

430 Why there are ſo few eclipſes.

Though all opaque bodies, on which the ſun ſhines, have their ſhadows, yet ſuch is the bulk of the ſun, and the diſtances of the planets, that the primary planets can never eclipſe one another. A primary can eclipſe only its ſecondary, or be eclipſed by it; and never but when in oppoſition or conjunction with the ſun. The primary planets are very ſeldom in theſe poſitions, but the ſun and moon are ſo every month: Whence one may imagine, that theſe two luminaries ſhould be eclipſed every month. But there are few eclipſes in reſpect of the number of new and full moons; the reaſon of which we ſhall now explain.

If the moon's orbit were coincident with the plane of the ecliptic, in which the earth always moves and the ſun appears to move, the moon's ſhadow would fall upon the earth at every change, and eclipſe the ſun to ſome parts of the earth. In like manner, the moon would go through the middle of the earth's ſhadow, and be eclipſed at every full; but with this difference, that ſhe would be totally darkened for above an hour and an half; whereas the ſun never was above four minutes totally eclipſed by the interpoſition of the moon. But one half of the moon's orbit is elevated $5\frac{1}{3}$ degrees above the ecliptic, and the other half as much depreſſed below it; conſequently, the moon's orbit interſects the ecliptic in two oppoſite points called the *moon's nodes*, as has been already taken notice of. When theſe points are in a right line with the centre of the ſun at new or full moon, the ſun, moon, and earth, are all in a right line; and if the moon be then new, her ſhadow falls upon the earth; if full, the earth's ſhadow falls upon her. When the ſun and moon are more than 17 degrees from either of the nodes at the time of conjunction, the moon is then generally too high or too low in her orbit to caſt any part of her ſhadow upon the earth; when the ſun is more than 12 degrees from either of the nodes at the time of full moon, the moon is generally too high or too low in her orbit to go through any part of the earth's ſhadow: and in both theſe caſes there will be no eclipſe. But when the moon is leſs than 17 degrees from either node at the time of conjunction, her ſhadow or penumbra falls more or leſs upon the earth, as ſhe is more or leſs within this limit. And when ſhe is leſs than 12 degrees from either node at the time of oppoſition, ſhe goes through a greater or leſs portion of the earth's ſhadow, as ſhe is more or leſs within this limit. Her orbit contains 360 degrees; of which 17, the limit of ſolar eclipſes on either ſide of the nodes, and 12, the limit of lunar eclipſes, are but ſmall portions: And as the ſun commonly paſſes by the nodes but twice in a year, it is no wonder that we have ſo many new and full moons without eclipſes.

To illuſtrate this (fig. 196.), let ABCD be the ecliptic, RSTU a circle laying in the ſame plane with the ecliptic, and VXYZ the moon's orbit, all thrown into an oblique view, which gives them an elliptical ſhape to the eye. One half of the moon's orbit, as VWX, is always below the ecliptic, and the other half XYV above it. The points V and X, where the moon's orbit interſects the circle RSTU, which lies even with the ecliptic, are the moon's nodes; and a right line, as XEV, drawn from one to the other, through the earth's centre, is the line of the nodes, which is carried almoſt parallel to itſelf round the ſun in a year.

If the moon moved round the earth in the orbit RSTU, which is coincident with the plane of the ecliptic, her ſhadow would fall upon the earth every time ſhe is in conjunction with the ſun, and at every oppoſition ſhe would go through the earth's ſhadow. Were this the caſe, the ſun would be eclipſed at every change, and the moon at every full, as already mentioned.

But although the moon's ſhadow N muſt fall upon the earth at *a*, when the earth is at E, and the moon in conjunction with the ſun at *i*, becauſe ſhe is then very near one of her nodes; and at her oppoſition *n* ſhe muſt go through the earth's ſhadow I, becauſe ſhe is then near the other node; yet, in the time that ſhe goes round the earth to her next change, according to the order of the letters XYVW, the earth advances from E to *e*, according to the order of the letters EFGH; and the line of the nodes VEX, being carried nearly parallel to itſelf, brings the point *f* of the moon's orbit in conjunction with the ſun at that next change: and then the moon being at *f*, is too high above the ecliptic to caſt her ſhadow on the earth: and as the earth is ſtill moving forward, the moon at her next oppoſition will be at *g*, too far below the ecliptic to go through any part of the earth's ſhadow; for by that time the point *g* will be at a conſiderable diſtance from the earth as ſeen from the ſun.

When the earth comes to F, the moon in conjunction with the ſun Z is not at *k* in a plane coincident with the ecliptic, but above it at Y in the higheſt part of her orbit; and then the point *b* of her ſhadow O goes far above the earth (as in fig. 2. which is an edge view of fig. 1.). The moon at her next oppoſition, is not at *o* (fig. 1.), but at W, where the earth's ſhadow goes far above her (as in fig. 2.). In both theſe caſes the line of the nodes VEX (fig. 1) is about ninety degrees from the ſun, and both luminaries are as far as poſſible from the limits of the eclipſes.

When the earth has gone half round the ecliptic from E to G, the line of the nodes VGX is nearly, if not exactly, directed towards the ſun at Z; and then the new moon *l* caſts her ſhadow P on the earth G; and the full moon *p* goes through the earth's ſhadow L; which brings on eclipſes again, as when the earth was at E.

When the earth comes to H, the new moon falls not at *m* in a plane coincident with the ecliptic CD, but at W in her orbit below it; and then her ſhadow Q (ſee fig. 197.) goes far below the earth. At the next full ſhe is not at *q* (fig. 196.), but at Y in her orbit $5\frac{1}{3}$ degrees above *q*, and at her greateſt height above the ecliptic CD; being then as far as poſſible, at any oppoſition, from the earth's ſhadow M, as in fig. 197.

So, when the earth is at E and G, the moon is about her nodes at new and full, and in her greateſt north and ſouth declination (or latitude as it is generally called) from the ecliptic at her quarters; but when the earth is at F or H, the moon is in her greateſt north and ſouth declination from the ecliptic at new and full, and in the nodes about her quarters.

The point X, where the moon's orbit croſſes the ecliptic, is called the *aſcending node*, becauſe the moon aſcends from it above the ecliptic; and the oppoſite point of interſection V called the *deſcending node*, becauſe the moon deſcends from it below the ecliptic. When the moon is at Y in the higheſt point of her orbit, ſhe is in her greateſt north latitude; and when ſhe is at W in the loweſt point of her orbit, ſhe is in her greateſt ſouth latitude.

431 Appearance of eclipſes determined from the motion of the nodes.

If the line of the nodes, like the earth's axis, was carried parallel to itſelf round the ſun, there would be juſt half a year between the conjunctions of the ſun and nodes. But the nodes ſhift backwards, or contrary to the earth's annual motion, $19\frac{1}{3}$ deg. every year; and therefore the ſame node comes round the ſun 19 days ſooner every year than on the year before. Conſequently, from the time that the aſcending node X (when the earth is at E) paſſes by the ſun as ſeen from the earth, it is only 173 days (not half a year) till the deſcending node V paſſes by him. Therefore in whatever time of the year we have eclipſes of the luminaries about either node, we may be ſure that in 173 days afterward we ſhall have eclipſes about the other node. And when at any time of the year the line of the nodes is in the ſituation VGX, at the ſame time next year it will be in the ſituation *r*G*s*; the aſcending node having gone backward, that is, contrary to the order of ſigns, from X to *s*, and the deſcending node from V to *r*; each $19\frac{1}{3}$ deg. At this rate, the nodes ſhift through all the ſigns and degrees of the ecliptic in 18 years and 225 days; in which time there would always be a regular period of eclipſes, if any complete number of lunations were finiſhed without a fraction. But this never happens; for if both the ſun and moon ſhould ſtart from a line of conjunction with either of the nodes in any point of the ecliptic, the ſun would perform 18 annual revolutions and 222 degrees over and above, and the moon 230 lunations and 85 degrees of the 231ſt, by the time the node came round to the ſame point of the ecliptic again; ſo that the ſun would then be 138 degrees from the node, and the moon 85 degrees from the ſun.

But, in 223 mean lunations, after the ſun, moon, and nodes, have been once in a line of conjunction, they return ſo nearly to the ſame ſtate again, as that the ſame node, which was in conjunction with the ſun and moon at the beginning of the firſt of theſe lunations, will be within 28′ 12″ of a degree of a line of conjunction with the ſun and moon again, when the laſt of theſe lunations is completed. And therefore in that time there will be a regular period of eclipſes, or return of the ſame eclipſe, for many ages——In this period (which was firſt diſcovered by the Chaldeans) there are 18 Julian years 11 days 7 hours 43 minutes 20 ſeconds, when the laſt day of February in leap years is four times included; but when it is five times inclu-

ASTRONOMY

Plate LXXXII

Fig. 190

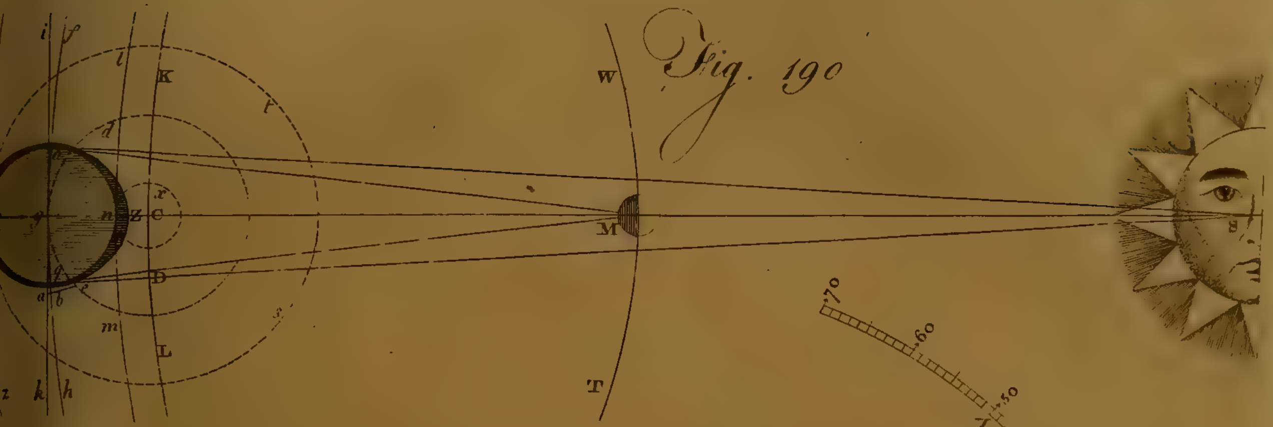


Fig. 195

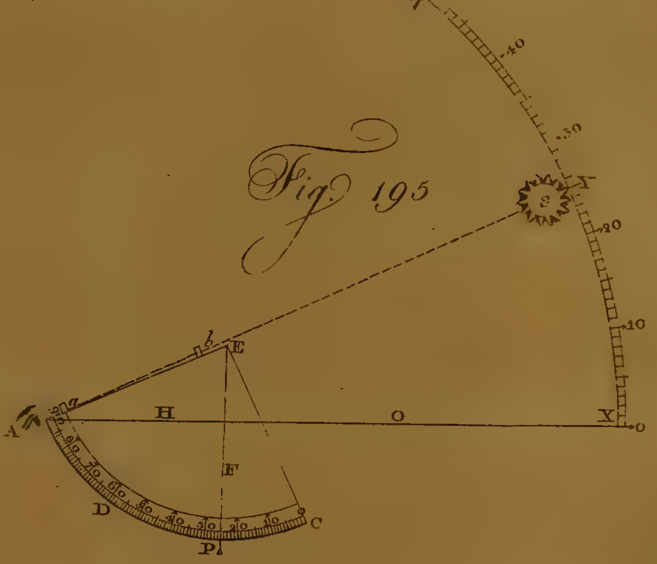


Fig. 191

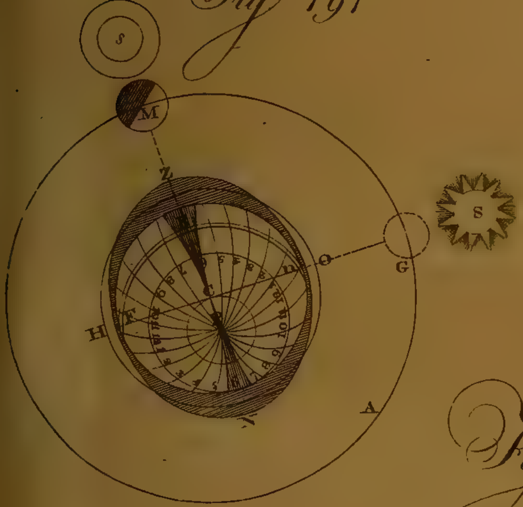


Fig. 192

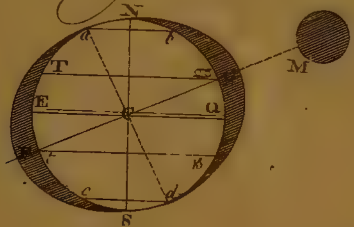


Fig. 193

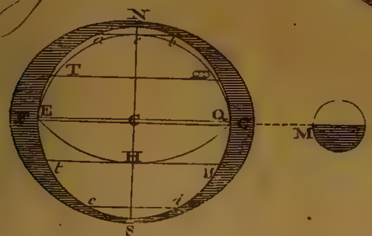
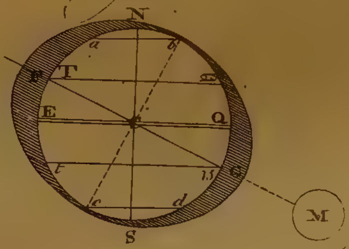


Fig. 194



Scot Philad.ª

ded, the period conſiſts of only 18 years 10 days 7 hours 43 minutes 20 ſeconds. Conſequently, if to the mean time of any eclipſe, either of the ſun or moon, you add 18 Julian years 11 days 7 hours 43 minutes 20 ſeconds, when the laſt day of February in leap-years comes in four times, or a day leſs when it comes in five times, you will have the mean time of the return of the ſame eclipſe.

432 When the ſame eclipſe returns again.

But the falling back of the line of conjunctions or oppoſitions of the ſun and moon 28′ 12″ with reſpect to the line of the nodes in every period, will wear it out in proceſs of time; and after that, it will not return again in leſs than 12,492 years.—Theſe eclipſes of the ſun, which happen about the aſcending node, and begin to come in at the north pole of the earth, will go a little ſoutherly at each return, till they go quite off the earth at the ſouth pole; and thoſe which happen about the deſcending node, and begin to come in at the ſouth pole of the earth, will go a little northerly at each return, till at laſt they quite leave the earth at the north pole.

433 Hiſtory of the ſolar eclipſe in 1764.

To exemplify this matter, we ſhall firſt conſider the ſun's eclipſe (March 21ſt old ſtyle, April 1ſt new ſtyle), A. D. 1764, according to its mean revolutions, without equating the times, or the ſun's diſtance from the node; and then according to its true equated times.

This eclipſe fell in open ſpace at each return, quite clear of the earth, ever ſince the creation, till A. D. 1295, June 13th old ſtyle, at 12 h. 52 m. 59 ſec. *poſt meridiem*, when the moon's ſhadow firſt touched the earth at the north pole; the ſun being then 17° 48′ 27″ from the aſcending node. In each period ſince that time, the ſun has come 28′ 12″ nearer and nearer the ſame node, and the moon's ſhadow has therefore gone more and more ſoutherly.—In the year 1962, July 18th old ſtyle, at 19 h. 36 m. 21 ſec. *p. m.* when the ſame eclipſe will have returned 38 times, the ſun will be only 24′ 45″ from the aſcending node, and the centre of the moon's ſhadow will fall a little northward of the earth's centre.—At the end of the next following period, A. D. 1980, July 28th old ſtyle, at 18 h. 19 m. 41 ſec. *p. m.* the ſun will have receded back 3′ 27″ from the aſcending node, and the moon will have a very ſmall degree of ſouthern latitude, which will cauſe the centre of her ſhadow to paſs a very ſmall matter ſouth of the earth's centre.—After which, in every following period, the ſun will be 28′ 12″ farther back from the aſcending node than in the period laſt before; and the moon's ſhadow will go ſtill farther and farther ſouthward, until September 12th old ſtyle, at 23 h. 46 m. 22 ſec. *p. m.* A. D. 2665; when the eclipſe will have completed its 77th periodical return, and will go quite off the earth at the ſouth pole (the ſun being then 17° 55′ 22″ back from the node), and cannot come in at the north pole, ſo as to begin the ſame courſe over again, in leſs than 12,492 years afterwads.—And ſuch will be the caſe of every other eclipſe of the ſun: For, as there is about 18 degrees on each ſide of the node within which there is a poſſibility of eclipſes, their whole revolution goes through 36 degrees about that node, which, taken from 360 degrees, leaves remaining 324 degrees for the eclipſes to travel *in expanſum*. And as this 36 degrees is not gone through in leſs than 77 periods, which takes up 1388 years, the remaining 324 degrees cannot be ſo gone through in leſs than 12,492 years. For, as 36 is to 1388, ſo is 324 to 12,492.

434 Of the eclipſe in 1748.

To illuſtrate this a little farther, we ſhall examine ſome of the moſt remarkable circumſtances of the returns of the eclipſe which happened July 14th 1748, about noon. This eclipſe, after traverſing the voids of ſpace from the creation, at laſt began to enter the Terra Auſtralis Incognita about 88 years after the conqueſt, which was the laſt of king Stephen's reign: every Chaldean period it has crept more northerly, but was ſtill inviſible in Britain before the year 1622; when, on the 30th of April, it began to touch the ſouth parts of England about two in the afternoon; its central appearance riſing in the American ſouth ſeas, and traverſing Peru and the Amazon's country, through the Atlantic ocean into Africa, and ſetting in the Æthiopian continent, not far from the beginning of the Red ſea.

Its next viſible period was, after three Chaldean revolutions, in 1676, on the firſt of June, riſing central in the Atlantic ocean, paſſing us about nine in the morning, with four digits eclipſed on the under limb, and ſetting in the gulph of Cochinchina in the Eaſt Indies.

It being now near the ſolſtice, this eclipſe was viſible the very next return in 1694, in the evening; and in two periods more, which was in 1730, on the 4th of July, was ſeen about half eclipſed juſt after ſun-riſe, and obſerved both at Wirtemberg in Germany, and Pekin in China, ſoon after which it went off.

Eighteen years more afforded us the eclipſe which fell on the 14th of July 1748.

The next viſible return happened on July 25th 1766 in the evening, about four digits eclipſed; and, after two periods more, will happen on Auguſt 16th 1802, early in the morning, about five digits, the centre coming from the north frozen continent, by the capes of Norway, through Tartary, China, and Japan, to the Ladrone iſlands, where it goes off.

Again, in 1820, Auguſt 26th, between one and two, there will be another great eclipſe at London, about 10 digits; but, happening ſo near the equinox, the centre will leave every part of Britain to the weſt, and enter Germany at Embden, paſſing by Venice, Naples, Grand Cairo, and ſet in the gulf of Baſſora near that city.

It will be no more viſible till 1874, when five digits will be obſcured (the centre being now about to leave the earth) on September 28th. In 1892, the ſun will go down eclipſed in London: and again, in 1928, the paſſage of the centre will be in the *expanſum*, though there will be two digits eclipſed at London, October the 31ſt of that year, and about the year 2090 the whole penumbra will be wore off; whence no more returns of this eclipſe can happen till after a revolution of 10,000 years.

435 Period in which the phenomena of an eclipſe are completed.

From theſe remarks on the entire revolution of this eclipſe, we may gather, that a thouſand years more or leſs (for there are ſome irregularities that may protract or lengthen this period 100 years), complete the whole terreſtrial phenomena of any ſingle eclipſe: and ſince 20 periods of 54 years each, and about 33 days, comprehend the entire extent of their revolution, is is evident, that the times of the returns will paſs through a circuit of one year and ten months, every Chaldean period being 10 or 11 days later, and of the equable appearances, about 32 or 33 days. Thus, though this eclipſe happens about the middle of July, no other ſubſequent eclipſe of this period will return till the middle of the ſame month again ; but wear conſtantly each period 10 or 11 days forward, and at laſt appear in winter, but then it begins to ceaſe from affecting us.

436 **Seldom more than two great eclipſes in this period.**

Another concluſion from this revolution may be drawn, that there will ſeldom be any more than two great eclipſes of the ſun in the interval of this period, and theſe follow ſometimes next return, and often at greater diſtances. That of 1715 returned again in 1733 very great; but this preſent eclipſe will not be great till the arrival of 1820, which is a revolution of four Chaldean periods : ſo that the irregularities of their circuits muſt undergo new computations to aſſign them exactly.

437 **Eclipſes come in by the north and ſouth poles.**

Nor do all eclipſes come in at the ſouth pole : that depends altogether on the poſition of the lunar nodes, which will bring in as many from the expanſum one way as the other ; and ſuch eclipſes will wear more ſoutherly by degrees, contrary to what happens in the preſent caſe.

The eclipſe, for example, of 1736 in September, had its centre in the expanſum, and ſet about the middle of its obſcurity in Britain ; it will wear in at the north pole, and in the year 2600, or thereabouts, go off into the expanſum on the ſouth ſide of the earth.

The eclipſes therefore which happened about the creation are little more than half way yet of their etherial circuit ; and will be 4000 years before they enter the earth any more. This grand revolution ſeems to have been entirely unknown to the ancients.

438 **Very ancient eclipſes cannot be calculated by our tables.**

It is particularly to be noted, that eclipſes which have happened many centuries ago will not be found by our preſent tables to agree exactly with ancient obſervations, by reaſon of the great anomalies in the lunar motions ; which appears an inconteſtable demonſtration of the non-eternity of the univerſe. For it ſeems confirmed by undeniable proofs, that the moon now finiſhes her period in leſs time than formerly, and will continue, by the centripetal law, to approach nearer and nearer the earth, and to go ſooner and ſooner round it : nor will the centrifugal power be ſufficient to compenſate the different gravitations of ſuch an aſſemblage of bodies as conſtitute the ſolar ſyſtem, which would come to ruin of itſelf, without ſome regulation and adjuſtment of their original motions.

We are credibly informed from the teſtimony of the ancients, that there was a total eclipſe of the ſun predicted by Thales to happen in the fourth year of the 48th Olympiad, either at Sardis or Miletus in Aſia, where Thales then reſided. That year correſponds to the 585th year before Chriſt ; when accordingly there happened a very ſignal eclipſe of the ſun, on the 28th of May, anſwering to the preſent 10th of that month, central through North America, the ſouth parts of France, Italy, &c. as far as Athens, or the iſles in the Ægean ſea ; which is the fartheſt that even the Caroline tables carry it ; and conſequently make it inviſible to any part of Aſia, in the total character ; though there are good reaſons to believe that it extended to Babylon, and went down central over that city. We are not however to imagine, that it was ſet before it paſſed Sardis and the Aſiatic towns, where the predictor lived ; becauſe an inviſible eclipſe could have been of no ſervice to demonſtrate his ability in aſtronomical ſciences to his countrymen, as it could give no proof of its reality.

For a further illuſtration, Thucydides relates, That a ſolar eclipſe happened on a ſummer's day, in the afternoon, in the firſt year of the Peloponneſian war, ſo great, that the ſtars appeared. Rhodius was victor in the Olympic games the fourth year of the ſaid war, being alſo the fourth year of the 87th Olympiad, on the 428th year before Chriſt. So that the eclipſe muſt have happened in the 431ſt year before Chriſt ; and by computation it appears, that on the third of Auguſt there was a ſignal eclipſe which would have paſſed over Athens, central about ſix in the evening, but which our preſent tables bring no farther than the ancient Syrtes on the African coaſt, above 400 miles from Athens ; which, ſuffering in that caſe but nine digits, could by no means exhibit the remarkable darkneſs recited by this hiſtorian : the centre therefore ſeems to have paſſed Athens about ſix in the evening, and probably might go down about Jeruſalem, or near it, contrary to the conſtruction of the preſent tables. Theſe things are only mentioned by way of caution to the preſent aſtronomers, in recomputing ancient eclipſes ; and they may examine the eclipſe of Nicias, ſo fatal to the Athenian fleet ; that which overthrew the Macedonian army, &c.

439 **Number of eclipſes in a year.**

In any year, the number of eclipſes of both luminaries cannot be leſs than two, nor more than ſeven ; the moſt uſual number is four, and it is very rare to have more than ſix. For the ſun paſſes by both the nodes but once a-year, unleſs he paſſes by one of them in the beginning of the year ; and if he does, he will paſs by the ſame node again a little before the year be finiſhed ; becauſe, as theſe points move $19\frac{1}{3}$ degrees backwards every year, the ſun will come to either of them 173 days after the other. And when either node is within 17 degrees of the ſun at the time of new moon, the ſun will be eclipſed. At the ſubſequent oppoſition, the moon will be eclipſed in the other node, and come round to the next conjunction again ere the former node be 17 degrees paſt the ſun, and will therefore eclipſe him again. When three eclipſes fall about either node, the like number generally falls about the oppoſite ; as the ſun comes to it in 173 days afterward ; and ſix lunations contain but four days more. Thus, there may be two eclipſes of the ſun and one of the moon about each of her nodes. But when the moon changes in either of the nodes, ſhe cannot be near enough the other node at the next full to be eclipſed ; and in ſix lunar months afterwards ſhe will change near the other node : in theſe caſes, there can be but two eclipſes in a year, and they are both of the ſun.

A longer period than the abovementioned, for comparing and examining eclipſes which happen at long intervals of time, is 557 years, 21 days, 18 hours, 30 minutes, 11 ſeconds ; in which time there are 6890 mean lunations ; and the ſun and node meet again ſo nearly as to be but 11 ſeconds diſtant; but then it is not the ſame eclipſe that returns, as in the ſhorter period abovementioned.

Of calculating Eclipſes, &c.

440 Why more eclipſes of the moon than of the ſun are obſerved.

Eclipſes of the ſun are more frequent than of the moon, becauſe the ſun's ecliptic limits are greater than the moon's; yet we have more viſible eclipſes of the moon than of the ſun, becauſe eclipſes of the moon are ſeen from all parts of that hemiſphere of the earth which is next her, and are equally great to each of thoſe parts; but the ſun's eclipſes are viſible only to that ſmall portion of the hemiſphere next him whereon the moon's ſhadow falls.

441 Total and annular eclipſes.

The moon's orbit being elliptical, and the earth in one of its focuſes, ſhe is once at her leaſt diſtance from the earth, and once at her greateſt, in every lunation. When the moon changes at her leaſt diſtance from the earth, and ſo near the node that her dark ſhadow falls upon the earth, ſhe appears big enough to cover the whole diſk of the ſun from that part on which her ſhadow falls; and the ſun appears totally eclipſed there for ſome minutes: but when the moon changes at her greateſt diſtance from the earth, and ſo near the node that her dark ſhadow is directed towards the earth, her diameter ſubtends a leſs angle than the ſun's; and therefore ſhe cannot hide his whole diſk from any part of the earth, nor does her ſhadow reach it at that time; and to the place over which the point of her ſhadow hangs, the eclipſe is annular, the ſun's edge appearing like a luminous ring all around the body of the moon.

When the change happens within 17 degrees of the node, and the moon at her mean diſtance from the earth, the point of her ſhadow juſt touches the earth, and ſhe eclipſeth the ſun totally to that ſmall ſpot whereon her ſhadow falls; but the darkneſs is not of a moment's continuance.

The moon's apparent diameter, when largeſt, exceeds the ſun's, when leaſt, only 1 minute 38 ſeconds of a degree; and in the greateſt eclipſe of the ſun that can happen at any time and place, the total darkneſs continues no longer than whilſt the moon is going 1 minute 38 ſeconds from the ſun in her orbit, which is about 3 minutes and 13 ſeconds of an hour.

442 Extent of the moon's ſhadow and penumbra.

The moon's dark ſhadow covers only a ſpot on the earth's ſurface about 180 Engliſh miles broad, when the moon's diameter appears largeſt, and the ſun's leaſt; and the total darkneſs can extend no farther than the dark ſhadow covers. Yet the moon's partial ſhadow or penumbra may then cover a circular ſpace 4900 miles in diameter, within all which the ſun is more or leſs eclipſed, as the places are leſs or more diſtant from the centre of the penumbra. When the moon changes exactly in the node, the penumbra is circular on the earth at the middle of the general eclipſe; becauſe at that time it falls perpendicularly on the earth's ſurface; but at every other moment it falls obliquely, and will therefore be elliptical: and the more ſo, as the time is longer before or after the middle of the general eclipſe; and then much greater portions of the earth's ſurface are involved in the penumbra.

443 Beginning, ending, &c. of a ſolar eclipſe.

When the penumbra firſt touches the earth, the general eclipſe begins; when it leaves the earth, the general eclipſe ends: from the beginning to the end the ſun appears eclipſed in ſome part of the earth or other. When the penumbra touches any place, the eclipſe begins at that place, and ends when the penumbra leaves it. When the moon changes in the node, the penumbra goes over the centre of the earth's diſk as ſeen from the moon; and conſequently by deſcribing the longeſt line poſſibly on the earth, continues the longeſt upon it; namely, at a mean rate, 5 hours 50 minutes; more, if the moon be at her greateſt diſtance from the earth, becauſe ſhe then moves ſloweſt; leſs, if ſhe be at her leaſt diſtance, becauſe of her quicker motion.

Of calculating Eclipſes, &c.

Fig. 198.

To make ſeveral of the above and other phenomena plainer, let S be the ſun, E the earth, M the moon, and AMP the moon's orbit. Draw the right line W *e* from the weſtern ſide of the ſun at W, touching the weſtern ſide of the moon at *c*, and the earth at *e*: draw alſo the right line V *d* from the eaſtern ſide of the ſun at V, touching the eaſtern ſide of the moon at *d*, and the earth at *e*: the dark ſpace *c e d* included between thoſe lines is the moon's ſhadow, ending in a point at *e*, where it touches the earth; becauſe in this caſe the moon is ſuppoſed to change at M in the middle between A the apogee, or fartheſt point of her orbit from the earth, and P the perigee, or neareſt point to it. For, had the point P been at M, the moon had been nearer the earth; and her dark ſhadow at *e* would have covered a ſpace upon it about 180 miles broad, and the ſun would have been totally darkened, with ſome continuance: but had the point A been at M, the moon would have been farther from the earth, and her ſhadow would have ended in a point a little above *e*, and therefore the ſun would have appeared like a luminous ring all around the moon. Draw the right lines WX *d h* and VX *c g*, touching the contrary ſides of the ſun and moon, and ending on the earth at *a* and *b*: draw alſo the right line SXM, from the centre of the ſun's diſk, through the moon's centre, to the earth; and ſuppoſe the two former lines WX*dh* and VX*cg* to revolve on the line SXM as an axis, and their points *a* and *b* will deſcribe the limits of the penumbra TT on the earth's ſurface, including the large ſpace *a b a*; within which the ſun appears more or leſs eclipſed, as the places are more or leſs diſtant from the verge of the penumbra *a b*.

Draw the right line *y* 12 acroſs the ſun's diſk, perpendicular to SXM the axis of the penumbra: then divide the line *y* 12 into 12 equal parts, as in the figure, for the twelve digits or equal parts of the ſun's diameter; and, at equal diſtances from the centre of the penumbra at *e* (on the earth's ſurface at YY) to its edge *a b*, draw twelve concentric circles, marked with the numeral figures 1 2 3 4, &c. and remember that the moon's motion in her orbit AMP is from weſt to eaſt, as from *s* to *t*. Then,

To an obſerver on the earth at *b*, the eaſtern limb of the moon at *d* ſeems to touch the weſtern limb of the ſun at W, when the moon is at M; and the ſun's eclipſe begins at *b*, appearing as at A, fig. 203. at the left hand; but at the ſame moment of abſolute time, to an obſerver at *a* in fig. 198. the weſtern edge of the moon at *c* leaves the eaſtern edge of the ſun at V, and the eclipſe ends, as at the right hand C fig. 203. At the very ſame inſtant, to all thoſe who live on the circle marked 1 on the earth E, in fig. 198. the moon M cuts off or darkens a twelfth part of the ſun S, and eclipſes him one digit, and at 1 in fig. 203.: to thoſe who live on the circle marked 2 in fig. 198. the moon cuts off two-twelfth parts of the ſun, as at 2 in fig. 203.: to thoſe on the circle 3, three parts; and ſo

4 A 2

on to the centre at 12 in fig. 198. where the ſun is centrally eclipſed, as at B in the middle of fig. 203.; under which figure there is a ſcale of hours and minutes, to ſhow at a mean ſtate how long it is from the beginning to the end of a central eclipſe of the ſun on the parallel of London; and how many digits are eclipſed at any particular time from the beginning at A to the middle at B, or the end at C. Thus, in 16 minutes from the beginning, the ſun is two digits eclipſed; in an hour and five minutes, eight digits; and in an hour and 37 minutes, 12 digits.

By fig. 198. it is plain, that the ſun is totally or centrally eclipſed but to a ſmall part of the earth at any time, becauſe the dark conical ſhadow *e* of the moon M falls but on a ſmall part of the earth; and that the partial eclipſe is confined at that time to the ſpace included by the circle *a b*, of which only one half can be projected in the figure, the other half being ſuppoſed to be hid by the convexity of the earth E: and likewiſe that no part of the ſun is eclipſed to the large ſpace YY of the earth, becauſe the moon is not between the ſun and any of that part of the earth; and therefore to all that part of the eclipſe is inviſible. The earth turns eaſtward on its axis, as from *g* to *h*, which is the ſame way that the moon's ſhadow moves; but the moon's motion is much ſwifter in her orbit from *s* to *t*: and therefore, although eclipſes of the ſun are of longer duration on account of the earth's motion on its axis than they would be if that motion was ſtopped, yet, in four minutes of time at moſt, the moon's ſwifter motion carries her dark ſhadow quite over any place that its centre touches at the time of greateſt obſcuration. The motion of the ſhadow on the earth's diſk is equal to the moon's motion from the ſun, which is about 30½ minutes of a degree every hour at a mean rate; but ſo much of the moon's orbit is equal to 30½ degrees of a great circle on the earth; and therefore the moon's ſhadow goes 30½ degrees, or 1830 geographical miles, on the earth in an hour, or 30½ miles in a minute, which is almoſt four times as ſwift as the motion of a cannon-ball.

As ſeen from the ſun or moon, the earth's axis appears differently inclined every day of the year, on account of keeeping its paralleliſm throughout its annual courſe. In fig. 205. let EDON be the earth at the two equinoxes and the two ſolſtices, NS its axis, N the north pole, S the ſouth pole, ÆQ the equator, T the tropic of Cancer, *t* the tropic of Capricorn, and ABC the circumference of the earth's enlightened diſk as ſeen from the ſun or new moon at theſe times. The earth's axis has the poſition NES at the vernal equinox, lying towards the right hand, as ſeen from the ſun or new moon; its poles N and S being then in the circumference of the diſk; and the equator and all its parallels ſeen to be ſtraight lines, becauſe their planes paſs through the obſerver's eye looking down upon the earth from the ſun or moon directly over E, where the ecliptic FG interſects the equator Æ. At the ſummer ſolſtice, the earth's axis has the poſition NDS; and that part of the ecliptic FG, in which the moon is then new, touches the tropic of Cancer T at D. The north pole at that time inclining 23½ degrees towards the ſun, falls ſo many degrees within the earth's enlightened diſk, becauſe the ſun is then vertical to D 23½ degrees north of the equator ÆQ; and the equator with all its parallels ſeem elliptic curves bending downward, or towards the ſouth pole, as ſeen from the ſun; which pole, together with 23½ degrees all round it, is hid behind the diſk in the dark hemiſphere of the earth. At the autumnal equinox, the earth's axis has the poſition NOS, lying to the left hand as ſeen from the ſun or new moon, which are then vertical to O, where the ecliptic cuts the equator ÆQ. Both poles now lie in the circumference of the diſk, the north pole juſt going to diſappear behind it, and the ſouth pole juſt entering into it; and the equator, with all its parallels, ſeem to be ſtraight lines, becauſe their planes paſs through the obſerver's eye, as ſeen from the ſun, and very nearly ſo as ſeen from the moon. At the winter ſolſtice, the earth's axis has the poſition NNS, when its ſouth pole S inclining 23½ degrees towards the ſun, falls 23½ degrees within the enlightened diſk, as ſeen from the ſun or new moon, which are then vertical to the tropic of Capricorn *t*, 23½ degrees ſouth of the equator ÆQ; and the equator, with all its parallels, ſeem elliptic curves bending upward; the north pole being as far behind the diſk in the dark hemiſphere as the ſouth pole is come into the light. The nearer that at any time of the year is to the equinoxes or ſolſtices, the more it partakes of the phenomena relating to them.

Thus it appears, that from the vernal equinox to the autumnal, the north pole is enlightened; and the equator and all its parallels appear elliptical as ſeen from the ſun, more or leſs curved as the time is nearer to, or farther from, the ſummer ſolſtice; and bending downwards, or towards the ſouth pole; the reverſe of which happens from the autumnal equinox to the vernal. A little conſideration will be ſufficient to convince the reader, that the earth's axis inclines towards the ſun at the ſummer ſolſtice; from the ſun at the winter ſolſtice: and ſidewiſe to the ſun at the equinoxes; but towards the right hand, as ſeen from the ſun at the vernal equinox; and towards the left hand at the autumnal. From the winter to the ſummer ſolſtice, the earth's axis inclines more or leſs to the right hand, as ſeen from the ſun; and the contrary from the ſummer to the winter ſolſtice.

444
Eclipſes affected by the poſition of the earth's axis.

The different poſitions of the earth's axis, as ſeen from the ſun at different times of the year, affect ſolar eclipſes greatly with regard to particular places; yea, ſo far as would make central eclipſes which fall at one time of the year inviſible if they fell at another, even though the moon ſhould always change in the nodes, and at the ſame hour of the day; of which indefinitely various affections, we ſhall only give examples for the times of the equinoxes and ſolſtices.

In the ſame diagram, let FG be part of the ecliptic, and IK, *i k*, *i k*, *i k*, part of the moon's orbit; both ſeen edgewiſe, and therefore projected into right lines; and let the interſections NODE be one and the ſame node at the above times, when the earth has the forementioned different poſitions; and let the ſpaces included by the circles P *p p p* be the penumbra at theſe times, as its centre is paſſing over the centre of the earth's diſk. At the winter ſolſtice, when the earth's axis has the poſition NNS, the centre of the penumbra P touches the tropic of Capricorn *t* in N at the middle of the general eclipſe; but no part of the penumbra touches the tropic of Cancer T. At the ſun

Of calculating Eclipſes, &c.

ſummer ſolſtice, when the earth's axis has the poſition NDS (*i* D *k* being then part of the moon's orbit whoſe node is at D), the penumbra *p* has its centre at D, on the tropic of Cancer T, at the middle of the general eclipſe, and then no part of it touches the tropic of Capricorn *t*. At the autumnal equinox, the earth's axis has the poſition NOS (*i* O *k* being then part of the moon's orbit), and the penumbra equally includes part of both tropics T and *t* at the middle of the general eclipſe: at the vernal equinox it does the ſame, becauſe the earth's axis has the poſition NES; but, in the former of theſe two laſt caſes, the penumbra enters the earth at A, north of the tropic of Cancer T, and leaves it at *m*, ſouth of the tropic of Capricorn *t*; having gone over the earth obliquely ſouthward, as its centre deſcribed the line AO*m*: whereas, in the latter caſe, the penumbra touches the earth at *n*, ſouth of the equator ÆQ, and deſcribing the line *n*E*q* (ſimilar to the former line AO*m* in open ſpace), goes obliquely northward over the earth, and leaves it at *q*, north of the equator.

In all theſe circumſtances the moon has been ſuppoſed to change at noon in her deſcending node: Had ſhe changed in her aſcending node, the phenomena would have been as various the contrary way, with reſpect to the penumbra's going northward or ſouthward over the earth. But becauſe the moon changes at all hours, as often in one node as in the other, and at all diſtances from them both at different times as it happens, the variety of the phaſes of eclipſes are almoſt innumerable, even at the ſame places; conſidering alſo how variouſly the ſame places are ſituated on the enlightened diſk of the earth, with reſpect to the penumbra's motion, at the different hours when eclipſes happen.

When the moon changes 17 degrees ſhort of her deſcending node, the penumbra P 18 juſt touches the northern part of the earth's diſk, near the north pole N; and as ſeen from that place, the moon appears to touch the ſun, but hides no part of him from ſight. Had the change been as far ſhort of the aſcending node, the penumbra would have touched the ſouthern part of the diſk near the ſouth pole S. When the moon changes 12 degrees ſhort of the deſcending node, more than a third part of the penumbra P12 falls on the northern part of the earth at the middle of the general eclipſe: Had ſhe changed as far paſt the ſame node, as much of the other ſide of the penumbra about P would have fallen on the ſouthern part of the earth; all the reſt in the expanſum, or open ſpace. When the moon changes 6 degrees from the node, almoſt the whole penumbra P6 falls on the earth at the middle of the general eclipſe. And laſtly, when the moon changes in the node at N, the penumbra PN takes the longeſt courſe poſſible on the earth's diſk; its centre falling on the middle thereof, at the middle of the general eclipſe. The farther the moon changes from either node, within 17 degrees of it, the ſhorter is the penumbra's continuance on the earth, becauſe it goes over a leſs portion of the diſk, as is evident by the figure.

445
Duration of eclipſes in different parts of the earth.

The nearer that the penumbra's centre is to the equator at the middle of the general eclipſe, the longer is the duration of the eclipſe at all thoſe places where it is central; becauſe, the nearer that any place is to the equator, the greater is the circle it deſcribes by the earth's motion on its axis: and ſo the place moving quicker, keeps longer in the penumbra, whoſe motion is the ſame way with that of the place, though faſter, as has been already mentioned. Thus (ſee the earth at D, and the penumbra at 12) whilſt the point *b* in the polar circle *abcd* is carried from *b* to *c* by the earth's diurnal motion, the point *d* on the tropic of Cancer T is carried a much greater length from *d* to D; and therefore, if the penumbra's centre goes one time over *c* and another time over D, the penumbra will be longer in paſſing over the moving place *d* than it was in paſſing over the moving place *b*. Conſequently, central eclipſes about the poles are of the ſhorteſt duration; and about the equator, of the longeſt.

In the middle of ſummer, the whole frigid zone, included by the polar circle *abcd*, is enlightened; and if it then happens that the penumbra's centre goes over the north pole, the ſun will be eclipſed much the ſame number of digits at *a* as at *c*; but whilſt the penumbra moves eaſtward over *c*, it moves eaſtward over *a*; becauſe, with reſpect to the penumbra, the motions of *a* and *c* are contrary: for *c* moves the ſame way with the penumbra towards *d*, but *a* moves the contrary way towards *b*; and therefore the eclipſe will be of longer duration at *c* than at *a*. At *a* the eclipſe begins on the ſun's eaſtern limb, but at *c* on his weſtern: at all places lying without the polar circles, the ſun's eclipſes begin on his weſtern limb, or near it, and end on or near his eaſtern. At thoſe places where the penumbra touches the earth, the eclipſe begins with the riſing ſun, on the top of his weſtern or uppermoſt edge; and at thoſe places where the penumbra leaves the earth, the eclipſe ends with the ſetting ſun, on the top of his eaſtern edge, which is then uppermoſt, juſt at its diſappearing in the horizon.

If the moon were ſurrounded by an atmoſphere of any conſiderable denſity, it would ſeem to touch the ſun a little before the moon made her appulſe to his edge, and we ſhould ſee a little faintneſs on that edge before it were eclipſed by the moon: but as no ſuch faintneſs has been obſerved, it ſeems plain, that the moon has no ſuch atmoſphere as that of the earth. The faint ring of light ſurrounding the ſun in total eclipſes, called by Caſſini *la chevelure du ſoliel*, is ſaid to be the atmoſphere of the ſun; becauſe it has been obſerved to move equally with the ſun, not with the moon. See nº 147.

446
Lunar eclipſes explained.

Having been ſo prolix concerning eclipſes of the ſun, we ſhall drop that ſubject at preſent, and proceed to the doctrine of lunar eclipſes; which, being more ſimple, may be explained in leſs time.

That the moon can never be eclipſed but at the time of her being full, and the reaſon why ſhe is not eclipſed at every full, has been ſhown already. In fig. 198. let S be the ſun, E the earth, RR the earth's ſhadow, and B the moon in oppoſition to the ſun: In this ſituation the earth intercepts the ſun's light in its way to the moon; and when the moon touches the earth's ſhadow at *v*, ſhe begins to be eclipſed on her eaſtern limb *x*, and continues eclipſed until her weſtern limb *y* leaves the ſhadow at *w*: At B ſhe is in the middle of the ſhadow, and conſequently in the middle of the eclipſe.

The moon, when totally eclipſed, is not inviſible if ſhe

447 Why the moon is viſible when eclipſed.

ſhe be above the horizon and the ſky be clear; but appears generally of a duſky colour, like tarniſhed copper, which ſome have thought to be the moon's native light. But the true cauſe of her being viſible is the ſcattered beams of the ſun, bent into the earth's ſhadow by going through the atmoſphere; which, being more or leſs denſe near the earth than at conſiderable heights above it, refracts or bends the ſun's rays more inward, the nearer they are paſſing by the earth's ſurface, than thoſe rays which go through higher parts of the atmoſphere, where it is leſs denſe according to its height, until it be ſo thin or rare as to loſe its refractive power. Let the circle *f g h i*, concentric to the earth, include the atmoſphere whoſe refractive power vaniſhes at the heights *f* and *i*; ſo that the rays W*fw* and V*iv* go on ſtraight without ſuffering the leaſt refraction: but all thoſe rays which enter the atmoſphere between *f* and *k*, and between *i* and *l*, on oppoſite ſides of the earth, are gradually more bent inward as they go thro' a greater portion of the atmoſphere, until the rays W*k* and V*l* touching the earth at *m* and *n*, are bent ſo much as to meet at *q*, a little ſhort of the moon; and therefore the dark ſhadow of the earth is contained in the ſpace *m o q p n*, where none of the ſun's rays can enter; all the reſt RR, being mixed by the ſcattered rays which are refracted as above, is in ſome meaſure enlightened by them; and ſome of thoſe rays falling on the moon, give her the colour of tarniſhed copper, or of iron almoſt red hot. So that if the earth had no atmoſphere, the moon would be as viſible in total eclipſes as ſhe is when new. If the moon were ſo near the earth as to go into its dark ſhadow, ſuppoſe about *p o*, ſhe would be inviſible during her ſtay in it; but viſible before and after in the fainter ſhadow RR.

When the moon goes thro' the centre of the earth's ſhadow, ſhe is directly oppoſite to the ſun; yet the moon has been often ſeen totally eclipſed in the horizon when the ſun was alſo viſible in the oppoſite part of it: for the horizontal refraction being almoſt 34 minutes of a degree, and the diameter of the ſun and moon being each at a mean ſtate but 32 minutes, the refraction cauſes both luminaries to appear above the horizon when they are really below it.

When the moon is full at 12 degrees from either of her nodes, ſhe juſt touches the earth's ſhadow, but enters not into it. In fig. 204. let GH be the ecliptic, *ef* the moon's orbit where ſhe is 12 degrees from the node at her full; *c d* her orbit where ſhe is 6 degrees from the node, *a b* her orbit where ſhe is full in the node, AB the earth's ſhadow, and M the moon. When the moon deſcribes the line *e f*, ſhe juſt touches the ſhadow, but does not enter into it; when ſhe deſcribes the line *c d*, ſhe is totally, though not centrally, immerſed in the ſhadow; and when ſhe deſcribes the line *a b*, ſhe paſſes by the node at M in the centre of the ſhadow, and takes the longeſt line poſſible, which is a diameter, through it: and ſuch an eclipſe being both total and central is of the longeſt duration, namely, 3 hours 57 minutes 6 ſeconds from the beginning to the end, if the moon be at her greateſt diſtance from the earth; and 3 hours 37 minutes 26 ſeconds, if ſhe be at her leaſt diſtance. The reaſon of this difference is, that when the moon is fartheſt from the earth, ſhe moves ſloweſt; and when neareſt to it, quickeſt.

The moon's diameter, as well as the ſun's, is ſuppoſed to be divided into 12 equal parts, called *digits*; and ſo many of theſe parts as are darkened by the earth's ſhadow, ſo many digits is the moon eclipſed. All that the moon is eclipſed above 12 digits, ſhows how far the ſhadow of the earth is over the body of the moon, on that edge to which ſhe is neareſt at the middle of the eclipſe.

448 Lunar eclipſes difficultly obſerved.

It is difficult to obſerve exactly either the beginning or ending of a lunar eclipſe, even with a good teleſcope, becauſe the earth's ſhadow is ſo faint and ill-defined about the edges, that when the moon is either juſt touching or leaving it, the obſcuration of her limb is ſcarce ſenſible; and therefore the niceſt obſervers can hardly be certain to four or five ſeconds of time. But both the beginning and ending of ſolar eclipſes are viſibly inſtantaneous; for the moment that the edge of the moon's diſk touches the ſun's, his roundneſs ſeems a little broke on that part; and the moment ſhe leaves it, he appears perfectly round again.

449 Eclipſes uſeful in determining longitudes, &c.

In aſtronomy, eclipſes of the moon are of a great uſe for aſcertaining the periods of her motions; eſpecially ſuch eclipſes as are obſerved to be alike in all her circumſtances, and have long intervals of time between them. In geography, the longitudes of places are found by eclipſes: but for this purpoſe eclipſes of the moon are more uſeful than thoſe of the ſun, becauſe they are more frequently viſible, and the ſame lunar eclipſe is of equal largeneſs and duration at all places where it is ſeen. In chronology, both ſolar and lunar eclipſes ſerve to determine exactly the time of any paſt event: for there are ſo many particulars obſervable in every eclipſe, with reſpect to its quantity, the places where it is viſible (if of the ſun), and the time of the day or night, that it is impoſſible there can be two ſolar eclipſes in the courſe of many ages which are alike in all circumſtances.

450 Darkneſs of our Saviour's crucifixion ſupernatural.

From the above explanation of the doctrine of eclipſes, it is evident, that the darkneſs at our Saviour's crucifixion was ſupernatural. For he ſuffered on the day on which the paſſover was eaten by the Jews, on which day it was impoſſible that the moon's ſhadow could fall on the earth; for the Jews kept the paſſover at the time of full moon: nor does the darkneſs in total eclipſes of the ſun laſt above four minutes in any place; whereas the darkneſs at the crucifixion laſted three hours, Math. xxviii. 15. and overſpread at leaſt all the land of Judea.

451 Conſtruction of tables for calculating eclipſes.

The theory of eclipſes being now, we hope, pretty plainly laid down, the conſtruction of tables for their calculation will be underſtood from the following conſiderations.

The motions of the ſun and moon are obſerved to be continually accelerated from the apogee to the perigee, and as gradually retarded from the perigee to the apogee; being ſloweſt of all when the mean anomaly is nothing, and ſwifteſt of all when it is ſix ſigns.

When the luminary is in its apogee or perigee, its place is the ſame as it would be if its motion were equable in all parts of its orbit. The ſuppoſed equable motions are called *mean*; the unequable are juſtly called the *true*.

The mean place of the ſun or moon is always forwarder than the true place, whilſt the luminary is moving from its apogee to its perigee: and the true place is always forwarder than the mean, whilſt the luminary is moving from its perigee to its apogee. In the former caſe the anomaly is always leſs than ſix ſigns; and in the latter caſe, more.

It has been found by a long ſeries of obſervations, that the ſun goes through the ecliptic, from the vernal equinox to the ſame equinox again, in 365 days, 5 hours 48 minutes 55 ſeconds; from the firſt ſtar of Aries to the ſame ſtar again, in 365 days 6 hours 9 minutes 24 ſeconds; and from his apogee to the ſame again, in 365 days 6 hours 14 minutes 0 ſeconds.—The firſt of theſe is called the *ſolar year;* the ſecond the *ſidereal year;* and the third the *anomaliſtic year.* So that the ſolar year is 20 minutes 29 ſeconds ſhorter than the ſidereal; and the ſidereal year is 4 minutes 36 ſeconds ſhorter than the anomaliſtic. Hence it appears, that the equinoctial point, or interſection of the ecliptic and equator at the beginning of Aries, goes backward with reſpect to the fixed ſtars, and that the ſun's apogee goes forward.

It is alſo obſerved that the moon goes through her orbit, from any given fixed ſtar to the ſame ſtar again, in 27 days 7 hours 43 minutes 4 ſeconds at a mean rate; and from her apogee to her apogee again, in 27 days 13 hours 18 minutes 43 ſeconds; and from the ſun to the ſun again, in 29 days 12 hours 44 minutes $3\frac{1}{10}$ ſeconds. This ſhows that the moon's apogee moves forward in the ecliptic, and that at a much quicker rate than the ſun's apogee does: ſince the moon is 5 hours 55 minutes 39 ſeconds longer in revolving from her apogee to her apogee again, than from any ſtar to the ſame ſtar again.

The moon's orbit croſſes the ecliptic in two oppoſite points, which are called her *Nodes:* and it is obſerved, that ſhe revolves ſooner from any node to the node again, than from any ſtar to the ſtar again, by 2 hours 38 minutes 27 ſeconds; which ſhows that her nodes move backward, or contrary to the order of ſigns in the ecliptic.

The time in which the moon revolves from the ſun to the ſun again (or from change to change) is called the *Lunation;* which according to Dr Pound's mean meaſures, would always conſiſt of 29 days 12 hours 44 minutes 3 ſeconds 2 thirds 58 fourths, if the motions of the ſun and moon were always equable. Hence 12 mean lunations contain 354 days 8 hours 48 minutes 36 ſeconds 35 thirds 40 fourths, which is 10 days 21 hours 11 minutes 23 ſeconds 24 thirds 20 fourths leſs than the length of a common Julian year, conſiſting of 365 days 6 hours; and 13 mean lunations contain 383 days 21 hours 32 minutes 39 ſeconds 38 thirds 38 fourths, which exceeds the length of a common Julian year, by 18 days 15 hours 32 minutes 39 ſeconds 38 thirds 38 fourths.

The mean time of new moon being found for any given year and month, as ſuppoſe for March 1700, old ſtyle, if this mean new moon falls later than the 11th day of March, then 12 mean lunations added to the time of this mean new moon will give the time of the mean new moon in March 1701, after having thrown off 365 days. But when the mean new moon happens to be before the 11th of March, we muſt add 13 mean lunations, in order to have the time of mean new moon in March the year following; always taking care to ſubtract 365 days in common years, and 366 days in leap years, from the ſum of this addition.

Thus A. D. 1700, old ſtyle, the time of mean new moon in March was the 8th day, at 16 hours 11 minutes 25 ſeconds after the noon of that day (viz. at 11 minutes 25 ſeconds paſt four in the morning of the 9th day, according to common reckoning.) To this we muſt add 13 mean lunations, or 383 days 21 hours 32 minutes 39 ſeconds 38 thirds 38 fourths, and the ſum will be 392 days 13 hours 44 minutes 4 ſeconds 38 thirds 38 fourths: from which ſubtract 365 days, becauſe the year 1701 is a common year, and there will remain 27 days 13 hours 44 minutes 4 ſeconds 38 thirds 38 fourths for the time of a mean new moon in March, A. D. 1701.

Carrying on this addition and ſubtraction till A. D. 1703, we find the time of mean new moon in March that year to be on the 6th day, at 7 hours 21 minutes 17 ſeconds 49 thirds 46 fourths paſt noon; to which add 13 mean lunations, and the ſum will be 390 days 4 hours 53 minutes 57 ſeconds 28 thirds 20 fourths; from which ſubtract 366 days, becauſe the year 1704 is a leap year, and there will remain 24 days 4 hours 53 minutes 57 ſeconds 28 thirds 20 fourths, for the time of mean new moon in March, A. D. 1704.

In this manner was the firſt of the following tables conſtructed to ſeconds, thirds, and fourths; and then wrote out to the neareſt ſeconds. The reaſon why we choſe to begin the year with March, was to avoid the inconvenience of adding a day to the tabular time in leap-years after February, or ſubtracting a day therefrom in January and February in thoſe years; to which all tables of this kind are ſubject, which begin the year with January, in calculating the times of new or full moons.

The mean anomalies of the ſun and moon, and the ſun's mean motion from the aſcending node of the moon's orbit, are ſet down in Table III. from 1 to 13 mean lunations. Theſe numbers, for 13 lunations, being added to the radical anomalies of the ſun and moon, and to the ſun's mean diſtance from the aſcending node, at the time of mean new moon in March 1700 (Table I.), will give their mean anomalies, and the ſun's mean diſtance from the node, at the time of mean new moon in March 1701; and being added for 12 lunations to thoſe for 1701, give them for the time of mean new moon in March 1702. And ſo on as far as you pleaſe to continue the table (which is here carried on to the year 1800), always throwing off 12 ſigns when their ſum exceeds 12, and ſetting down the remainder as the proper quantity.

If the numbers belonging to A. D. 1700 (in Table I.) be ſubtracted from thoſe belonging to 1800, we ſhall have their whole differences in 100 complete Julian years; which accordingly we find to be 4 days 8 hours 10 minutes 52 ſeconds 15 thirds 40 fourths, with reſpect to the time of mean new moon. Theſe being added together 60 times (always taking care to throw off a whole lunation when the days exceed $29\frac{1}{2}$) make up 60 centuries, or 6000 years, as in Table VI. which was carried on to ſeconds, thirds, and fourths; and then wrote out to the neareſt ſeconds. In the ſame manner were the reſpective anomalies and the ſun's diſtance from the node found, for theſe centurial years; and then (for want of room) wrote out only to the neareſt minutes, which is ſufficient in whole centuries. By means of theſe two tables, we may find the time of any mean new moon in March, together with the anomalies of the ſun and moon, and the ſun's diſtance from the node, at theſe times within the limits of 6000 years, either before or after any given year in the 18th century; and the mean time of any new or full moon in any given month after March, by means of the third and fourth tables, within the ſame limits, as ſhown in the precepts for calculation.

Thus it would be a very eaſy matter to calculate the time of any new or full moon, if the ſun and moon moved equably in all parts of their orbits. But we have already ſhown, that their places are never the ſame as they would be by equable motions, except when they are in apogee or perigee; which is, when their mean anomalies are either nothing, or ſix ſigns: and that their mean places are always forwarder than their true places, whilſt the anomaly is leſs than ſix ſigns; and their true places are forwarder than the mean, whilſt the anomaly is more.

Hence it is evident, that while the ſun's anomaly is leſs than ſix ſigns, the moon will overtake him, or be oppoſite to him, ſooner than ſhe could if his motion were equable; and later whilſt his anomaly is more than ſix ſigns. The greateſt difference that can poſſibly happen between the mean and true time of new or full moon, on account of the inequality of the ſun's motion, is 3 hours 48 minutes 28 ſeconds: and that is, when the ſun's anomaly is either 3 ſigns 1 degree, or 8 ſigns 29 degrees; ſooner in the firſt caſe, and later in the laſt.—In all other ſigns and degrees of anomaly, the difference is gradually leſs, and vaniſhes when the anomaly is either nothing or ſix ſigns.

The ſun is in his apogee on the 30th of June, and in his perigee on the 30th of December, in the preſent age: ſo that he is nearer the earth in our winter than in our ſummer.—The proportional difference of diſtance, deduced from the difference of the ſun's apparent diameter at theſe times, is as 983 to 1017.

The moon's orbit is dilated in winter, and contracted in ſummer; therefore the lunations are longer in winter than in ſummer. The greateſt difference is found to be 22 minutes 29 ſeconds; the lunations increaſing gradually in length whilſt the ſun is moving from his apogee to his perigee, and decreaſing in length whilſt he is moving from his perigee to his apogee.—On this account, the moon will be later every time in coming to her conjunction with the ſun, or being in oppoſition to him, from December till June, and ſooner from June till December, than if her orbit had continued of the ſame ſize all the year round.

As both theſe differences depend on the ſun's anomaly, they may be fitly put together into one table, and called *The annual or firſt equation of the mean to the true ſyzygy*, (ſee Table VII.) This equational difference is to be ſubtracted from the time of the mean ſyzygy when the ſun's anomaly is leſs than ſix ſigns, and added when the anomaly is more.—At the greateſt it is 4 hours 10 minutes 57 ſeconds, viz. 3 hours 48 minutes 28 ſeconds, on account of the ſun's unequal motion, and 22 minutes 29 ſeconds, on account of the dilatation of the moon's orbit.

This compound equation would be ſufficient for reducing the mean time of new or full moon to the true time thereof, if the moon's orbit were of a circular form, and her motion quite equable in it. But the moon's orbit is more elliptical than the ſun's, and her motion in it ſo much the more unequal. The difference is ſo great, that ſhe is ſometimes in conjunction with the ſun, or in oppoſition to him, ſooner by 9 hours 47 minutes 54 ſeconds, than ſhe would be if her motion were equable; and at other times as much later. The former happens when her mean anomaly is 9 ſigns 4 degrees, and the latter when it is 2 ſigns 26 degrees. See Table IX.

At different diſtances of the ſun from the moon's apogee, the figure of the moon's orbit becomes different. It is longeſt of all, or moſt eccentric, when the ſun is in the ſame ſign and degree either with the moon's apogee or perigee; ſhorteſt of all, or leaſt eccentric, when the ſun's diſtance from the moon's apogee is either three ſigns or nine ſigns; and at a mean ſtate when the diſtance is either 1 ſign 15 degrees, 4 ſigns 15 degrees, 7 ſigns 15 degrees, or 10 ſigns 15 degrees. When the moon's orbit is at its greateſt eccentricity; her apogeal diſtance from the earth's centre is to her perigeal diſtance therefrom, as 1067 is to 933; when leaſt eccentric, as 1043 is to 957; and when at the mean ſtate, as 1055 is to 945.

But the ſun's diſtance from the moon's apogee is equal to the quantity of the moon's mean anomaly at the time of new moon, and by the addition of ſix ſigns it becomes equal in quantity to the moon's mean anomaly at the time of full moon. Therefore, a table may be conſtructed ſo as to anſwer to all the various inequalities depending on the different eccentricities of the moon's orbit, in the ſyzygies, and called *The ſecond equation of the mean to the true ſyzygy*. (See Table IX.): and the moon's anomaly, when equated by Table VIII. may be made the proper argument for taking out this ſecond equation of time; which muſt be added to the former equated time, when the moon's anomaly is leſs than ſix ſigns, and ſubtracted when the anomaly is more.

There are ſeveral other inequalities in the moon's motion, which ſometimes bring on the true ſyzygy a little ſooner, and at other times keep it back a little later, than it would otherwiſe be: but they are ſo ſmall, that they may be all omitted except two; the former of which (ſee Table X.) depends on the difference between the anomalies of the ſun and moon in the ſyzygies, and the latter (ſee Table XI.) depends on the ſun's diſtance from the moon's nodes at theſe times.—The greateſt difference ariſing from the former is 4 minutes 48 ſeconds; and from the latter, 1 minute 34 ſeconds.

452
Directions for the uſe of thoſe tables.

The tables here inſerted being calculated by Mr Ferguſon according to the methods already given, he gives the following directions for their uſe.

To calculate the true Time of New or full Moon.

Precept I. If the required time be within the limits of the 18th century, write out the mean time of new moon in March, for the propoſed year, from Table I. in the old ſtyle, or from Table II. in the new; together with the mean anomalies of the ſun and moon, and the ſun's mean diſtance from the moon's aſcending node. If you want the time of full moon in March, add the half lunation at the foot of Table III. with its

ASTRONOMY

Plate LXXXIII

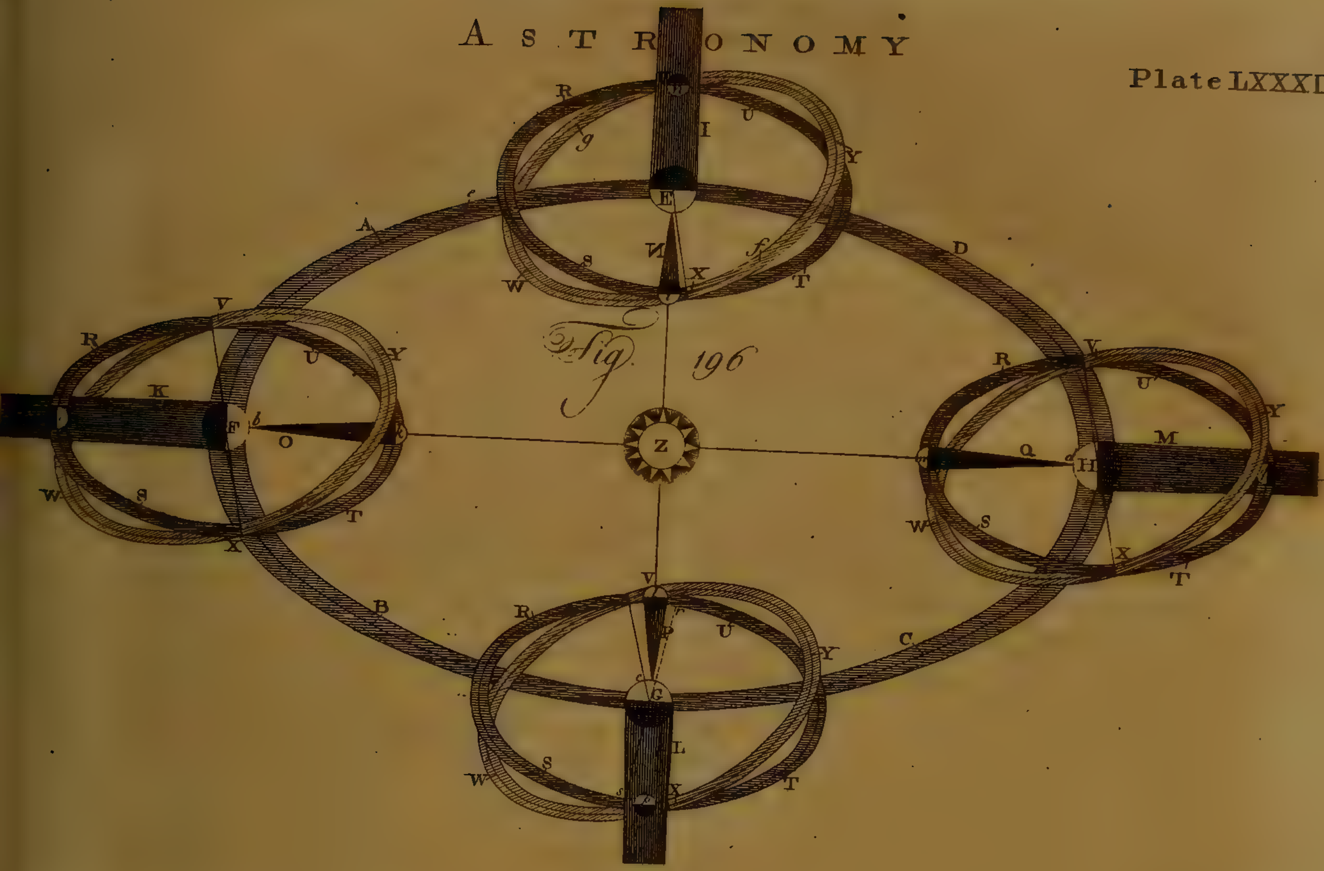


Fig. 196

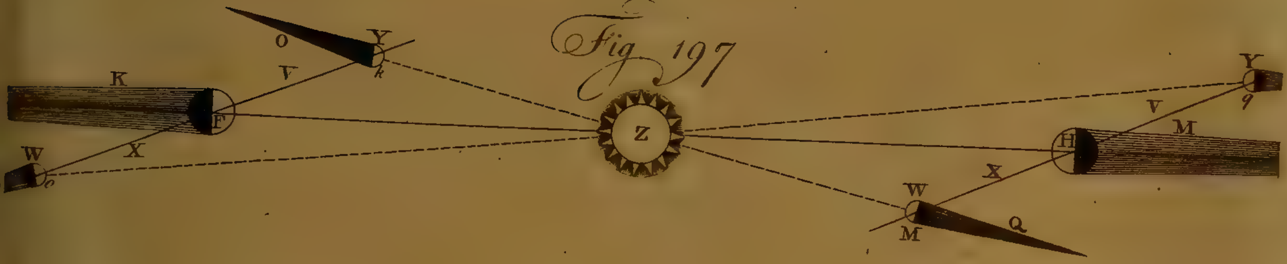


Fig. 197

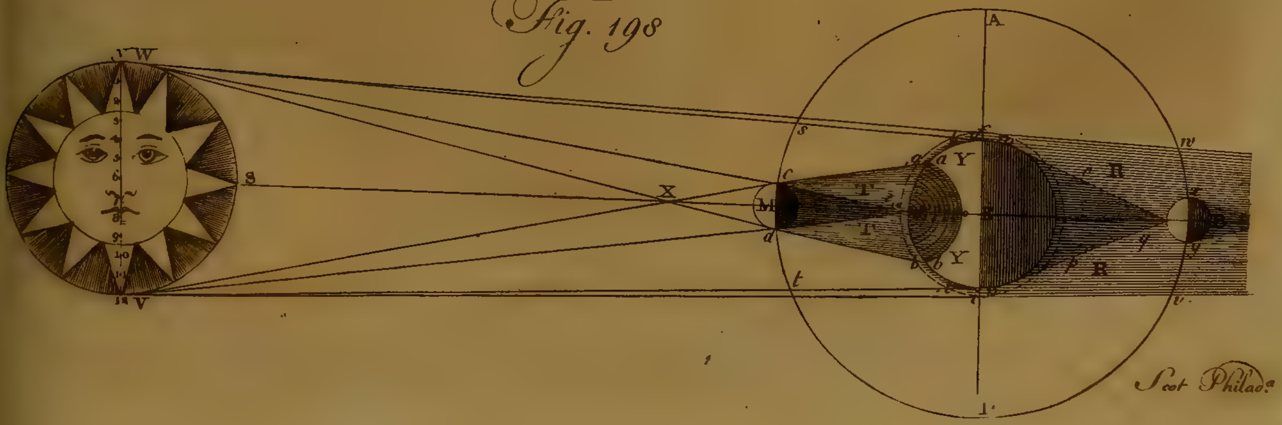


Fig. 198

Scot Philada

its anomalies, &c. to the former numbers, if the new moon falls before the 15th of March; but if it falls after, ſubtract the half lunation, with the anomalies, &c. belonging to it, from the former numbers, and write down the reſpective ſums or remainders.

II. In theſe additions or ſubtractions, obſerve, that 60 ſeconds make a minute, 60 minutes make a degree, 30 degrees make a ſign, and 12 ſigns make a circle. When you exceed 12 ſigns in addition, reject 12, and ſet down the remainder. When the number of ſigns to be ſubtracted is greater than the number you ſubtract from, add 12 ſigns to the leſſer number, and then you will have a remainder to ſet down. In the tables ſigns are marked thus ˢ, degrees thus °, minutes thus ′, and ſeconds thus ″.

III. When the required new or full moon is in any given month after March, write out as many lunations with their anomalies, and the ſun's diſtance from the node from Table III. as the given month is after March, ſetting them in order below the numbers taken out for March.

IV. Add all theſe together, and they will give the mean time of the required new or full moon, with the mean anomalies and ſun's mean diſtance from the aſcending node, which are the arguments for finding the proper equations.

V. With the number of days added together, enter Table IV. under the given month; and againſt that number you have the day of mean new or full moon in the left-hand column, which ſet before the hours, minutes, and ſeconds, already found.

But (as it will ſometimes happen) if the ſaid number of days fall ſhort of any in the column under the given month, add one lunation and its anomalies, &c. (from Table III.) to the foreſaid ſums, and then you will have a new ſum of days wherewith to enter Table IV. under the given month, where you are ſure to find it the ſecond time, if the firſt falls ſhort.

VI. With the ſigns and degrees of the ſun's anomaly, enter Table VII. and therewith take out the annual or firſt equation for reducing the mean ſyzygy to the true; taking care to make proportions in the table for the odd minutes and ſeconds of anomaly, as the table gives the equation only to whole degrees.

Obſerve, in this and every other caſe of finding equations, that if the ſigns are at the head of the table, their degrees are at the left hand, and are reckoned downwards; but if the ſigns are at the foot of the table, their degrees are at the right hand, and are counted upward; the equation being in the body of the table, under or over the ſigns, in a collateral line with the degrees. The titles *Add* or *Subtract* at the head or foot of the tables where the ſigns are found, ſhow whether the equation is to be added to the mean time of new or full moon, or to be ſubtracted from it. In this table the equation is to be ſubtracted, if the ſigns of the ſun's anomaly are found at the head of the table; but it is to be added, if the ſigns are at the foot.

VII. With the ſigns and degrees of the ſun's mean anomaly, enter Table VIII. and take out the equation of the moon's mean anomaly; ſubtract this equation from her mean anomaly, if the ſigns of the ſun's anomaly be at the head of the table, but add it if they are at the foot; the reſult will be the moon's equated anomaly, with which enter table IX. and take out the ſecond equation for reducing the mean to the true time of new or full moon; adding this equation, if the ſigns of the moon's anomaly are at the head of the table, but ſubtracting it if they are at the foot; and the reſult will give you the mean time of the required new or full moon twice equated, which will be ſufficiently near for common almanacs.—But when you want to calculate an eclipſe, the following equations muſt be uſed: thus,

VIII. Subtract the moon's equated anomaly from the ſun's mean anomaly, and with the remainder in ſigns and degrees enter Table X. and take out the third equation, applying it to the former equated time, as the titles *Add* or *Subtract* do direct.

IX. With the ſun's mean diſtance from the aſcending node enter Table XI. and take out the equation anſwering to that argument, adding it to, or ſubtracting it from, the former equated time, as the titles direct, and the reſult will give the time of new or full moon, agreeing with well regulated clocks or watches very near the truth. But to make it agree with the ſolar, or apparent time, you muſt apply the equation of natural days, taken from an equation-table, as it is leap-year, or the firſt, ſecond, or third after. This, however, unleſs in very nice calculations, needs not be regarded, as the difference between true and apparent time is never very conſiderable.

The method of calculating the time of any new or full moon without the limits of the 18th century, will be ſhown further on. And a few examples compared with the precepts will make the whole work plain.

N. B. The tables begin the day at noon, and reckon forward from thence to the noon following.—Thus, March the 31ſt, at 22 ho. 30 min. 25 ſec. of tabular time, is April 1ſt (in common reckoning) at 30 min. 25 ſec. after 10 o'clock in the morning.

453

EXAMPLE I.

Required the true time of New Moon in April 1764, *New Style?*

By the Precepts.

	New Moon.				Sun's Anomaly.				Moon's Anomaly.				Sun from Node.			
	D.	H.	M.	S.	s	o	′	″	s	o	′	″	s	o	′	″
March 1764,	2	8	55	36	8	2	20	0	10	13	35	21	11	4	54	48
Add 1 Lunation,	29	12	44	3	0	29	6	19	0	25	49	0	1	0	40	14
Mean New Moon,	31	21	39	39	9	1	26	19	11	9	24	21	0	5	35	2
First Equation,	+	4	10	40	11	10	59	18	+	1	34	57				
Time once equated,	32	1	50	19	9	20	27	1	11	10	59	18	Sun from Node, and Arg. 4th equation.			
Second Equation,	—	3	24	49	Arg. 3d. equation				Arg. 2d equation.							
Time twice equated,	31	22	25	30												
Third Equation,		+	4	37												
Time thrice equated,	31	22	30	7												
Fourth Equation,			+	18												
True New Moon,	31	22	30	25												
Equation of days,		—	3	48												
Apparent time,	31	22	26	37												

So the true time is 22 h. 30 min. 25 ſec. after the noon of the 31ſt March; that is, April 1ſt, at 30 min. 25 ſec. after ten in the morning. But the apparent time is 26 min. 37 ſec. after ten in the morning.

454

EXAMPLE II.

Qu. *The true time of the Full Moon in* May 1762, *New Style?*

By the Precepts,

	New Moon.				Sun's Anomaly.				Moon's Anomaly.				Sun from Node.			
	D.	H.	M.	S.	s	o	′	″	s	o	′	″	s	o	′	″
March 1762,	24	15	18	24	8	23	48	16	1	23	59	11	10	18	49	14
Add 2 Lunations,	59	1	28	6	1	28	12	39	1	21	38	1	2	1	20	28
New Moon, May,	22	16	46	30	10	22	0	55	3	15	37	12	0	20	9	42
Subt. ½ Lunation,	14	18	22	2	0	14	33	10	6	12	54	30	0	15	20	7
Full Moon, May,	7	22	24	28	10	7	27	45	9	2	42	42	0	4	49	35
First equation,	+	3	16	36	9	3	57	18	+	1	14	36				
Time once equated,	8	1	41	4	1	3	30	27	9	3	57	18	Sun from Node, and Arg. fourth equation.			
Second Equation,	—	9	47	53	Arg. 3d equation.				Arg. 2d equation.							
Time twice equated,	7	15	53	11												
Third Equation,		—	2	36												
Time thrice equated,	7	15	50	35												
Fourth Equation,			+	15												
The Full Moon,	7	15	50	50												

Anſ. May 7th at 15 h. 50 min. 50 ſec. paſt noon, *viz.* May 8th at 3 h. 50 min. 50 ſec. in the morning.

455 *To calculate the time of New and Full Moon in a given year and month of any particular century, between the Chriſtian æra and the 18th century.*

Precept I. Find a year of the ſame number in the 18th century with that of the year in the century propoſed, and take out the mean time of new moon in March, old ſtyle, for that year, with the mean anomalies and ſun's mean diſtance from the node at that time, as already taught.

II. Take as many complete centuries of years from Table VI. as, when ſubtracted from the abovefaid year in the 18th century, will anſwer to the given year; and take out the firſt mean new moon and its anomalies, &c. belonging to the ſaid centuries, and ſet them below thoſe taken out for March in the 18th century.

III. Subtract the numbers belonging to theſe centuries from thoſe of the 18th century, and the remainders will be the mean time and anomalies, &c. of new moon, in March, in the given year of the century propoſed,—Then, work in all reſpects for the true time of new or full moon, as ſhown in the above precepts and examples.

IV. If the days annexed to theſe centuries exceed the number of days from the beginning of March taken out in the 18th century, add a lunation and its anomalies, &c. from Table III. to the time and anomalies of new moon in March, and then proceed in all reſpects as above.—This circumſtance happens in Example V.

EXAMPLE

EXAMPLE III.

Required the true time of Full Moon, in April, Old Style, A. D. 30?
From 1730 ſubtract 1700 (or 17 centuries) and there remains 30.

By the Precepts.	New Moon.				Sun's Anomaly.				Moon's Anomaly.				Sun from Node.			
	D.	H.	M.	S.	s.	o.	′	″	s.	o.	′	″	s.	o.	′	″
March 1730,	7	12	34	16	8	18	4	31	9	[illegible]	32	17	1	23	17	16
Add ½ Lunation,	14	18	22	2	0	14	33	10	6	12	54	30	0	15	20	7
Full Moon,	22	6	56	18	9	2	37	41	3	13	26	47	2	8	37	23
1700 years ſubtr.	14	17	36	42	11	28	46	0	10	29	36	0	4	29	23	0
Full ☽ March A. D. 30.	7	13	19	36	9	3	51	41	4	13	50	47	9	9	14	23
Add 1 Lunation,	29	12	44	3	0	29	6	19	0	25	49	0	1	0	40	14
Full Moon, April,	6	2	3	39	10	2	58	0	5	9	39	47	10	9	54	37
Firſt Equation,	+	3	28	4	5	10	58	40	+	1	18	53				
Time once equated,	6	5	31	43	4	21	59	20	5	10	58	40	Sun from Node, and Arg. fourth equation.			
Second Equation,	+	2	57	48	Arg. 3d equation.				Arg. 2d equation.							
Time twice equated,	6	8	29	31												
Third Equation,		—	2	54												
Time thrice equated,	6	8	26	37												
Fourth Equation,		—	1	33												
True Full Moon, April,	6	8	25	4												

Hence it appears, that the true time of Full Moon in April, A. D. 30, old ſtyle, was on the 6th day at 25 m. 4 ſ. paſt eight in the evening.

456 *To calculate the true time of New or Full Moon in any given year and month before the Chriſtian æra.*

Precept I. Find a year in the 18th century, which being added to the given number of years before Chriſt diminiſhed by one, ſhall make a number of complete centuries.

II. Find this number of centuries in Table VI. and ſubtract the time and anomalies belonging to it from thoſe of the mean new moon in March, the above-found year of the 18th century; and the remainder will denote the time and anomalies, &c. of mean new moon in March, the given year before Chriſt.—Then, for the true time thereof in any month of that year, proceed as above taught.

EXAMPLE IV.

Required the true time of New Moon in May, *Old Style, the year before Chriſt 585?*
The years 584 added to 1716, makes 2300, or 23 centuries.

By the Precepts.	New Moon.				Sun's Anomaly.				Moon's Anomaly.				Sun from Node.			
	D.	H.	M.	S.	s.	o	′	″	s.	o	′	″	s.	o	′	″
March 1716,	11	17	33	29	8	22	50	39	4	4	14	2	4	27	17	5
2300 years ſubtract,	11	5	57	53	11	19	47	0	1	5	59	0	7	25	27	0
March before Chriſt 585,	0	11	35	36	9	3	3	39	2	28	15	2	9	1	50	5
Add 3 Lunations,	88	14	12	9	2	27	18	58	2	17	27	1	3	2	0	42
May before Chriſt 585,	28	1	47	45	0	0	22	37	5	15	42	3	0	3	50	47
Firſt Equation,		—	1	37	5	15	41	17			—	46				
Time once equated,	28	1	46	8	6	14	41	20	5	15	41	17	Sun from Node, and Arg. fourth equation.			
Second Equation,	+	2	15	1	Arg. 3d equation.				Arg. 2d equation.							
Time twice equated,	28	4	1	9												
Third Equation,		+	1	9												
Time thrice equated,	28	4	[illegible]	18												
Fourth Equation,			+	12												
True New Moon,	28	4	2	30												

So the true time was May 28th, at 2 minutes 30 ſeconds paſt four in the afternoon.

Theſe Tables are calculated for the meridian of London; but they will ſerve for any other place, by ſubtracting four minutes from the tabular time, for every degree that the meridian of the given place is weſtward of London, or adding four minutes for every degree that the meridian of the given place is eaſtward: as in

EXAMPLE V.

Required the true time of Full Moon at Alexandria *in* Egypt *in* September, *Old Style, the year before Chriſt* 201?

The years 200 added to 1800, make 2000, or 20 centuries.

By the Precepts.	New Moon.				Sun's Anomaly.				Moon's Anomaly.				Sun from Node.			
	D.	H.	M.	S.	s	o	′	″	s	o	′	″	s	o	′	″
March 1800,	13	0	22	17	8	23	19	55	10	7	52	36	11	3	58	24
Add 1 Lunation,	29	12	44	3	0	29	6	19	0	25	49	0	1	0	40	14
From the ſum,	42	13	6	20	9	22	26	14	11	3	41	36	0	4	38	38
Subtract 2000 years,	27	18	9	19	0	8	50	0	0	15	42	0	6	27	45	0
N. M. bef. Chr. 201,	14	18	57	1	9	13	36	14	10	17	59	36	5	6	53	38
Add 6 Lunations,	177	4	24	18	5	24	37	56	5	4	54	3	6	4	1	24
half Lunations,	14	18	22	2	0	14	33	10	6	12	54	30	0	15	20	7
Full Moon, September,	22	17	43	21	3	22	47	20	10	5	48	9	11	26	15	9
Firſt Equation,	—	3	52	6	10	4	19	55	—	1	28	14	Sun from Node, and Argument fourth equation.			
Time once equated,	22	13	51	15	5	18	27	25	10	4	19	55				
Second Equation,	—	8	25	4	Arg. 3d equation.				Arg. 2d equation.							
Time twice equated,	22	5	26	11												
Third Equation,			—	58												
Time thrice equated,	22	5	25	13												
Fourth Equation,			—	12												
True time at London,	22	5	25	1												
Add for Alexandria,		2	1	27												
True time there,	22	7	26	28												

Thus it appears, that the true time of Full Moon at Alexandria, in September, old ſtyle, the year before Chriſt 201, was the 22d day, at 26 minutes 28 ſeconds after ſeven in the evening.

EXAMPLE VI.

Required the true time of Full Moon at Babylon *in* October, *Old Style, the* 4008 *year before the firſt year of Chriſt, or* 4007 *before the year of his birth?*

The years 4007 added to 1793, make 5800, or 58 centuries.

By the Precepts.	New Moon.				Sun's Anomaly.				Moon's Anomaly.				Sun from Node.			
	D.	H.	M	S.	s	o	′	″	s	o	′	″	s	o	′	″
March 1793,	30	9	13	55	9	10	16	11	8	7	37	58	7	6	18	26
Subtract 5800 years,	15	12	38	7	10	21	35	0	6	24	43	0	9	13	1	0
N. M. bef. Chr. 4007,	14	20	35	48	10	18	41	11	1	12	54	58	9	23	17	26
Add 7 Lunations,	206	17	8	21	6	23	44	15	6	0	43	3	7	4	41	38
half Lunations.	14	18	22	2	0	14	33	10	6	12	54	30	0	15	20	7
Full Moon, October,	22	8	6	11	5	26	58	36	1	26	32	31	5	13	19	11
Firſt Equation,		—	13	26	1	26	27	26		—	5	5	Sun from Node, and Argument fourth equation.			
Time once equated,	22	7	52	45	4	0	31	10	1	26	27	26				
Second Equation,	+	8	29	21	Arg. 3d equation.				Arg. 2d equation.							
Time twice equated,	22	16	22	6												
Third Equation,		—	4	10												
Time thrice equated,	22	16	17	56												
Fourth Equation,			—	51												
Full Moon at London,	22	16	17	5												
Add for Babylon,		2	25	41												
True time there,	22	18	42	46												

So that, on the meridian of London, the true time was October 23d, at 17 minutes 5 ſeconds paſt four in the morning; but at Babylon, the true time was October 23d, at 42 minutes 46 ſeconds paſt ſix in the morning.—This is ſuppoſed by ſome to have been the year of the creation.

EXAMPLE

Of calculating Eclipſes, &c.

458 *To calculate the true time of New or Full Moon in any given year and month after the 18th century.*

Precept I. Find a year of the ſame number in the 18th century with that of the year propoſed, and take out the mean time and anomalies, &c. of new moon in March, old ſtyle, for that year, in Table I.

II. Take ſo many years from Table VI. as when added to the abovementioned year in the 18th century will anſwer to the given year in which the new or full moon is required; and take out the firſt new moon, with its anomalies for theſe complete centuries.

III. Add all theſe together, and then work in all reſpects as above ſhown, only remember to ſubtract a lunation and its anomalies, when the abovesaid addition carries the new moon beyond the 31ſt of March; as in the following example.

EXAMPLE VII.

Required the true time of New Moon in July, *Old Style,* A. D. 2180?

Four centuries (or 400 years) added to A. D. 1780, make 2180.

By the Precepts.	New Moon.				Sun's Anomaly.				Moon's Anomaly.				Sun from Node.			
	D.	H	M.	S.	s	°	′	″	s	°	′	″	s	°	′	″
March 1780,	23	23	1	44	9	4	18	13	1	21	7	47	10	18	21	1
Add 400 years.	17	8	43	29	0	13	24	0	10	1	28	0	6	17	49	0
From the ſum	41	7	45	13	9	17	42	13	11	22	35	47		6	10	1
Subtract 1 Lunation,	29	12	44	3	0	29	6	19	0	25	49	0		0	40	14
New Moon March 2180,	11	19	1	10	8	18	35	54	10	26	46	47	4	5	29	47
Add 4 Lunations,	118	2	56	12	3	26	25	17	3	13	16	2	4	2	40	56
New Moon July 2180.	7	21	57	22	0	15	1	11	2	10	2	49	8	8	10	43
Firſt Equation,	—	1	3	39	3	9	38	37		—	24	12	Sun from Node, and Argument fourth equation.			
Time once equated,	7	20	53	43	10	5	22	34	2	9	38	37				
Second Equation,	+	9	24	8	Arg. 3d equation.				Arg. 2d equation.							
Time twice equated,	8	6	17	51												
Third Equation,		+	3	56												
Time thrice equated,	8	6	21	47												
Fourth Equation,		+	1	8												
True time, July,	8	6	22	55												

True time, July 8th, at 22 minutes 55 ſeconds paſt ſix in the evening.

In keeping by the old ſtyle, we are always ſure to be right, by adding or ſubtracting whole hundreds of years to or from any given year in the 18th century. But in the new ſtyle we may be very apt to make miſtakes, on account of the leap-year's not coming in regularly every fourth year: and therefore, when we go without the limits of the 18th century, we had beſt keep to the old ſtyle, and at the end of the calculation reduce the time to the new. Thus, in the 22d century there will be fourteen days difference between the ſtyles; and therefore the true time of new moon in this laſt example being reduced to the new ſtyle, will be the 22d of July, at 22 minutes 55 ſeconds paſt ſix in the evening.

459 *To calculate the true place of the Sun for any given moment of time.*

Precept I. In Table XII. find the next leſſer year in number to that in which the ſun's place is ſought, and write out his mean longitude and anomaly anſwering thereto: to which add his mean motion and anomaly for the complete reſidue of years, months, days, hours, minutes and ſeconds, down to the given time, and this will be the ſun's mean place and anomaly at that time, in the old ſtyle, provided the ſaid time be in any year after the Chriſtian æra. *See the firſt following Example.*

II. Enter Table XIII. with the ſun's mean anomaly, and making proportions for the odd minutes and ſeconds thereof, take out the equation of the ſun's centre: which, being applied to his mean place as the title *Add* or *Subtract* directs, will give his true place or longitude from the vernal equinox, at the time for which it was required.

III. To calculate the ſun's place for any time in a given year before the Chriſtian æra, take out his mean longitude and anomaly for the firſt year thereof, and from theſe numbers ſubtract the mean motions and anomalies for the complete hundreds or thouſands next above the given year; and to the remainders, add thoſe for the reſidue of years, months, &c. and then work in all reſpects as above. *See the ſecond Example following.*

EXAMPLE I.

Required the Sun's true place, March 20th *Old Style,* 1764, *at* 22 *hours* 30 *minutes* 25 *ſeconds paſt noon?* *In common reckoning,* March 21ſt, *at* 10 *hours* 30 *minutes* 25 *ſeconds in the forenoon.*

		Sun's Longitude.				Sun's Anomaly.			
		s	°	′	″	s	°	′	″
To the radical year after Chriſt — —	1701	9	20	43	50	6	13	1	0
Add complete years — —	60	0	0	27	12	11	29	26	0
	3	11	29	17	0	11	29	14	0
	March	1	28	9	11	1	28	9	0
Biſſextile Days —	20		20	41	55		20	41	55
Hours —	22			54	13			54	13
Minutes —	30			1	14			1	14
Seconds —	25				1				1
Sun's mean place at the given time — — — —		0	10	14	36	9	1	27	23
Equation of the Sun's centre, add — — — —			1	55	36	Mean Anomaly.			
Sun' true place at the ſame time — — — —		0	12	10	12	or ♈	12	10	12

EXAMPLE II.

Required the Sun's true place, October 23d, *Old Style, at* 16 *hours* 57 *minutes paſt noon, in the* 4008th *year before the year of Chriſt* 1; *which was the* 4007th *before the year of his birth, and the year of Julian period* 706.

By the Precepts.

		Sun's Longitude.				Sun's Anomaly.			
		s	°	′	″	s	°	′	″
From the radical numbers after Chriſt — — —	1	9	7	53	10	6	28	48	0
Subtract thoſe for 5000 complete years — — — —		1	7	46	40	10	13	25	0
Remains for a new radix		8	0	6	30	8	15	23	0
To which add, to bring it to the given time: complete years — —	900	0	6	48	0	11	21	37	0
	80	0	0	36	16	11	29	15	0
	12	0	0	5	26	11	29	53	0
	October	8	29	4	54	8	29	4	0
Days	23		22	40	12		22	40	12
Hours	16			39	26			39	26
Minutes,	57			2	20			2	20
Sun's mean place at the given time — — —		6	0	3	4	5	28	33	58
Equation of the ſun's centre ſubtract — — — —				3	4	Sun's Anomaly.			
Sun's true place at the ſame time — — — — —		6	0	0	0	or ♎	0	0	0

So that in the meridian of London, the ſun was then juſt entering the ſign ♎ Libra, and conſequently was upon the point of the autumnal equinox.

If to the above time of the autumnal equinox at London, we add 2 hours 25 minutes 41 ſeconds for the longitude of Babylon, we ſhall have for the time of the ſame equinox, at that place, October 23d, at 19 hours 22 minutes 41 ſeconds; which, in the common way of reckoning, is October 24th, at 22 minutes 41 ſeconds paſt ſeven in the morning.

And it appears by Example VI. that in the ſame year, the true time of full moon at Babylon was October 23d, at 42 minutes 46 ſeconds after ſix in the morning; ſo that the autumnal equinox was on the day next after the day of full moon.—The dominical letter for that year was G, and conſequently the 24th of October was on a Wedneſday.

To find the Sun's diſtance from the Moon's aſcending node, at the time of any given new or full moon; and conſequently to know whether there is an eclipſe at that time, or not. 460

The ſun's diſtance from the moon's aſcending node is the argument for finding the moon's fourth equation in the ſyzygies, and therefore it is taken into all the foregoing examples in finding the times thereof. Thus, at the time of mean new moon in April 1764, the ſun's mean diſtance from the aſcending node, is $0^s\ 5^\circ\ 35'\ 2''$. See Example I. p. 562.

The deſcending node is oppoſite to the aſcending one, and they are juſt ſix ſigns diſtant from each other.

When the ſun is within 17 degrees of either of the nodes at the time of new moon, he will be eclipſed at that time: and when he is within 12 degrees of either of the nodes at the time of full moon, the moon will be then eclipſed. Thus we find, that there was an eclipſe of the ſun at the time of new moon in April 1764.

But the true time of that new moon comes out by the equations to be 50 minutes 46 ſeconds later than the mean time thereof, by comparing theſe times in the above example: and therefore we muſt add the ſun's motion from the node during that interval to the above mean diſtance 0ˢ 5° 35′ 2″, which motion is found in Table XII. for 50 minutes 46 ſeconds, to be 2′ 12″. And to this we muſt apply the equation of the ſun's mean diſtance from the node in Table XV. found by the ſun's anomaly, which at the mean time of new moon in Example I. is 9ˢ 1° 26′ 19″; and then we ſhall have the ſun's true diſtance from the node ,at the true time of new moon, as follows:

		Sun from Node.			
		s	°	′	″
At the mean time of new moon in April 1764		0	5	35	2
Sun's motion from the node for	50 minutes			[illegible]	10
	46 ſeconds				2
Sun's mean diſtance from node at true new moon		0	5	37	14
Equation of mean diſtance from node, add			2	5	0
Sun's true diſtance from the aſcending node		0	7	42	14

Which being far within the above limit of 17 degrees, ſhows that the ſun muſt then have been eclipſed.

And now we ſhall ſhow how to project this, or any other eclipſe, either of the ſun or moon.

461 *To project an Eclipſe of the Sun.*

In order to this, we muſt find the 10 following elements, by means of the tables.

1. The true time of conjunction of the ſun and moon; and at that time. 2. The ſemidiameter of the earth's diſk, as ſeen from the moon, which is equal to the moon's horizontal parallax. 3. The ſun's diſtance from the ſolſtitial colure to which he is then neareſt. 4. The ſun's declination. 5. The angle of the moon's viſible path with the ecliptic. 6. The moon's latitude. 7. The moon's true horary motion from the ſun. 8. The ſun's ſemidiameter. 9. The moon's. 10. The ſemidiameter of the penumbra.

We ſhall now proceed to find theſe elements for the ſun's eclipſe in April 1764.

462 *To find the true time of new moon.* This, by Example I. p. 562, is found to be on the firſt day of the ſaid month, at 30 minutes 25 ſeconds after ten in the morning.

463 2. *To find the moon's horizontal parallax, or ſemidiameter of the earth's diſk, as ſeen from the moon.* Enter Table XVII. with the ſigns and degrees of the moon's anomally (making proportions, becauſe the anomaly is in the table only to every 6th degree), and thereby take out the moon's horizontal parallax; which for the above time, anſwering to the anomaly 11ˢ 9° 24′ 21″, is 54′ 43″.

464 3. *To find the ſun's diſtance from the neareſt ſolſtice, viz. the beginning of Cancer, which is 3ˢ or 90° from the beginning of Aries.* It appears by Example I. in p. 566 (where the ſun's place is calculated to the above time of new moon), that the ſun's longitude from the beginning of Aries is then 0ˢ 12° 10′ 12″; that is, the ſun's place at that time is ♈ Aries, 12° 10′ 12″.

	s	°	′	″
Therefore from - -	3	0	0	0
Subtract the Sun's longitude or place	0	12	10	12
Remains the ſun's diſtance from the ſolſtice ♋ =	2	17	49	48

Or 77° 49′ 48″; each ſign containing 30 degrees.

465 5. *To find the ſun's declination.* Enter Table XIV. with the ſigns and degrees of the ſun's true place, viz. 0ˢ 12°, and making proportions for the 10′ 12″, take out the ſun's declination anſwering to his true place, and it will be found to be 4° 49′ north.

466 5. *To find the moon's latitude.* This depends on her diſtance from her aſcending node, which is the ſame as the ſun's diſtance from it at the time of new moon; and is thereby found in Table XVI.

But we have already found, that the ſun's equated diſtance from the aſcending node, at the time of new moon in April 1764, is 0ˢ 7° 42′ 14″. See above.

Therefore, enter Table XVI. with 0 ſigns at the top, and 7 and 8 degrees at the left hand, and take out 36′ and 39″, the latitude for 7°; and 41′ 51″, the latitude for 8°: and by making proportions between theſe latitudes for the 42′ 14″, by which the moon's diſtance from the node exceeds 7 degrees; her true latitude will be found to be 40′ 18″ north aſcending.

467 6. *To find the moon's true horary motion from the ſun.* With the moon's anomaly, viz. 11ˢ 9° 24′ 21″, Table XVII. and take out the moon's horary motion; which, by making proportions in that table, will be found to be 30′ 22″. Then, when the ſun's anomaly, 9ˢ 1° 26′ 19″, take out his horary motion 2′ 28″ from the ſame table: and ſubtracting the latter from the former, there will remain 27′ 54″ for the moon's true horary motion from the ſun.

468 7. *To find the angle of the moon's viſible path with the ecliptic.* This, in the projection of eclipſes, may be always rated at 5° 35′, without any ſenſible error.

469 8, 9. *To find the ſemidiameters of the ſun and moon.* Theſe are found in the ſame table, and by the ſame arguments, as their horary motions. In the preſent caſe, the ſun's anomaly gives his ſemidiameters 16′ 6″, and the moon's anomaly gives her ſemidiameter 14′ 57″.

470 10. *To find the ſemidiameter of the penumbra.* Add the moon's ſemidiameter to the ſun's, and their ſum will be the ſemidiameter of the penumbra, viz. 31′ 3″.

Now collect theſe elements, that they may be found the more readily when they are wanted in the conſtruction of this eclipſe.

Of calculating Eclipſes, &c.

1. True time of new moon in April, 1764 - -	1	10	30	25
		°	′	″
2. Semidiameter of the earth's diſk		0	54	53
3. Sun's diſtance from the neareſt ſolſt.		77	49	48
4. Sun's declination, north		4	49	0
5. Moon's latitude, north aſcending		0	40	18
6. Moon's horary motion from the ſun		0	27	54
7. Angle of the moon's viſible path with the ecliptic		5	35	0
8. Sun's ſemidiameter			16	6
9. Moon's ſemidiameter			14	57
10. Semidiameter of the penumbra			31	3

To project an Eclipſe of the Sun geometrically.

Make a ſcale of any convenient length, as AC, and divide it into as many equal parts as the earth's ſemidiſk contains minutes of a degree; which, at the time of the eclipſe in April 1764, is 54′ 53″. Then, with the whole length of the ſcale as a radius, deſcribe the ſemicircle AMB upon the centre C; which ſemicircle ſhall repreſent the northern half of the earth's enlightened diſk, as ſeen from the ſun.

Upon the centre C raiſe the ſtraight line CH, perpendicular to the diameter ACB; ſo ACB ſhall be a part of the ecliptic, and CH its axis.

Being provided with a good ſector, open it to the radius CA in the line of chords; and taking from thence the chord of 23½ degrees in your compaſſes, ſet it off both ways from H, to *g* and to *h*, in the periphery of the ſemidiſk; and draw the ſtraight line *g* V *h*, in which the north pole of the diſk will be always found.

When the ſun is in Aries, Taurus, Gemini, Cancer, Leo, and Virgo, the north pole of the earth is enlightened by the ſun; but whilſt the ſun is in the other ſix ſigns, the ſouth pole is enlightened, and the north pole is in the dark.

And when the ſun is in Capricorn, Aquarius, Piſces, Aries, Taurus, and Gemini, the northern half of the earth's axis C XII P lies to the right hand of the axis of the ecliptic, as ſeen from the ſun; and to the left hand, whilſt the ſun is in the other ſix ſigns.

Open the ſector till the radius (or diſtance of the two 90's) of the ſines be equal to the length of V *h*, and take the ſine of the ſun's diſtance from the ſolſtice (77° 49′ 48″) as nearly as you can gueſs, in your compaſſes, from the line of ſines, and ſet off that diſtance from V to P in the line *g* V *h*, becauſe the earth's axis lies to the right hand of the axis of the ecliptic in this caſe, the ſun being in Aries; and draw the ſtraight line C XII P for the earth's axis, of which P is the north pole. If the earth's axis had lain to the left hand from the axis of the ecliptic, the diſtance VP would have been ſet off from V towards *g*.

To draw the parallel of latitude of any given place, as ſuppoſe London, or the path of that place on the earth's enlightened diſk as ſeen from the ſun, from ſunriſe till ſun-ſet, take the following method.

Subtract the latitude of London, 51°½ from 90°, and the remainder 38°½ will be the co-latitude, which take in your compaſſes from the line of chords, making CA or CB the radius, and ſet it from *h* (Where the earth's axis meets the periphery of the diſk) to VI and VI, and draw the occult or dotted line VI K VI. Then, from the points where this line meets the earth's diſk, ſet off the chord of the ſun's declination 4° 49′ to D and F, and to E and G, and connect theſe points by the two occult lines F XII G and DLE.

Of calculating Eclipſes, &c.

Biſect LK XII in K, and through the point K draw the black line VI K VI. Then making CB the radius of a line of ſines on the ſector, take the co-latitude of London 38°½ from the ſines in your compaſſes, and ſet it both ways from K to VI and VI. Theſe hours will be juſt in the edge of the diſk at the equinoxes, but at no other time in the whole year.

With the extent K VI taken into your compaſſes, ſet one foot in K (in the black line below the occult one) as a centre, and with the other foot deſcribe the ſemicircle VI 7 8 9 10, &c. and divide it into 12 equal parts. Then from theſe points of diviſion draw the occult lines 7*p*, 8*o*, 9*n*, &c. parallel to the earth's axis C XII P.

With the ſmall extent K XII as a radius, deſcribe the quadrantal arc XII*f*, and divide it into ſix equal parts, as XII *a*, *ab*, *bc*, *cd*, *de*, and *ef*; and through the diviſion-points *a*, *b*, *c*, *d*, *e*, draw the occult lines VII *e* V, VIII *d* IV, IX *c* III, X *b* II, and XI *a* I, all parallel to VI K VI, and meeting the former occult lines 7 *p* 8 *o*, &c. in the points VII VIII IX X XI, V IV III II and I: which points ſhall mark the ſeveral ſituations of London on the earth's diſk, at theſe hours reſpectively, as ſeen from the ſun; and the elliptic curve VI VII VII, &c. being drawn through theſe points, ſhall repreſent the parallel of latitude, or path of London on the diſk, as ſeen from the ſun, from its riſing to its ſetting.

N. B. If the ſun's declination had been ſouth, the diurnal path of London would have been on the upper ſide of the line VI K VI, and would have touched the line DLE in L. It is requiſite to divide the horary ſpaces into quarters (as ſome are in the figure), and, if poſſible, into minutes alſo.

Make CB the radius of a line of chords on the ſector, and taking therefrom the chord of 5° 35′, the angle of the moon's viſible path with the ecliptic, ſet it off from H to M on the left hand of CH, the axis of the ecliptic, becauſe the moon's latitude is north aſcending. Then draw CM for the axis of the moon's orbit, and biſect the angle MCH by the right line C*z*. If the moon's latitude had been north deſcending, the axis of her orbit would have been on the right hand from the axis of the ecliptic.——N. B. The axis of the moon's orbit lies the ſame way when her latitude is ſouth aſcending as when it is north aſcending; and the ſame way when ſouth deſcending as when north deſcending.

Take the moon's latitude 40′ 18″ from the ſcale C A in your compaſſes, and ſet it from *i* to *x* in the biſecting line C*z*, making *ix* parallel to C*y*: and thro' *x*, at right angles to the axis of the moon's orbit CM, draw the ſtraight line N *wxy* S for the path of the penumbra's centre over the earth's diſk.—The point *w*, in the axis of the moon's orbit, is that where the penumbra's centre approaches neareſt to the centre of the earth's diſk, and conſequently is the middle of the general eclipſe: the point *x* is that where the conjunction

Fig. 199

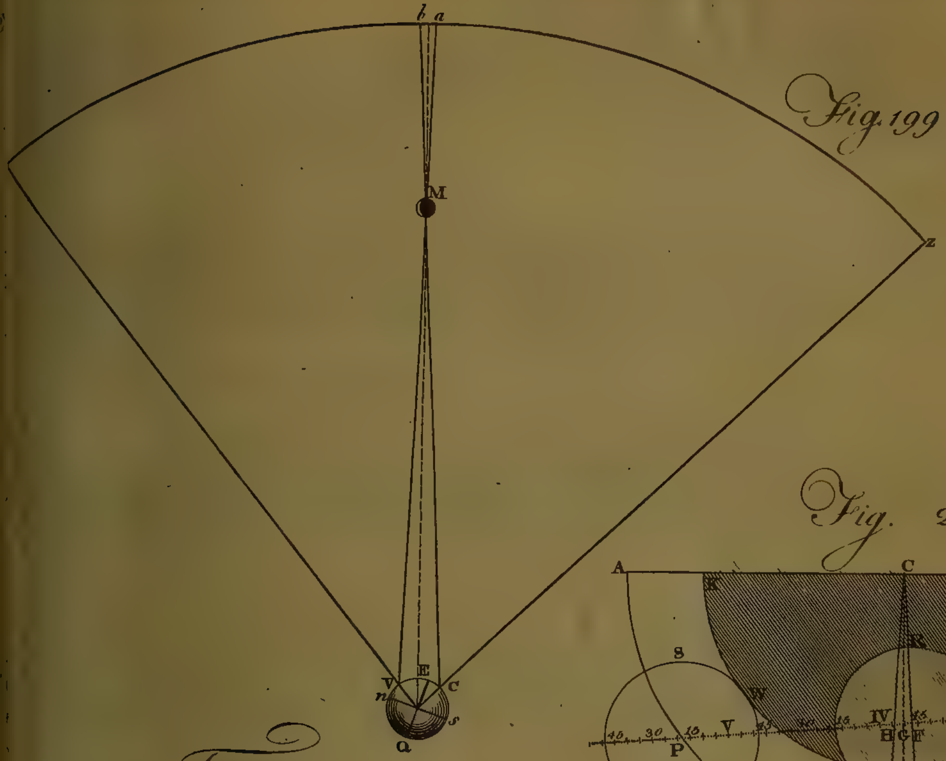


Fig. 202

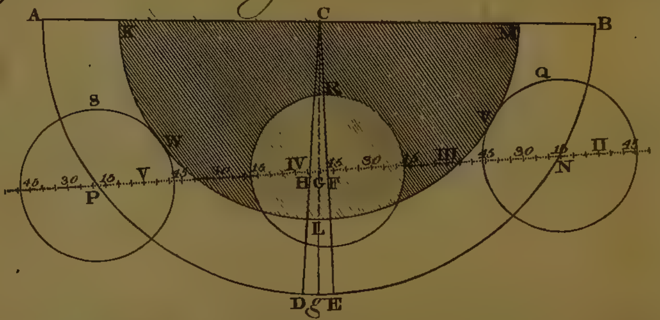


Fig. 201

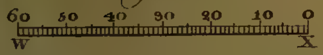
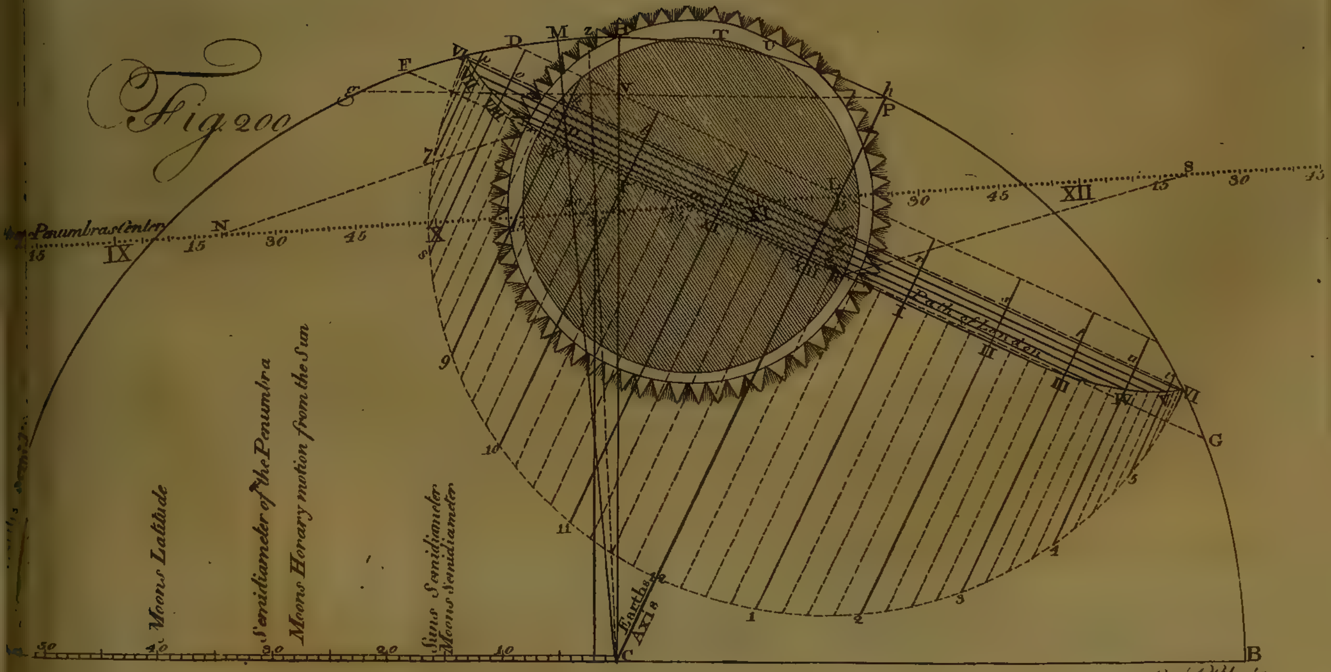


Fig. 200



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of the ſun and moon falls, according to equal time by the tables; and the point *y* is the ecliptical conjunction of the ſun and moon.

Take the moon's true horary motion from the ſun, 27′ 54″, in your compaſſes, from the ſcale CA (every diviſion of which is a minute of a degree), and with that extent make marks along the path of the penumbra's centre; and divide each ſpace from mark to mark into ſixty equal parts or horary minutes, by dots; and ſet the hours to every 60th minute in ſuch a manner, that the dot ſignifying the inſtant of new moon by the tables, may fall into the point *x*, half way between the axis of the moon's orbit and the axis of the ecliptic; and then, the reſt of the dots will ſhow the points of the earth's diſk, where the penumbra's centre is at the inſtants denoted by them, in its tranſit over the earth.

Apply one ſide of a ſquare to the line of the penumbra's path, and move the ſquare backwards and forwards until the other ſide of it cuts the ſame hour and minute (as at *m* and *m*) both in the path of London and in the path of the penumbra's centre; and the particular minute or inſtant which the ſquare cuts at the ſame time in both paths, ſhall be the inſtant of the viſible conjunction of the ſun and moon, or greateſt obſcuration of the ſun, at the place for which the conſtruction is made, namely, London, in the preſent example; and this inſtant is at $47\frac{1}{12}$ minutes paſt ten o'clock in the morning; which is 17 minutes five ſeconds later than the tabular time of true conjunction.

Take the ſun's ſemidiameter, 16′ 6″, in your compaſſes, from the ſcale CA, and ſetting one foot in the path of London, at *m*, namely at $47\frac{1}{12}$ minutes paſt ten, with the other foot deſcribe the circle UY, which ſhall repreſent the ſun's diſk as ſeen from London at the greateſt obſcuration.—Then take the moon's ſemidiameter, 14′ 57″, in your compaſſes from the ſame ſcale; and ſetting one foot in the path of the penumbra's centre at *m*, in the $47\frac{1}{12}$ minute after ten, with the other foot deſcribe the circle TY for the moon's diſk, as ſeen from London, at the time when the eclipſe is at the greateſt, and the portion of the ſun's diſk which is hid or cut off by the moon's will ſhow the quantity of the eclipſe at that time; which quantity may be meaſured on a line equal to the ſun's diameter, and divided into 12 equal parts for digits.

Laſtly, take the ſemidiameter of the penumbra, 31′ 3″, from the ſcale CA in your compaſſes; and ſetting one foot in the line of the penumbra's central path, on the left hand from the axis of the ecliptic, direct the other foot toward the path of London; and carry that extent backwards and forwards till both the points of the compaſſes fall into the ſame inſtants in both the paths: and theſe inſtants will denote the time when the eclipſe begins at London.—Then, do the like on the right hand of the axis of the ecliptic; and where the points of the compaſſes fall into the ſame inſtants in both of the paths, they will ſhow at what time the eclipſe ends at London.

Theſe trials give 20 minutes after nine in the morning for the beginning of the eclipſe at London, at the points N and O; $47\frac{1}{12}$ minutes after ten, at the points *m* and *n*, for the time of greateſt obſcuration; and 18 minutes after twelve, at R and S, for the time when the eclipſe ends; according to mean or equal time.

From theſe times we may ſubtract the equation of natural days, &c. 3 minutes 48 ſeconds, in leap-year April 1, and we ſhall have the apparent times; namely, 9 hours 16 minutes 12 ſeconds for the beginning of the eclipſe, 10 hours 43 minutes 42 ſeconds for the time of greateſt obſcuration, and 12 hours 14 minutes 12 ſeconds for the time when the eclipſe ends. But the beſt way is to apply this equation to the true equal time of new moon, before the projection be begun; as is done in Example I. For the motion or poſition of places on the earth's diſk anſwer to apparent or ſolar time.

In this conſtruction it is ſuppoſed, that the angle under which the moon's diſk is ſeen, during the whole time of the eclipſe, continues invariably the ſame; and that the moon's motion is uniform and rectilineal during that time. But theſe ſuppoſitions do not exactly agree with the truth; and therefore, ſuppoſing the elements given by the tables to be accurate, yet the times and phaſes of the eclipſe, deduced from its conſtruction, will not anſwer exactly to what paſſeth in the heavens; but may be at leaſt two or three minutes wrong, though done with the greateſt care. Moreover, the paths of all places of conſiderable latitudes, are nearer the centre of the earth's diſk, as ſeen from the ſun, than thoſe conſtructions make them: becauſe the diſk is projected as if the earth were a perfect ſphere although it is known to be a ſpheroid. Conſequently, the moon's ſhadow will go farther northward in all places of northern latitude, and farther ſouthward in all places of ſouthern latitude, than it is ſhown to do in theſe projections.—According to Meyer's Tables, this eclipſe was about a quarter of an hour ſooner than either theſe tables, or Mr Flamſtead's or Dr Halley's, make it, and was not annular at London. But M. de la Caille's make it almoſt central.

The projection of lunar eclipſes.

When the moon is within 12 degrees of either of her nodes at the time when ſhe is full, ſhe will be eclipſed, otherwiſe not. 471

We find by example ſecond, page 562, that at the time of mean full moon in May 1762, the ſun's diſtance from the aſcending node was only 4° 49′ 35″; and the moon being then oppoſite to the ſun, muſt have been juſt as near her deſcending node, and was therefore eclipſed.

The elements for conſtructing an eclipſe of the moon, are eight in number, as follow:

1. The true time of full moon; and at that time. 472
2. The moon's horizontal parallax. 3. The ſun's ſemidiameter. 4. The moon's. 5. The ſemidiameter of the earth's ſhadow at the moon. 6. The moon's latitude. 7. The angle of the moon's viſible path with the ecliptic. 8. The moon's true horary motion from the ſun.——Therefore,

1. *To find the true time of new or full moon.* Work as already taught in the precepts.—Thus we had the true time of full moon in May 1762 (See Example II. page 562) on the 8th day, at 50 minutes 50 ſeconds paſt three o'clock in the morning. 473

2. *To find the moon's horizontal parallax.* Enter Table XVII. with the moon's mean anomaly (at the above full) 9^s 2° 42′ 42″, and thereby take out her horizontal parallax, which by making the requiſite proportions, will be found to be 57′ 23″. 474

3, 4. *To find the ſemidiameters of the ſun and moon.* Enter Table XVII. with their reſpective anomalies, the ſun's being 10^s 7° 27′ 45″ (by the above example) and the moon's 9^s 2° 42′ 42″; and thereby take out their reſpective ſemidiameters; the ſun's 15′ 56″, and the moon's 15′ 38″. 475

476 5. *To find the ſemidiameter of the earth's ſhadow at the moon.* Add the ſun's horizontal parallax, which is always 10″, to the moon's which in the preſent caſe is 57′ 23″, the ſum will be 57′ 33″, from which ſubtract the ſun's ſemidiameter 15′ 56″, and there will remain 41′ 36″ for the ſemidiameter of that part of the earth's ſhadow which the moon then paſſes through.

477 6. *To find the moon's latitude.* Find the ſun's true diſtance from the aſcending node (as already taught in page 566) at the true time of full moon; and this diſtance increaſed by ſix ſigns, will be the moon's true diſtance from the ſame node; and conſequently the argument for finding her true latitude, as ſhown in p. 566.

478 Thus, in Example II. the ſun's mean diſtance from the aſcending node was 0^{s} 4° 49′ 35″, at the time of mean full moon: but it appears by the example, that the true time thereof was ſix hours 33 minutes 38 ſeconds ſooner than the mean time; and therefore we muſt ſubtract the ſun's motion from the node (found in Table XII.) during this interval, from the above mean diſtance 0^{s} 4° 49′ 35″, in order to have his mean diſtance from it at the true time of full moon. Then to this apply the equation of his mean diſtance from the node, found in Table XV. by his mean anomaly 10^{s} 7° 27′ 45″; and laſtly add ſix ſigns: ſo ſhall the moon's true diſtance from the aſcending node be found as follows:

		s	°	′	″
Sun from node at mean full moon		0	4	49	35
His motion from it in	6 hours			15	35
	33 minutes			1	26
	38 ſeconds				2
Sum, ſubtract from the uppermoſt line				17	3
Remains his mean diſtance at true full moon		0	4	32	32
Equation of his mean diſtance, add			1	38	0
Sun's true diſtance from the node		0	6	10	32
To which add		6	0	0	0
And the ſum will be		6	6	10	32

Which is the moon's true diſtance from her aſcending node at the true time of her being full; and conſequently the argument for finding her true latitude at that time.—Therefore, with this argument, enter Table XVI. making proportions between the latitudes belonging to the 6th and 7th degree of the argument at the left hand (the ſigns being at top) for the 10′ 32″ and it will give 32′ 21″ for the moon's true latitude, which appears by the table to be ſouth deſcending.

479 7. *To find the angle of the moon's viſible path with the ecliptic.* This may be ſtated at 5° 35′, without any error of conſequence in the projection of the eclipſe.

480 8. *To find the moon's true horary motion from the ſun.* With their reſpective anomalies take out their horary motions from Table XVII. and the ſun's horary motion ſubtracted from the moon's leaves remaining the moon's true horary motion from the ſun: in the preſent caſe 30′ 52″.

481 Now collect theſe elements together for uſe.

	D.	H.	M.	S.
1. True time of full moon in May, 1762	8	3	50	50
		°	′	″
2. Moon's horizontal parallax		0	57	23
3. Sun's ſemidiameter		0	15	56
4. Moon's ſemidiameter		0	15	38
5. Semidiameter of the earth's ſhadow at the moon		0	41	37
6. Moon's true latitude, ſouth deſcending		0	32	21
7. Angle of her viſible path with the ecliptic		5	35	0
8. Her true horary motion from the ſun		0	30	52

Theſe elements being found for the conſtruction of the moon's eclipſe in May 1762, proceed as follows:

Make a ſcale of any convenient length, as WX (fig. 201.), and divide it into 60 equal parts, each part ſtanding for a minute of a degree.

Draw the right line ACB (fig. 202.) for part of the ecliptic, and CD perpendicular thereto for the ſouthern part of its axis; the moon having ſouth latitude.

Add the ſemidiameters of the moon and earth's ſhadow together, which in this eclipſe will make 57′ 15″; and take this from the ſcale in your compaſſes, and ſetting one foot in the point C as a centre, with the other foot deſcribe the ſemicircle ADB; in one point of which the moon's centre will be at the beginning of the eclipſe, and in another at the end thereof.

Take the ſemidiameter of the earth's ſhadow, 41′ 37″, in your compaſſes from the ſcale, and ſetting one foot in the centre C, with the other foot deſcribe the ſemicircle KLM for the ſouthern half of the earth's ſhadow, becauſe the moon's latitude is ſouth in this eclipſe.

Make CD equal to the radius of a line of chords on the ſector, and ſet off the angle of the moon's viſible path with the ecliptic, 5° 35′, from D to E, and draw the right line CFE for the ſouthern half of the axis of the moon's orbit lying to the right hand from the axis of the ecliptic CD, becauſe the moon's latitude is ſouth deſcending.—It would have been the ſame way (on the other ſide of the ecliptic) if her latitude had been north deſcending; but contrary in both caſes, if her latitude had been either north aſcending or ſouth aſcending.

Biſect the angle DCE by the right line C*g*; in which line the true equal time of oppoſition of the ſun and moon falls, as given by the tables.

Take the moon's latitude, 32′ 21″ from the ſcale with your compaſſes, and ſet it from C to G, in the line CG*g*; ond through the point G, at right angles to CFE, draw the right line PHGFN for the path of the moon's centre. Then, F ſhall be the point in the earth's ſhadow, where the moon's centre is at the middle of the eclipſe: G, the point where her centre is at the tabular time of her being full; and H, the point where her centre is at the inſtant of her ecliptical oppoſition.

Take the moon's horary motion from the ſun, 30′ 52″, in your compaſſes from the ſcale; and with that extent make marks along the line of the moon's path PGN: then divide each ſpace from mark to mark, into 60 equal parts, or horary minutes, and ſet the hours to the proper dots in ſuch a manner, that the dot ſignifying the inſtant of full moon (viz. 50 minutes 50 ſeconds after III in the morning) may be in the point G, where the line of the moon's path cuts the line that biſects the angle DCE.

Take the moon's ſemidiameter, 15′ 38″, in your compaſſes from the ſcale, and with that extent, as a radius, upon the points N, F, and P, as centres, deſcribe the circle Q for the moon at the beginning of the eclipſe, when ſhe touches the earth's ſhadow at V; the circle R for the moon at the middle of the eclipſe; and the circle S for the moon at the end of the eclipſe, juſt leaving the earth's ſhadow at W.

The point N denotes the inſtant when the eclipſe began, namely, at 15 minutes 10 ſeconds after II in the morning: the point F the middle of the eclipſe at 47 minutes 44 ſeconds paſt III; and the point P the end of the eclipſe, at 18 minutes after V.—At the greateſt obſcuration the moon was 10 digits eclipſed.

TABLES

TABLE I. *The mean Time of New Moon, in* March, *Old Style; with the mean Anomalies of the Sun and Moon, and the Sun's mean Diſtance from the Moon's aſcending Node, from* A. D. 1700 *to* A. D. 1800 *incluſive.*

A. D.	Mean N. Moon in March.				Sun's mean Anomaly.				Moon's mean Anomaly.				Sun's mean Dif. from the Node.			
	D.	H.	M.	S.	s	°	′	″	s	°	′	″	s	°	′	″
1700	8	16	11	25	8	19	58	48	1	22	30	37	6	14	31	7
1701	27	13	44	5	9	8	20	59	0	28	7	42	7	23	24	8
1702	16	22	32	41	8	27	36	51	11	7	55	47	8	0	16	55
1703	6	7	21	18	8	16	52	43	9	17	43	52	8	9	19	42
1704	24	4	53	57	9	5	14	54	8	23	20	57	9	18	2	43
1705	13	13	42	34	8	24	30	47	7	3	9	2	9	26	5	30
1706	2	22	31	11	8	13	46	39	5	12	57	7	10	4	8	17
1707	21	20	3	50	9	2	8	50	4	18	34	13	11	12	51	18
1708	10	4	52	27	8	21	24	43	2	28	22	18	11	20	54	5
1709	29	2	25	7	9	9	46	54	2	3	59	24	0	29	37	6
1710	18	11	13	43	8	29	2	47	0	13	47	30	1	7	39	54
1711	7	20	2	20	8	18	18	39	10	23	35	36	1	15	42	41
1712	25	17	34	59	9	6	40	51	9	29	12	42	2	14	25	43
1713	15	2	23	36	8	25	56	43	8	9	0	47	3	2	28	30
1714	4	11	12	13	8	15	12	35	6	18	48	52	3	10	31	17
1715	23	8	44	52	9	3	34	47	5	24	25	57	4	19	14	18
1716	11	17	33	29	8	22	50	39	4	4	14	2	4	27	17	5
1717	1	2	22	5	8	12	6	32	2	14	2	8	5	5	19	52
1718	19	23	54	45	9	0	28	44	1	19	39	13	6	14	2	54
1719	9	8	43	22	8	19	44	37	11	29	27	18	6	22	5	41
1720	27	6	16	1	9	8	6	49	11	5	4	24	8	0	48	43
1721	16	15	4	38	8	27	22	41	9	14	52	29	8	8	51	29
1722	5	23	53	14	8	16	38	33	7	24	40	34	8	16	54	16
1723	24	21	25	54	9	5	0	45	7	0	17	40	9	25	37	18
1724	13	6	14	31	8	24	16	37	5	10	5	45	0	3	40	5
1725	2	15	3	7	8	13	32	29	3	19	53	50	10	11	42	52
1726	21	12	35	47	9	1	54	41	2	25	30	56	11	20	25	54
1727	10	21	24	23	8	21	10	34	1	5	19	1	11	28	28	41
1728	28	18	57	3	9	9	52	46	0	10	56	7	1	7	11	42
1729	18	3	45	40	8	28	48	39	10	20	44	12	1	15	14	29
1730	7	12	34	16	8	18	4	31	9	0	32	17	1	23	17	16
1731	26	10	6	56	9	6	26	42	8	6	9	23	3	2	0	17
1732	14	18	55	33	8	25	42	34	6	15	57	28	3	10	3	4
1733	4	3	44	9	8	14	58	26	4	25	45	38	3	18	5	51
1734	23	1	16	49	9	3	20	38	4	1	22	39	4	26	48	53
1735	12	10	5	25	8	22	36	30	2	11	10	44	5	4	51	40
1736	0	18	54	2	8	11	52	22	0	20	58	49	5	12	54	27
1737	19	16	26	42	9	0	14	34	11	26	35	55	6	21	37	29
1738	9	1	15	18	8	19	30	26	10	6	24	0	6	29	40	16
1739	27	22	47	58	9	7	52	38	9	12	1	6	8	8	23	18
1740	16	7	36	34	8	27	8	30	7	21	49	11	8	16	26	5
1741	5	16	25	11	8	16	24	22	6	1	37	16	8	24	28	52
1742	42	13	57	52	9	4	46	34	5	7	14	22	10	3	11	54
1743	3	22	46	27	8	24	2	27	3	17	2	27	10	1	14	41
1744	2	7	35	4	8	13	18	20	1	26	50	32	10	19	17	28
1745	21	5	7	44	9	1	40	32	1	2	27	38	11	28	0	30
1746	10	13	56	20	8	20	56	24	11	12	15	43	0	6	3	17
1747	29	11	29	0	9	9	98	36	10	17	52	49	1	14	46	19
1748	17	20	17	36	8	28	34	29	8	27	40	54	1	22	49	5
1749	7	5	6	13	8	17	50	20	7	7	28	59	2	0	51	52
1750	26	2	38	53	9	6	12	32	6	13	6	5	3	9	34	53
1751	15	11	27	29	8	25	28	24	4	22	54	10	3	17	37	40
1752	3	20	16	6	8	14	44	16	3	2	42	15	3	25	40	27
1753	22	17	48	45	9	3	6	28	2	8	19	21	5	4	23	28
1754	12	2	37	22	8	22	22	20	0	18	7	26	5	12	26	15
1755	1	11	25	59	8	11	38	12	10	27	55	31	5	20	29	2
1756	19	8	58	38	9	0	0	24	10	3	32	37	6	29	12	3
1757	8	17	47	15	8	19	16	16	8	13	20	42	7	7	14	50
1758	27	15	19	54	9	7	38	28	7	18	57	48	8	15	57	52
1759	17	0	8	31	8	26	54	20	5	28	45	54	8	24	0	39
1760	5	8	57	8	8	16	10	12	4	8	34	0	9	2	3	26
1761	24	6	29	47	9	4	32	24	3	14	11	6	10	10	46	27
1762	13	15	18	24	8	23	48	16	1	23	59	11	10	18	49	14
1763	3	0	7	1	8	13	4	8	0	3	47	16	10	26	52	1
1764	20	21	39	40	9	1	26	20	11	9	24	21	0	5	35	2
1765	10	6	28	17	8	20	42	13	9	19	12	26	0	13	37	49
1766	29	4	0	56	9	9	4	20	8	24	49	32	1	22	20	51
1767	18	12	49	33	8	28	20	17	7	4	37	37	2	0	23	38
1768	6	21	38	10	8	17	36	9	5	14	25	42	2	8	26	25
1769	25	19	10	40	9	5	58	21	4	20	2	48	3	17	9	27
1770	15	3	59	26	8	25	14	13	2	29	50	53	3	25	12	14
1771	4	12	48	2	8	14	30	5	1	9	38	58	4	3	15	1
1772	22	10	20	43	9	2	52	17	0	15	16	4	5	11	58	3
1773	11	19	9	19	8	22	8	9	10	25	4	9	5	20	0	50
1774	1	3	57	55	8	11	24	1	9	4	52	14	5	28	3	37
1775	20	1	30	35	8	29	46	13	8	10	29	20	7	6	46	38
1776	8	10	19	12	8	19	2	5	6	20	17	25	7	14	49	25
1777	27	7	51	51	9	7	24	17	5	25	54	31	8	23	32	26
1778	16	16	40	28	8	26	40	9	4	5	42	36	9	1	35	13
1779	6	1	29	4	8	15	56	1	2	15	30	41	9	9	38	0
1780	23	23	1	44	8	4	18	13	1	21	7	47	10	18	21	1
1781	13	7	50	21	8	23	34	5	0	0	55	52	10	26	23	48
1782	2	16	38	57	8	12	49	58	10	10	43	57	11	4	26	35
1783	21	14	11	37	9	1	12	10	9	16	21	3	0	13	9	36
1784	9	23	0	13	8	20	28	3	7	26	9	8	0	21	12	23
1785	28	20	32	53	9	8	50	15	7	1	46	14	1	29	55	25
1786	18	5	21	30	8	28	6	7	5	11	34	19	2	7	58	12
1787	7	14	10	6	8	17	21	59	3	21	22	24	2	16	0	59
1788	25	11	42	46	9	5	44	11	2	26	59	30	3	24	44	1
1789	14	20	31	23	8	25	0	3	1	6	47	35	4	2	46	48
1790	4	5	19	59	8	14	15	55	11	16	35	40	4	10	49	35
1791	23	2	52	39	9	2	38	7	10	22	12	46	5	19	32	37
1792	11	11	41	15	8	21	53	59	9	2	0	52	5	27	35	24
1793	30	9	13	55	9	10	16	11	8	7	37	58	7	6	18	26
1794	19	18	2	32	8	29	32	3	6	17	26	4	7	14	21	13
1795	9	2	51	8	8	18	47	55	4	27	14	9	7	22	24	0
1796	27	0	23	48	9	7	10	7	4	2	51	14	9	1	7	1
1797	16	9	12	24	8	26	25	59	2	12	39	19	9	9	9	48
1798	5	18	1	1	8	15	41	51	0	22	27	25	9	17	12	35
1799	24	15	33	41	9	4	4	3	11	28	4	31	10	25	55	37
1800	13	0	22	17	8	23	19	55	10	7	52	36	11	3	58	24

TABLE II. *Mean New Moon, &c.* in March, *New Style, from* A. D. 1790 *to* A. D. 1840.

Y. of Chr.	Mean N. Moon in March.				Sun's mean Anomaly.				Moon's mean Anomaly.				Sun's mean Dif. from the Node.			
	D.	H.	M.	S.	s	°	′	″	s	°	′	″	s	°	′	″
1790	15	5	19	59	8	14	15	55	11	16	35	40	4	10	49	35
1791	4	14	8	35	8	3	31	47	9	26	23	45	4	18	52	22
1792	22	11	41	15	8	21	53	59	9	2	0	52	5	27	35	24
1793	11	20	29	51	8	11	9	51	7	11	48	57	6	5	38	11
1794	30	18	2	32	8	29	32	3	6	17	26	4	7	14	21	13
1795	20	2	51	8	8	18	47	55	4	27	14	9	7	22	24	0
1796	8	11	39	44	8	8	3	47	3	7	2	14	8	0	26	47
1797	27	9	12	24	8	26	25	59	2	12	39	19	9	9	9	48
1798	16	18	1	1	8	15	41	51	0	22	27	25	9	17	12	35
1799	6	2	49	37	8	4	57	43	11	2	15	30	9	25	15	22
1800	25	0	22	17	8	23	19	55	10	7	52	36	11	3	58	24
1801	14	9	10	54	8	12	35	47	8	17	40	41	11	12	1	9
1802	3	17	59	29	8	1	51	39	6	27	28	46	11	20	3	56
1803	22	15	32	10	8	20	13	52	6	3	5	51	0	28	46	57
1804	11	0	20	46	8	9	29	44	4	12	53	56	1	6	49	45
1805	29	21	53	26	8	27	51	56	3	18	31	2	2	15	32	46
1806	19	6	42	2	8	17	7	48	1	28	19	7	2	23	35	33
1807	8	15	30	39	8	6	23	40	0	8	7	12	3	8	38	21
1808	26	13	3	19	8	24	45	52	11	13	44	18	4	10	21	22
1809	15	21	51	55	8	14	1	44	9	23	32	23	4	18	24	9
1810	5	6	40	32	8	3	17	36	8	3	20	28	4	26	26	56
1811	24	4	13	12	8	21	39	48	7	8	57	34	6	5	9	58
1812	12	13	1	48	8	10	55	40	5	18	45	39	6	13	12	45
1813	1	21	50	24	8	0	11	32	3	28	33	44	6	21	15	32
1814	20	19	23	5	8	18	33	44	3	4	10	50	7	29	58	33
1815	10	4	11	41	8	7	49	36	1	13	58	55	8	8	1	20
1816	28	1	44	21	8	26	11	48	0	19	36	1	9	16	44	21
1817	17	10	32	57	8	15	27	40	10	29	24	6	9	24	47	8
1818	6	19	21	33	8	4	43	32	9	9	12	11	10	2	49	55
1819	25	16	54	14	8	23	5	44	8	14	49	17	11	11	32	55
1820	14	21	42	50	8	12	21	37	6	24	37	22	11	19	35	43
1821	3	10	31	26	8	1	37	29	5	4	25	27	11	27	38	30
1822	22	8	4	6	8	19	59	42	4	10	2	33	1	6	21	31
1823	11	16	52	43	8	9	15	34	2	19	50	38	1	14	24	18
1824	29	14	25	23	8	27	37	46	1	25	27	44	2	23	7	20
1825	18	23	13	59	8	16	53	38	0	5	15	49	3	1	10	7
1826	8	8	2	35	8	6	9	30	10	15	3	54	3	9	12	54
1827	27	5	35	16	8	24	31	42	9	20	41	0	4	17	55	56
1828	15	14	23	52	8	13	47	34	8	0	29	5	4	25	58	43
1829	4	23	12	28	8	3	3	26	6	10	17	10	5	4	1	30
1830	23	20	45	8	8	21	25	38	5	15	54	17	6	12	44	32
1831	13	5	33	44	8	10	41	30	3	25	42	22	6	20	47	19
1832	31	3	6	25	8	29	3	42	3	1	19	29	7	29	30	21
1833	20	11	55	1	8	18	19	34	1	11	7	34	8	7	33	8
1834	9	20	43	37	8	7	35	26	11	20	55	39	8	15	35	55
1835	28	18	16	17	8	25	57	38	10	26	32	44	9	24	18	56
1836	17	3	4	54	8	15	13	30	9	6	20	50	10	2	21	43
1837	6	11	53	30	8	4	29	22	7	16	8	55	10	10	24	30
1838	25	9	26	10	8	22	51	34	6	21	46	1	11	19	7	32
1839	14	18	14	46	8	12	7	26	5	1	34	6	11	27	10	18
1840	3	3	3	22	8	1	23	18	3	11	22	11	0	5	13	5

TABLE III. *Mean Anomalies, and Sun's mean Diſtance from the Node for* 13½ *mean Lunations.*

N	Mean Lunations.				Sun's mean Anomaly.				Moon's mean Anomaly.				Sun's mean Dif from the Node.			
	D.	H.	M.	S.	s	°	′	″	s	°	′	″	s	°	′	″
1	29	12	44	3	0	29	6	19	0	25	49	0	1	0	40	14
2	59	1	28	6	1	28	12	39	1	21	38	1	2	1	20	28
3	88	14	12	9	2	27	18	58	2	17	27	1	3	2	0	42
4	118	2	56	12	3	26	25	17	3	13	16	2	4	2	40	56
5	147	15	40	15	4	25	31	37	4	9	5	2	5	3	21	10
6	177	4	24	18	5	24	37	56	5	4	54	3	6	4	1	24
7	206	17	8	21	6	23	44	15	6	0	43	3	7	4	41	38
8	236	5	52	24	7	22	50	35	6	26	32	3	8	5	21	52
9	265	18	36	27	8	21	56	54	7	22	21	4	9	6	2	6
10	295	7	20	30	9	21	3	14	8	18	10	4	10	6	42	20
11	324	20	4	33	10	20	9	33	9	13	59	5	11	7	22	34
12	354	8	48	36	11	19	15	52	10	9	48	5	0	8	2	47
13	383	21	32	40	0	18	22	12	11	5	37	6	1	8	43	1
½	14	18	22	2	0	14	33	10	6	12	54	30	0	15	20	7

TABLE IV. *The Days of the Year, reckoned from the beginning of* March.

Days.	March.	April.	May.	June.	July.	Auguſt.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
1	1	32	62	93	123	154	185	215	246	276	307	338
2	2	33	63	94	124	155	186	216	247	277	308	339
3	3	34	64	95	125	156	187	217	248	278	309	340
4	4	35	65	96	126	157	188	218	249	279	310	341
5	5	36	66	97	127	158	189	219	250	280	311	342
6	6	37	67	98	128	159	190	220	251	281	312	343
7	7	38	68	99	129	160	191	221	252	282	313	344
8	8	39	69	100	130	161	192	222	253	283	314	345
9	9	40	70	101	131	162	193	223	254	284	315	346
10	10	41	71	102	132	163	194	224	255	285	316	347
11	11	42	72	103	133	164	195	225	256	286	317	348
12	12	43	73	104	134	165	196	226	257	287	318	349
13	13	44	74	105	135	166	197	227	258	288	319	350
14	14	45	75	106	136	167	198	228	259	289	320	351
15	15	46	76	107	137	168	199	229	260	290	321	352
16	16	47	77	108	138	169	200	230	261	291	322	353
17	17	48	78	109	139	170	201	231	262	292	323	354
18	18	49	79	110	140	171	202	232	263	293	324	355
19	19	50	80	111	141	172	203	233	264	294	325	356
20	20	51	81	112	142	173	204	234	265	295	326	357
21	21	52	82	113	143	174	205	235	266	296	327	358
22	22	53	83	114	144	175	206	236	267	297	328	359
23	23	54	84	115	145	176	207	237	268	298	329	360
24	24	55	85	116	146	177	208	238	269	299	330	361
25	25	56	86	117	147	178	209	239	270	300	331	362
26	26	57	87	118	148	179	210	240	271	301	332	363
27	27	58	88	119	149	180	211	241	272	302	333	364
28	28	59	89	120	150	181	212	242	273	303	334	365
29	29	60	90	121	151	182	213	243	274	304	335	366
30	30	61	91	122	152	183	214	244	275	305	336	
31	31		92		153	184		245		306	337	

Fig. 203

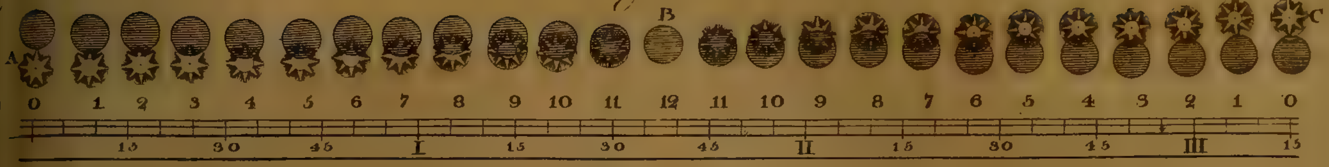
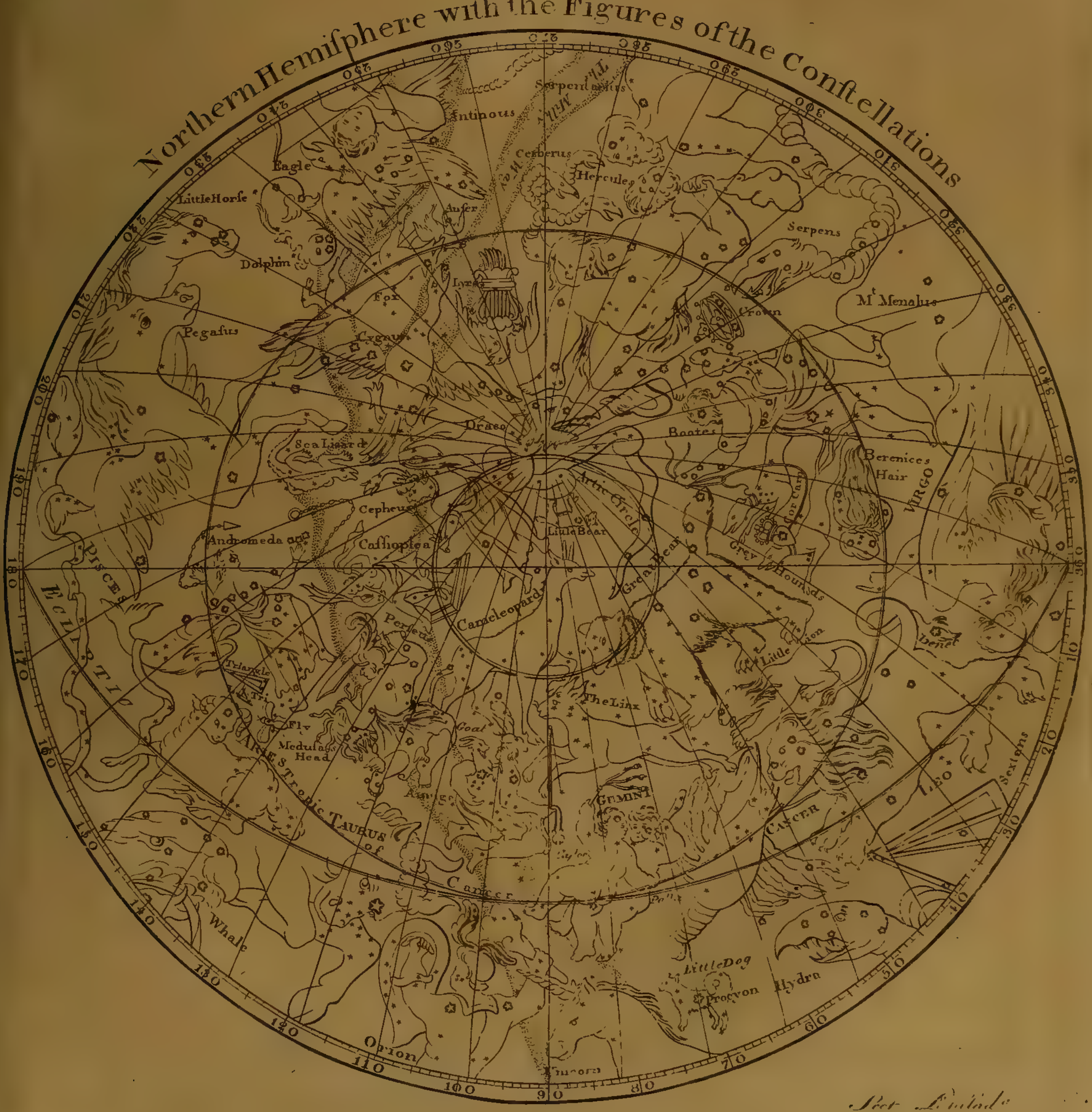


Fig. 204



Scot Lizars

TABLE V. *Mean Lunations from* 1 *to* 100000.

Lunat.	Days. Decimal Parts.	Days.	Hou.	M.	S.	Th.	Fo.
1	29.530590851080 =	29	12	44	3	2	58
2	59.061181702160	59	1	28	6	5	57
3	88.591772553240	88	14	12	9	8	55
4	118.122363404320	118	2	56	12	11	53
5	147.652954255401	147	15	40	15	14	52
6	177.183545106481	177	4	24	18	17	50
7	206.714135957561	206	17	8	21	20	48
8	236.244726808641	236	5	52	24	23	47
9	265.775317659722	265	18	36	27	26	45
10	295.305908510800	295	7	20	30	29	43
20	590.611817021600	590	14	41	0	59	26
30	885.917725532400	885	22	1	31	29	10
40	1181.223634043200	1181	5	22	1	58	53
50	1476.529542554010	1476	12	42	32	28	36
60	1771.835451064810	1771	20	3	2	58	19
70	2067.141359575610	2067	3	23	33	28	2
80	2362.447268086410	2362	10	44	3	57	46
90	2657.753176597220	2657	18	4	34	27	29
100	2953.059085108000	2953	1	25	4	57	12
200	5906.118170216000	5906	2	50	9	54	24
300	8859.177255324000	8859	4	15	14	51	36
400	11812.236340432000	11812	5	40	19	48	48
500	14765.295425540100	14765	7	5	24	46	0
600	17718.354510648100	17718	8	30	29	43	12
700	20671.413595756100	20671	9	55	34	40	24
800	23624.472680864100	23624	11	20	39	37	36
900	26577.531765972200	26577	12	45	44	34	48
1000	29530.590851080	29530	14	10	49	32	0
2000	59061.181702160	59061	4	21	39	4	0
3000	88591.772553240	88591	18	32	28	36	0
4000	118122.363404320	118122	8	43	18	8	0
5000	147652.954255401	147652	22	54	7	40	0
6000	177183.545106481	177183	13	4	57	12	0
7000	206714.135957561	206714	3	15	46	44	0
8000	236244.726808641	236244	17	26	36	16	0
9000	265775.317659722	265775	7	37	25	48	0
10000	295305.90851080	295305	21	48	15	20	0
20000	590611.81702160	590611	19	36	30	40	0
30000	885917.72553240	885917	17	24	46	0	0
40000	1181223.63404320	1181223	15	13	1	20	0
50000	1476529.54255401	1476529	13	1	16	40	0
60000	1771835.45106481	1771835	10	49	32	0	0
70000	2067141.35957561	2067141	8	37	47	20	6
80000	2362447.26808641	2362447	6	25	2	40	0
90000	2657753.17659722	2657753	4	14	18	0	0
100000	2953059.0851080	2953059	2	2	33	20	0

TABLE VI. *The first mean New Moon, with the mean Anomalies of the Sun and Moon, and the Sun's mean Distance from the Ascending Node, next after complete Centuries of Julian years.*

Lunations	Julian Years.	First New Moon.				Sun's Mean Anomaly.			M.'s mean Anomaly.			Sun from Node.		
		D.	H.	M.	S.	s	o	′	s	o	′	s	o	′
1237	100	4	8	10	52	0	3	21	8	15	22	4	19	27
2474	200	8	16	21	44	0	6	42	5	0	44	9	8	55
3711	300	13	0	32	37	0	10	3	1	16	6	1	28	22
4948	400	17	8	43	29	0	13	24	10	1	28	6	17	49
6185	500	21	16	54	21	0	16	46	6	16	50	11	7	16
7422	600	26	1	5	14	0	20	7	3	2	12	3	26	44
8658	700	0	20	32	3	11	24	22	10	21	45	7	15	31
9895	800	5	4	42	55	11	27	43	7	7	7	0	4	58

Lunations.	Julian Years.	First New Moon.				Sun's mean Anomaly.				M's mean Anomaly.				Suu from Node.			
		D.	H.	M.	S.	s	o	′	″	s	o	′	″	s	o	′	″
11132	900	9	12	53	47	0	1	4		3	22	29		4	24	25	
12369	1000	13	21	4	40	0	4	25		0	7	51		9	13	53	
13606	1100	18	5	15	32	0	7	46		8	23	13		2	3	20	
14843	1200	22	13	26	24	0	11	7		5	8	35		6	22	47	
16080	1300	26	11	37	16	0	14	28		1	23	57		11	12	15	
17316	1400	1	17	4	6	11	18	43		9	13	30		3	1	2	
18553	1500	6	1	14	58	11	22	4		5	28	52		7	20	29	
19790	1600	10	9	25	50	11	25	25		2	14	14		0	9	56	
21027	1700	14	17	36	42	11	28	46		10	29	36		4	29	23	
22264	1800	19	1	47	35	0	2	8		7	14	58		9	18	51	
23501	1900	23	[illegible]	58	27	0	5	29		4	0	20		2	8	18	
24738	2000	27	18	9	19	0	8	50		0	15	42		6	27	45	
25974	2100	2	13	36	8	11	13	5		8	5	15		10	16	32	
27211	2200	6	21	47	1	11	16	26		4	20	37		3	6	0	
28448	2300	11	5	57	53	11	19	47		1	5	59		7	25	27	
29685	2400	15	14	8	45	11	23	8		9	21	21		0	14	54	
30922	2500	19	22	19	38	11	26	29		6	6	43		5	4	22	
32159	2600	24	6	30	30	11	29	50		2	22	4		9	23	49	
33396	2700	28	14	41	22	0	3	11		11	7	26		2	13	16	
34632	2800	3	10	8	11	11	7	26		6	26	59		6	2	3	
35869	2900	7	18	19	3	11	10	47		3	12	21		10	21	30	
37106	3000	12	2	29	56	11	14	8		11	27	43		3	10	58	
38343	3100	16	10	40	48	11	17	30		8	13	5		8	0	25	
39580	3200	20	18	51	40	11	20	51		4	28	27		0	19	52	
40817	3300	25	3	2	33	11	24	12		1	13	49		5	9	20	
42054	3400	29	11	13	25	11	27	33		9	29	11		9	28	47	
43290	3500	4	6	40	14	11	1	48		5	18	44		1	17	34	
44527	3600	8	14	51	6	11	5	9		2	4	6		6	7	1	
45764	3700	12	23	1	59	11	8	30		10	19	28		10	26	29	
47001	3800	17	7	12	51	11	11	51		7	4	50		3	15	56	
48238	3900	21	15	23	43	11	15	12		3	20	12		8	5	23	
49475	4000	25	23	34	35	11	18	33		0	5	34		0	24	50	
50711	4100	0	19	1	25	10	22	48		7	25	7		4	13	37	
51948	4200	5	3	12	17	10	26	9		4	10	29		9	3	5	
53185	4300	9	11	23	9	10	29	31		0	25	51		1	22	32	
54422	4400	13	19	34	1	11	2	52		9	11	13		6	11	59	
55659	4500	18	3	44	54	11	6	13		5	26	35		11	1	27	
56896	4600	22	11	55	46	11	9	34		2	11	57		3	20	54	
58133	4700	26	20	6	38	11	12	55		10	27	19		8	10	21	
59369	4800	1	15	33	27	10	17	9		6	16	52		11	29	8	
60606	4900	5	23	44	20	10	20	31		3	2	14		4	18	36	
61843	5000	10	7	55	12	10	23	52		11	17	36		9	8	3	
63080	5100	14	16	6	4	10	27	13		8	2	58		1	27	30	
64317	5200	19	0	16	56	11	0	34		4	18	20		6	16	57	
65554	5300	23	8	27	49	11	3	55		1	3	42		11	6	25	
65791	5400	27	16	38	41	11	7	16		9	19	4		2	25	52	
68028	5500	[illegible]	12	5	30	10	11	31		5	8	37		7	14	39	
69265	5600	6	20	16	22	10	14	52		1	23	59		0	4	6	
70502	5700	11	4	27	15	10	18	14		10	9	21		4	23	34	
71739	5800	15	12	38	7	10	21	35		6	24	43		9	13	1	
72976	5900	19	20	48	59	10	24	56		3	10	5		2	2	28	
74212	6000	24	4	59	52	10	28	17		11	25	27		6	21	56	

TABLE VII. *The annual, or firſt Equation of the mean to the true Syzygy.*

Argument. Sun's mean Anomaly.

Subtract.

Degrees	0 Signs	1 Sign	2 Signs	3 Signs	4 Signs	5 Signs	Degrees
	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	
0	0 0 0	2 3 12	3 35 0	4 10 53	3 39 30	2 7 45	30
1	0 4 18	2 6 55	3 37 10	4 10 57	3 37 19	2 3 55	29
2	0 8 35	2 10 36	3 39 18	4 10 55	3 35 6	2 0 1	28
3	0 12 51	2 14 15	3 41 23	4 10 49	3 32 50	1 56 5	27
4	0 17 8	2 17 52	3 43 26	4 10 39	3 30 30	1 52 6	26
5	0 21 24	2 21 27	3 45 25	4 10 24	3 28 5	1 48 4	25
6	0 25 39	2 25 9	3 47 19	4 10 4	3 25 35	1 41 1	24
7	0 28 55	2 28 29	3 49 7	4 9 39	3 23 0	1 39 56	23
8	0 34 11	2 31 57	3 50 50	4 9 10	3 20 20	1 35 49	22
9	0 38 26	2 35 22	3 52 29	4 8 37	3 17 35	1 31 41	21
10	0 42 39	2 38 44	3 54 4	4 7 59	3 14 49	1 27 31	20
11	0 46 52	2 42 3	3 55 35	4 7 16	3 11 59	1 23 19	19
12	0 51 4	2 45 18	3 57 2	4 6 29	3 9 6	1 19 5	18
13	0 55 17	2 48 30	3 58 27	4 5 37	3 6 10	1 14 49	17
14	0 59 27	2 51 40	3 59 49	4 4 41	3 3 10	1 10 32	16
15	1 3 36	2 54 48	3 1 7	4 3 40	3 0 7	1 6 15	15
16	1 7 45	2 57 53	4 2 18	4 2 35	2 57 0	1 1 56	14
17	1 11 53	3 0 54	4 3 23	4 1 26	2 53 49	0 57 36	13
18	1 16 0	3 3 51	4 4 22	4 0 12	2 50 36	0 53 15	12
19	1 20 6	3 6 45	4 5 18	3 58 52	2 47 18	0 48 52	11
20	1 24 10	3 9 36	4 6 10	3 57 27	2 43 57	0 44 28	10
21	1 28 12	3 12 24	4 6 58	3 55 59	2 40 33	0 40 2	9
22	1 32 12	3 15 9	4 7 41	3 54 26	2 37 6	0 35 36	8
23	1 36 10	3 17 51	4 8 21	3 52 49	2 33 35	0 31 10	7
24	1 40 6	3 20 30	4 8 57	3 51 9	2 30 2	0 26 44	6
25	1 44 1	3 23 5	4 9 29	3 49 26	2 26 26	0 22 17	5
26	1 47 54	3 25 36	4 9 55	3 47 38	2 22 47	0 17 50	4
27	1 51 46	3 28 3	4 10 16	3 45 44	2 19 5	0 13 23	3
28	1 55 37	3 30 26	4 10 33	3 43 45	2 15 20	0 8 56	2
29	1 59 26	3 32 45	4 10 45	3 41 40	2 11 35	0 4 29	1
30	2 3 12	3 35 0	4 10 53	3 39 30	2 7 45	0 0 0	0
Deg.	11 Signs	10 Signs	9 Signs	8 Signs	7 Signs	6 Signs	Deg.

Add

TABLE VIII. *Equation of the Moon's mean Anomaly.*

Argument. Sun's mean Anomaly.

Subtract.

Degrees	0 Signs	1 Sign	2 Signs	3 Signs	4 Signs	5 Signs	Degrees
	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	
0	0 0 0	0 46 45	1 21 32	1 35 1	1 23 4	0 48 19	30
1	0 1 37	0 48 10	1 22 21	1 35 2	1 22 14	0 46 51	29
2	0 3 13	0 49 34	1 23 10	1 35 1	1 21 24	0 45 23	28
3	0 4 52	0 50 53	1 23 57	1 35 0	1 20 32	0 43 54	27
4	0 6 28	0 52 19	1 24 41	1 34 57	1 19 38	0 42 24	26
5	0 8 6	0 53 40	1 25 24	1 34 50	1 18 42	0 40 53	25
6	0 9 42	0 55 0	1 26 6	1 34 43	1 17 45	0 39 21	24
7	0 11 20	0 56 21	1 26 48	1 34 33	1 16 48	0 37 49	23
8	0 12 56	0 57 38	1 27 28	1 34 22	1 15 47	0 36 15	22
9	0 14 33	0 58 56	1 28 6	1 34 9	1 14 44	0 34 40	21
10	0 16 10	1 0 13	1 28 43	1 33 53	1 13 41	0 33 5	20
11	0 17 47	1 1 29	1 29 17	1 33 37	1 12 37	0 31 31	19
12	0 19 23	1 2 43	1 29 51	1 33 20	1 11 33	0 29 54	18
13	0 20 59	1 3 56	1 30 22	1 33 0	1 10 26	0 28 18	17
14	0 22 35	1 5 8	1 30 50	1 32 38	1 9 17	0 26 40	16
15	0 24 10	1 6 18	1 31 19	1 32 14	1 8 8	0 25 3	15
16	0 25 45	1 7 27	1 31 45	1 31 50	1 6 58	0 23 23	14
17	0 27 19	1 8 36	1 32 12	1 31 23	1 5 46	0 21 45	13
18	0 28 52	1 9 42	1 32 34	1 30 55	1 4 32	0 20 7	12
19	0 30 25	1 10 49	1 32 57	1 30 25	1 3 19	0 18 28	11
20	0 31 57	1 11 54	1 33 17	1 29 54	1 2 1	0 16 48	10
21	0 33 29	1 12 58	1 33 36	1 29 20	1 0 45	0 15 8	9
22	0 35 2	1 14 1	1 33 52	1 28 45	0 59 26	0 13 28	8
23	0 36 32	1 15 1	1 34 6	1 28 9	0 58 7	0 11 48	7
24	0 38 1	1 16 0	1 34 18	1 27 30	0 56 45	0 10 7	6
25	0 39 29	1 16 59	1 34 30	1 26 50	0 55 23	0 8 20	5
26	0 40 59	1 17 57	1 34 40	1 26 27	0 54 1	0 6 44	4
27	0 42 26	1 18 52	1 34 48	1 25 5	0 52 37	0 5 3	3
28	0 43 54	1 19 47	1 34 54	1 24 39	0 51 12	0 3 21	[illegible]
29	0 45 19	1 20 40	1 34 58	1 23 52	0 49 45	0 1 40	1
30	0 46 45	1 21 32	1 35 1	1 23 4	0 48 19	0 0 0	0
Deg.	11 Signs	10 Signs	9 Signs	8 Signs	7 Signs	6 Signs	Deg.

TAB. IX. *The ſecond Equation of the mean to the true Sizygy.*

Argument. Moon's equated Anomaly.

Add

Degrees	0 Signs	1 Sign	2 Sign	3 Signs	4 Signs	5 Signs	Degrees
	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	
0	0 0 0	5 12 48	8 47 8	9 46 44	8 8 59	4 34 33	30
1	0 10 58	5 21 56	8 51 45	9 45 3	8 3 12	4 26 1	29
2	0 21 56	5 30 57	8 56 10	9 45 12	7 57 23	4 17 25	28
3	0 32 54	5 39 51	9 0 25	9 44 11	7 51 33	4 8 47	27
4	0 43 52	5 48 37	9 4 31	9 42 59	7 45 46	4 0 7	26
5	0 54 50	5 57 17	9 8 25	9 41 36	7 39 46	3 51 23	25
6	1 5 48	6 5 51	9 12 9	9 40 3	7 33 36	3 42 32	24
7	1 16 46	6 14 19	9 15 43	9 38 19	7 27 22	3 33 38	23
8	1 27 44	6 22 41	9 19 5	9 36 24	7 21 2	3 24 42	22
9	1 38 40	6 30 57	9 22 14	9 34 18	7 14 30	3 15 44	21
10	1 49 33	6 39 4	9 25 12	9 32 1	7 7 50	3 6 45	20
11	2 0 23	6 47 0	9 27 54	9 29 33	7 1 2	2 57 43	19
12	2 11 10	6 54 46	9 30 32	9 26 54	6 54 8	2 48 39	18
13	2 21 54	7 2 24	9 32 58	9 24 4	6 47 9	2 39 34	17
14	2 32 34	7 9 52	9 35 12	9 21 3	6 40 6	2 30 28	16
15	2 43 9	7 17 9	9 37 14	9 17 51	6 32 56	2 21 19	15

TABLE IX. *Concluded.*

Degrees	[illegible] Signs H. M. S.	1 Sign H. M. S.	2 Signs H. M. S.	3 Signs H. M. S.	4 Signs H. M. S.	5 Signs H. M. S.	Degrees
0	0 0 0	5 12 48	8 47 8	9 46 44	8 8 59	4 34 33	30
16	2 53 38	7 24 19	9 39 8	9 14 28	6 25 40	2 12 8	14
17	3 4 3	7 31 18	9 40 51	9 10 54	6 18 18	2 2 53	13
18	3 14 24	7 38 9	9 42 21	9 7 9	6 10 49	1 53 36	12
19	3 24 42	7 44 51	9 43 42	9 3 13	6 3 16	1 44 16	11
20	3 34 58	7 51 24	9 44 53	8 59 6	5 55 38	1 34 54	10
21	3 45 11	7 57 45	9 45 52	8 54 50	5 47 54	1 25 31	9
22	3 55 21	8 3 56	9 46 38	8 50 24	5 40 4	1 16 7	8
23	4 5 26	8 9 57	9 47 13	8 45 48	5 32 9	1 6 41	7
24	4 15 26	8 15 46	9 47 36	8 41 2	5 24 9	0 57 13	6
25	4 25 20	8 21 24	9 47 49	8 36 6	5 16 5	0 47 44	5
26	4 35 6	8 26 53	9 47 54	8 31 0	5 7 56	0 38 13	4
27	4 44 42	8 32 11	9 47 46	8 25 44	4 59 42	0 28 41	3
28	4 54 11	8 37 19	9 47 33	8 20 18	4 51 15	0 19 8	2
29	5 3 33	8 42 18	9 47 14	8 14 33	4 43 2	0 9 34	1
30	5 12 48	8 47 8	9 46 44	8 8 59	4 34 33	0 0 0	0
Deg.	11 Signs	10 Signs	9 Signs	8 Signs	7 Signs	6 Signs	Deg.

TAB. X. *The third equation of the mean to the true Syzygy.*

Argument. Sun's Anomaly.—Moon's Anomaly.

Degrees	Signs 0 Sub. 6 Add M.	 S.	Signs 1 Sub. 7 Add M.	 S.	Signs 2 Sub. 8 Add M.	 S.	Degrees
0	0	0	2	22	4	12	30
1	0	5	2	26	4	15	29
2	0	10	2	30	4	18	28
3	0	15	2	34	4	21	27
4	0	20	2	38	4	24	26
5	0	25	2	42	4	27	25
6	0	30	2	46	4	30	24
7	0	35	2	50	4	32	23
8	0	40	2	54	4	34	22
9	0	45	2	58	4	36	21
10	0	50	3	2	4	38	20
11	0	55	3	6	4	40	19
12	1	0	3	10	4	42	18
13	1	5	3	14	4	44	17
14	1	10	3	18	4	46	16
15	1	15	3	22	4	48	15
16	1	20	3	26	4	50	14
17	1	25	3	30	4	51	13
18	1	30	3	34	4	52	12
19	1	35	3	38	4	53	11
20	1	40	3	42	4	54	10
21	1	45	3	45	4	55	9
22	1	49	3	48	4	56	8
23	1	52	3	51	4	57	7
24	1	56	3	54	4	57	6
25	2	0	3	57	4	57	5
26	2	4	4	0	4	58	4
27	2	9	4	3	4	58	3
28	2	13	4	6	4	58	2
29	2	18	4	9	4	58	1
30	2	22	4	12	4	58	0
Degrees	Signs 5 Sub. 11 Add		Signs 4 Sub 10 Add		Signs 3 Sub. 9 Add		Degrees

TAB. XI. *The fourth equation of the mean to the true Syzygy.*

Argument Sun's mean diſtance from the Node.

Add

Degrees	0 } 6 } Sig. M.	 S.	1 } 7 } Sig. M.	 S.	2 } 8 } Sig. M.	 S.	Degrees
0	0	0	1	22	1	22	30
1	0	4	1	23	1	21	29
2	0	7	1	24	1	20	28
3	0	10	1	25	1	18	27
4	0	13	1	26	1	16	26
5	0	16	1	27	1	14	25
6	0	20	1	28	1	12	24
7	0	23	1	29	1	10	23
8	0	26	1	30	1	8	22
9	0	29	1	31	1	6	21
10	0	32	1	32	1	3	20
11	0	35	1	33	1	0	19
12	0	38	1	33	0	57	18
13	0	41	1	34	0	54	17
14	0	44	1	34	0	51	16
15	0	47	1	34	0	49	15
16	0	50	1	34	0	45	14
17	0	52	1	34	0	41	13
18	0	54	1	34	0	37	12
19	0	57	1	33	0	34	11
20	1	0	1	33	0	31	10
21	1	2	1	32	0	28	9
22	1	5	1	31	0	25	8
23	1	8	1	30	0	22	7
24	1	10	1	29	0	19	6
25	1	12	1	28	0	16	5
26	1	14	1	27	0	13	4
27	1	16	1	26	0	10	3
28	1	18	1	25	0	6	2
29	1	20	1	24	0	3	1
30	1	22	1	22	0	0	0
Deg.	5 } 11 } Sig		4 } 10 } Sig		3 } 9 } Sig.		Deg.

Subtract

TABLE XII. *The Sun's mean Longitude, Motion, an d Anomaly: Old Style.*

Years beginning	Sun's mean Longitude. s	 °	 ′	 ″	Sun's mean Anomaly. s	 °	 ′
1	9	7	53	10	6	28	48
201	9	9	23	50	6	26	57
301	9	10	9	10	6	26	1
401	9	10	54	30	6	25	5
501	9	11	39	50	6	24	9
1001	9	15	26	30	6	19	32
1101	9	16	11	50	6	18	36
1201	9	16	57	10	6	17	40
1301	9	17	42	30	6	16	44
1401	9	18	27	50	6	15	49
1501	9	19	13	10	6	14	53
1601	9	19	58	30	6	13	57
1701	9	20	43	50	6	13	1
1801	9	21	29	10	6	12	6

Years complete	Sun's mean Motion. s	 °	 ′	 ″	Sun's mean Anomaly. s	 °	 ′
1	11	29	45	40	11	29	45
2	11	29	31	20	11	29	29
3	11	29	17	9	11	29	14
4	0	0	1	49	11	29	58
5	11	29	47	29	11	29	42
6	11	29	33	9	11	29	27
7	11	29	18	49	11	29	11
8	0	0	3	38	11	29	55
9	11	29	49	18	11	29	40
10	11	29	34	58	11	29	24
11	11	29	20	38	11	29	9
12	0	0	5	26	11	29	53
13	11	29	51	7	11	29	37
14	11	29	36	47	11	29	22
15	11	29	22	27	11	29	7
16	0	0	7	15	11	29	50
17	11	29	52	55	11	29	35
18	11	29	38	35	11	29	20

Years complete	Sun's mean Motion. s	 °	 ′	 ″	Sun's mean Anomaly. s	 °	 ′
19	11	29	24	16	11	29	4
20	0	0	9	4	11	29	48
40	0	0	18	8	11	29	37
60	0	0	27	12	11	29	26
80	0	0	36	16	11	29	15
100	0	0	45	20	11	29	4
200	0	1	30	40	11	28	8
300	0	2	16	0	11	27	12
400	0	3	[illegible]	20	11	26	16
500	0	3	46	40	11	25	21
600	0	4	32	0	11	24	25
700	0	5	17	20	11	23	29
800	0	6	2	40	11	22	33
900	0	6	48	0	11	21	37
1000	0	7	33	20	11	20	41
2000	0	15	6	40	11	11	22
3000	0	22	40	0	11	2	3
4000	1	0	13	20	10	22	44
5000	1	7	46	40	10	13	25
6000	1	15	20	0	10	4	6

Months	Sun's mean Motion. s	 °	 ′	 ″	Sun's mean Anomaly. s	 °	 ′
Jan.	0	0	[illegible]	0	0	0	0
Feb.	1	0	33	18	1	0	33
Mar.	1	28	9	11	1	28	9
Apr.	2	28	42	30	2	28	42
May	3	28	16	40	3	28	17
June	4	28	49	58	4	28	50
July	5	28	24	8	5	28	24
Aug.	6	28	57	26	6	28	57
Sept.	7	29	30	44	7	29	30
Oct.	8	29	4	54	8	29	4
Nov.	9	29	38	12	9	29	37
Dec.	10	29	12	22	10	29	11

Days	Sun's mean Motion and Anomaly. s	 °	 ′	 ″	H M S	Sun's mean Motion and Anomaly. ° ′ ″ ′ ″ ‴	 ″ ‴ ⁗		Sun's mean dist. from the Node. ° ′ ″ ′ ″ ‴	 ″ ‴ ⁗		H M S	Sun's mean Motion and Anomaly. ° ′ ″ ′ ″ ‴	 ″ ‴ ⁗		Sun's mean dist. from the Node. ° ′ ″ ′ ″ ‴	 ″ ‴ ⁗	
1	0	0	59	8														
2	0	1	58	17	1	0	2	28	0	2	36	31	1	16	23	1	20	30
3	0	2	57	25	2	0	4	56	0	5	12	32	1	18	51	1	23	6
4	0	3	56	33	3	0	7	24	0	7	48	33	1	21	19	1	25	42
5	0	4	55	42	4	0	9	51	0	10	23	34	1	23	47	1	28	18
6	0	5	54	50	5	0	12	19	0	12	59	35	1	26	15	1	30	54
7	0	6	53	58	6	0	14	47	0	15	35	36	1	28	42	1	33	29
8	0	7	53	7	7	0	17	15	0	18	11	37	1	31	10	1	36	5
9	0	8	52	15	8	0	19	43	0	20	47	38	1	33	38	1	38	40
10	0	9	51	23	9	0	22	11	0	23	23	39	1	36	[illegible]	1	41	16
11	0	10	50	32	10	0	24	38	0	25	58	40	1	38	34	1	43	52
12	0	11	49	40	11	0	27	6	0	28	34	41	1	41	2	1	46	28
13	0	12	48	48	12	0	29	34	0	31	10	42	1	43	30	1	49	4
14	0	13	47	57	13	0	32	2	0	33	45	43	1	45	57	1	51	39
15	0	14	47	5	14	0	34	30	0	36	21	44	1	48	25	1	54	15
16	0	15	46	13	15	0	36	58	0	38	57	45	1	50	53	1	55	51
17	0	16	45	22	16	0	39	26	0	41	33	46	1	53	21	1	59	27
18	0	17	44	30	17	0	41	53	0	44	8	37	1	55	49	2	2	3
19	0	18	43	38	18	0	44	21	0	46	44	48	1	58	17	2	4	39
20	0	19	42	47	19	0	46	49	0	49	20	49	2	0	44	2	7	13
21	0	20	41	55	20	0	49	17	0	51	56	50	2	3	12	2	9	50
22	0	21	41	3	21	0	51	45	0	54	32	51	2	5	40	2	12	25
23	0	22	40	12	22	0	54	13	0	57	8	52	2	[illegible]	8	2	15	2
24	0	23	39	20	23	0	56	40	0	59	43	53	2	10	36	2	17	38
25	0	24	38	28	24	0	59	8	1	2	19	54	2	13	4	2	20	14
26	0	25	37	37	25	1	1	36	1	4	55	55	2	15	32	2	22	50
27	0	26	36	45	26	1	4	4	1	7	31	56	2	17	59	2	25	26
28	0	27	35	53	27	1	6	32	1	10	7	57	2	20	27	2	28	2
29	0	28	35	2	28	1	9	0	1	12	43	58	2	22	55	2	30	28
30	0	29	34	10	29	1	11	28	1	15	19	59	2	25	23	2	33	14
31	1	0	33	18	30	1	13	55	1	17	45	60	2	27	51	2	35	50

In Leap-years, after February, add one day, and one day's motion.

TABLE XIII. *Equation of the Sun's centre, or the difference between his mean and true place.*

Argument. Sun's mean Anomaly.

Subtract.

Degrees	0 Signs			1 Sign			2 Signs			3 Signs			4 Signs			5 Signs			Degrees
	°	′	″	°	′	″	°	′	″	°	′	″	°	′	″	°	′	″	
0	0	0	0	0	56	47	1	39	6	1	55	37	1	41	12	0	58	33	30
1	0	1	59	0	58	30	1	40	7	1	55	39	1	40	12	0	57	7	29
2	0	3	57	1	0	12	1	41	6	1	55	38	1	39	10	0	55	19	28
3	0	5	56	1	1	53	1	42	3	1	55	36	1	38	6	0	53	30	27
4	0	7	54	1	3	33	1	42	59	1	55	31	1	37	0	0	51	40	26
5	0	9	52	1	5	12	1	43	52	1	55	24	1	35	52	0	49	49	25
6	0	11	50	1	6	50	1	44	44	1	55	15	1	34	43	0	47	57	24
7	0	13	48	1	8	27	1	45	34	1	55	3	1	33	32	0	46	5	23
8	0	15	46	1	10	2	1	46	22	1	54	50	1	32	19	0	44	11	22
9	0	17	43	1	11	36	1	47	8	1	54	35	1	31	4	0	42	16	21
10	0	19	40	1	13	9	1	47	52	1	54	17	1	29	47	0	40	21	20
11	0	21	37	1	14	41	1	48	35	1	53	57	1	28	29	0	38	25	19
12	0	23	33	1	16	11	1	49	15	1	53	36	1	27	9	0	36	28	18
13	0	25	29	1	17	40	1	49	54	1	53	12	1	25	48	0	34	30	17
14	0	27	25	1	19	8	1	50	30	1	52	46	1	24	25	0	32	32	16
15	0	29	20	1	20	34	1	51	5	1	52	18	1	23	0	0	30	33	15
16	0	31	15	1	21	59	1	51	37	1	51	48	1	21	34	0	28	33	14
17	0	33	9	1	23	22	1	52	8	1	51	15	1	20	6	0	26	33	13
18	0	35	2	1	24	44	1	52	36	1	50	40	1	18	36	0	24	32	12
19	0	36	55	1	26	5	1	53	3	1	50	5	1	17	5	0	22	32	11
20	0	38	47	1	27	24	1	53	27	1	49	26	1	15	33	0	20	30	10
21	0	40	39	1	28	41	1	53	50	1	48	46	1	13	59	0	18	28	9
22	0	42	30	1	29	57	1	54	10	1	48	3	1	12	24	0	16	26	8
23	0	44	20	1	31	11	1	54	28	1	47	19	1	10	47	0	14	24	7
24	0	46	9	1	32	25	1	54	44	1	46	32	1	9	9	0	12	21	6
25	0	47	57	1	33	35	1	54	58	1	45	44	1	7	29	0	10	18	5
26	0	49	45	1	34	45	1	55	10	1	44	53	1	5	49	0	8	14	4
27	0	51	32	1	35	53	1	55	20	1	44	1	1	4	7	0	6	11	3
28	0	53	18	1	36	59	1	55	28	1	43	7	1	2	24	0	4	7	2
29	0	55	3	1	38	3	1	55	34	1	42	10	1	0	39	0	2	4	1
30	0	56	47	1	39	6	1	55	37	1	41	12	0	58	53	0	0	0	0
Deg.	11 Signs			10 Signs			9 Signs			8 Signs			7 Signs			6 Signs			Deg.

Add

TABLE XIV. *The Sun's Declination.*

Argument. Sun's true place.

Degrees	Signs 0 N. 6 S.		Signs 1 N. 7 S.		Signs 2 N. 8 S.		Degrees
	°	′	°	′	°	′	
0	0	0	11	30	20	11	30
1	0	24	11	51	20	24	29
2	0	48	12	11	20	36	28
3	1	12	12	32	20	48	27
4	1	36	12	53	20	59	26
5	1	59	13	13	21	10	25
6	2	23	13	33	21	21	24
7	2	47	13	53	21	31	23
8	3	11	14	12	21	41	22
9	3	34	14	31	2	50	21
10	3	58	14	50	21	59	20
11	4	22	15	9	22	8	19
12	4	45	15	28	22	16	18
13	5	9	15	46	22	24	17
14	5	32	16	4	22	31	16
15	5	5	16	22	22	38	15
30	0	0	11	30	20	11	30
16	6	18	16	39	22	45	14
17	6	41	16	57	22	51	13
18	7	4	17	14	22	56	12
19	7	27	17	30	23	2	11
20	7	50	17	46	23	6	10
21	8	12	18	2	23	11	9
22	8	35	18	18	23	14	8
23	9	57	18	33	23	18	7
24	9	20	18	48	23	21	6
25	9	42	19	2	23	22	5
26	10	4	19	17	23	25	4
27	10	25	19	31	23	27	3
28	10	47	19	45	23	28	2
29	11	8	19	58	23	29	1
30	11	30	20	11	23	29	0
Degrees	Signs 11 S. 5 N.		Signs 10 S. 4 N.		Signs 9 S. 3 N.		Degrees

TABLE XV. *Equation of the Sun's mean Distance from the Node.*

Argument. Sun's mean Anomaly.

Subtract.

Deg.	0 Signs		1 Sign		2 Signs		3 Signs		4 Signs		5 Signs		Deg.
	°	′	°	′	°	′	°	′	°	′	°	′	
0	0	0	1	2	1	47	2	5	1	50	1	4	30
1	0	2	1	4	1	48	2	5	1	48	1	2	29
2	0	4	1	6	1	49	2	5	1	47	1	0	28
3	0	6	1	8	1	50	2	5	1	46	0	58	27
4	0	9	1	10	1	51	2	5	1	45	0	56	26
5	0	11	1	12	1	52	2	5	1	44	0	54	25
6	0	13	1	14	1	53	2	5	1	43	0	52	24
7	0	15	1	16	1	54	2	4	1	41	0	50	23
8	0	17	1	17	1	55	2	4	1	40	0	48	22
9	0	19	1	18	1	56	2	4	1	39	0	46	21
10	0	21	1	19	1	57	2	4	1	37	0	44	20
11	0	23	1	21	1	58	2	3	1	36	0	42	19
12	0	25	1	22	1	58	2	3	1	34	0	40	18
13	0	28	1	24	1	59	2	3	1	33	0	37	17
14	0	30	1	26	2	0	2	2	1	31	0	35	16
15	0	32	1	27	2	0	2	2	1	30	0	33	15
0	0	0	1	2	1	47	2	5	1	50	1	4	30
16	0	34	1	28	2	1	2	1	1	28	0	31	14
17	0	36	1	30	2	1	2	1	1	27	0	29	13
18	0	38	1	31	2	2	2	0	1	25	0	27	12
19	0	40	1	34	2	2	2	0	1	24	0	24	11
20	0	42	1	35	2	3	1	59	1	23	0	22	10
21	0	44	1	36	2	3	1	59	1	21	0	20	9
22	0	46	1	37	2	4	1	58	1	19	0	18	8
23	0	48	1	39	2	4	1	57	1	17	0	16	7
24	0	50	1	40	2	4	1	56	1	15	0	13	6
25	0	52	1	41	2	4	1	55	1	13	0	11	5
26	0	54	1	43	2	5	1	54	1	11	0	9	4
27	0	56	1	44	2	5	1	53	1	9	0	7	3
27	0	58	1	45	2	5	1	52	1	8	0	5	2
29	1	0	1	46	2	5	1	51	1	6	0	3	1
30	1	2	1	47	2	5	1	50	1	5	0	0	0
Deg.	11 Signs		10 Signs		9 Signs		8 Signs		7 Signs		6 Signs		Deg.

Add

TABLE XVI.

The Moon's Latitude in Eclipſes.

Arg. Moon's equated Diſtance from the Node.

0 Signs. *North Aſcend.*

6 Signs. *South Deſcend.*

°	°	′	″	°
0	0	0	0	30
1	0	5	15	29
2	0	10	30	28
3	0	15	45	27
4	0	20	59	26
5	0	26	13	25
6	0	31	26	24
7	0	36	39	23
8	0	41	51	22
9	0	47	2	21
10	0	52	13	20
11	0	57	23	19
12	1	2	31	18
13	1	7	38	17
14	1	12	44	16
15	1	17	49	15
16	1	22	52	14
17	1	27	53	13
18	1	32	52	12
19	1	37	49	11

5 Signs. *North Deſcend.*

11 Signs. *South Aſcend.*

This Table ſhows the Moon's Latitude a little beyond the utmoſt Limits of Eſclipſes.

TABLE XVII. *The Moon's horizontal Parallax, with the Semidiameters and true Horary Motions of the Sun and Moon, to every ſixth degree of their mean Anomalies, the quantities for the intermediate degrees being eaſily proportioned by ſight.*

Anomaly of Sun and Moon.		Moon's horizontal Parallax.		Sun's Semidiameter.		Moon's Semidiameter.		Moon's Horary Motion.		Sun's Horary Motion.		Anomaly of Sun and Moon.	
s	°	′	″	′	″	′	″	′	″	′	″	s	°
0	0	54	29	15	50	14	54	30	10	2	23	12	[illegible]
	6	54	31	15	50	14	55	30	12	2	23		24
	12	54	34	15	50	14	56	30	15	2	23		18
	18	54	40	15	51	14	57	30	19	2	23		12
	24	54	47	15	51	14	58	30	26	2	23		6
1	0	54	56	15	52	14	59	30	34	2	24	11	0
	6	55	6	15	53	15	1	30	44	2	24		24
	12	55	17	15	54	15	4	30	55	2	24		18
	18	55	29	15	55	15	8	31	9	2	24		12
	24	55	42	15	56	15	12	31	23	2	25		[illegible]
2	0	55	56	15	58	15	17	31	40	2	25	10	0
	6	56	12	15	59	15	22	31	56	2	26		24
	12	56	29	16	1	15	26	32	17	2	27		18
	18	56	48	16	2	15	30	32	39	2	27		12
	24	57	8	16	4	15	36	33	11	2	28		6
3	0	57	30	16	6	15	41	33	23	2	28	9	0
	6	57	52	16	8	15	46	33	47	2	29		24
	12	58	12	16	10	15	52	34	11	2	29		18
	18	58	31	16	11	15	58	34	34	2	29		12
	24	58	49	16	13	16	3	34	58	2	30		6
4	0	59	6	16	14	16	9	35	22	2	30	8	0
	6	59	21	16	15	16	14	35	45	2	31		24
	12	59	35	16	17	16	19	36	0	2	31		18
	18	59	48	16	19	16	24	36	20	2	32		12
	24	60	0	16	20	16	28	36	40	2	32		[illegible]
5	0	60	11	16	21	16	31	37	0	2	32	7	0
	6	60	21	16	21	16	32	37	10	2	33		24
	12	60	30	16	22	16	37	37	19	2	33		18
	18	60	38	16	22	16	38	37	28	2	33		12
	24	60	45	16	23	16	39	37	36	2	33		6
6	0	60	45	16	23	16	39	37	40	2	33	6	0

ASTRONOMY Plate LXXXVI

Fig. 205.

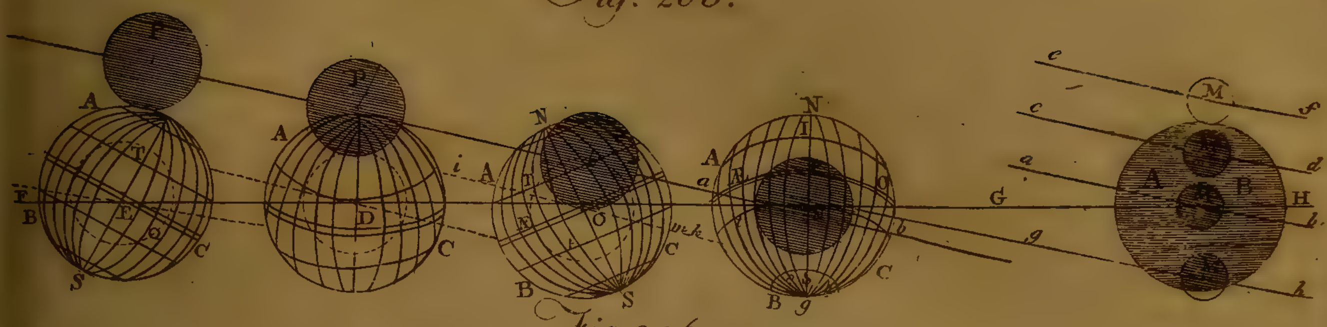
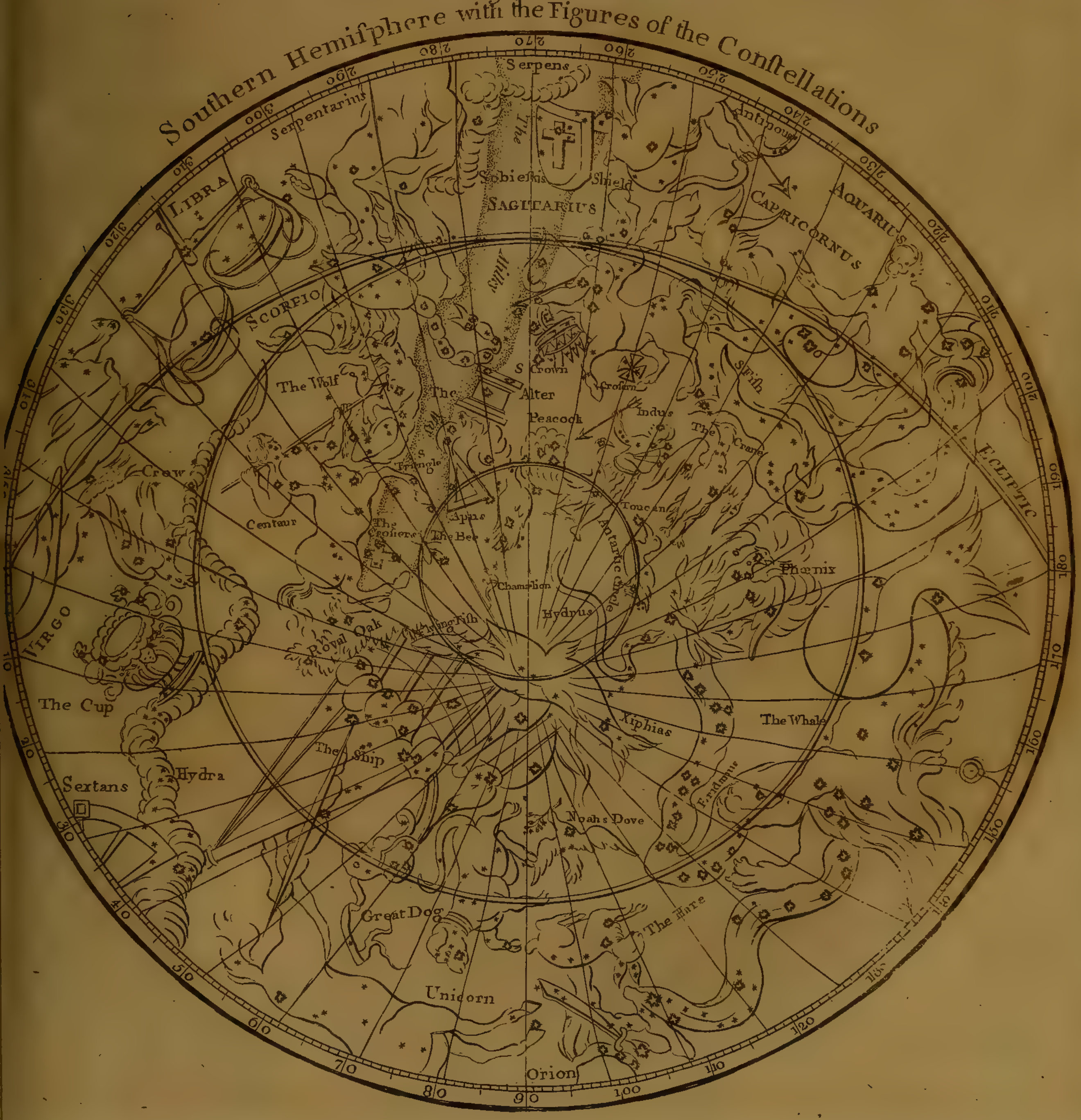


Fig. 206

Southern Hemisphere with the Figures of the Constellations



EXPLANATION AND USE OF THE SOLAR AND LUNAR TABLES.

USE *of the* TABLES *of the* EQUATION *of* TIME.

PROBLEM I.

To convert apparent time into mean time, and the contrary.

SINCE the place of the Sun's apogee does not remain fixed in the ſame point of the ecliptic, but goes forward 1′ 6″ every year, and conſequently about a degree in 55 years, the ſame equation of time will not ſerve accurately for many years continuance. To remedy this defect, we have here given two tables, one adapted to the 16th year of this century, at which time the Sun's apogee was in 8° ♋, the other to the year 1771, when the Sun's apogee was in 9° ♋. Whence the equation of time may be readily found by proportion; and that with ſufficient accuracy, not only for any intermediate year, but alſo for thoſe preceding and following, provided they are not diſtant from theſe above 60 or 100 years. The uſe of tables of this kind is ſo familiar to aſtronomers, that it ſeems unneceſſary to enter into any further explanation of theſe; we ſhall therefore only remark, that the titles of the equation or algebraic ſigns ſtanding over them are what are to be uſed for turning apparent into mean time: but the contrary are to be uſed for turning mean into apparent time.

EXAMPLE.

In the year 1756, April 30, 23ʰ. 20′. 28″, apparent time, the Sun's place was obſerved 1ˢ. 11°. 25′ 8″,6; the equation of time and the mean time are required.

With the given place of the Sun, the equation of time anſwering to the year 1716 is had = — 3′. 18″; and anſwering to the year 1771 = — 3′ 12″; and conſequently to the given year it will be = —3′ 14″; and therefore the mean time is 23ʰ. 17′. 14″.

SCHOLIUM I.

But if the equation of time be required either more accurately or for a time above 100 years diſtant from the limits of the tables, the mean longitude of the Sun muſt be found reckoned from the true equinox, and his true right aſcenſion by Prob. III. and VII. which follow hereafter, and the difference between the two is to be converted into time of the *primum mobile*. And if the right aſcenſion is greater than the mean longitude, the equation ſo found is additive to apparent time, otherwiſe ſubſtractive.

SCHOLIUM II.

I ſay that the true equation of time is to be found by converting the difference abovementioned into time of the *primum mobile*, and not into mean ſolar time. For though the learned De La Caille preſcribes the latter method in his Solar Tables, yet it is eaſy to demonſtrate that the former method is the true one.

USE *of the* CATALOGUE *of* PLACES.

PROBLEM II.

To convert the time of the given place into the time of the meridian of the tables, or the contrary.

THERE is given in a ſelect catalogue the difference in time of the meridians of 60 famous places from the meridian of the tables, marked with the ſign + or —, the firſt of which denotes the place to be weſt of Greenwich, and the latter ſhews it to be eaſt of the ſame. Theſe ſigns are to be uſed if the time of the given place is to be reduced into Greenwich time; but the contrary if Greenwich time is to be reduced into time of the given place.

EXAMPLE.

Let the time at Gottingen be given 6ʰ. 9′. 38″, the time that anſwers to it under the meridian of Greenwich is required?

	h	′	″
Since the difference in time of the meridians of Gottingen and Greenwich, by catalogue, is	0	39	32 —
Subtract it, on account of the ſign —, from the given time - - - - -	6	9	38
The remainder is the Greenwich time required	5	30	6

SCHOLIUM I.

I deduced the differences aſcribed to the cities of France and the Netherlands from the geometrical meaſure of the French mathematicians, making allowance at the ſame time for the ſpheroidical figure of the earth. The ſituation of the cities in Germany and ſome others I ſettled with particular care from eclipſes of the Sun and occultations of fixed ſtars by the Moon. The reſt I either determined from eclipſes of Jupiter's ſatellites and eclipſes of the Moon, or, where this could not be done, retained them as they are given in the *Connoiſſance des Temps*.

SCHOLIUM II.

In the ſame catalogue are inſerted the latitudes of the places, concerning the uſe of which, as well known, it is ſuperfluous to add any thing. The latitude of Gottingen, as given in the catalogue, is that of the obſervatory of this city; the latitude of Nuremberg is adjuſted to Hoffman's houſe, famous for the ſhop of geographical maps. I deduced both, but particularly that of Gottingen, from my own obſervations. Concerning that of Nuremberg, See Com. Soc. Reg. Gotting. tom. I. p. 373.

USE *and* EXPLANATION *of the* TABLES *of the* MOTION *of the* SUN.

PROBLEM III.

To find the true longitude of the Sun at any aſſigned time by the meridian of the Greenwich obſervatory.

1. FROM the table of epoches, take out the epoches of the mean longitude of the Sun, the apogee, and the numbers I, II, III, IV, for the given year; or, if that is not there to the neareſt year that is ſet down preceding the given year; underneath which place the mean motions anſwering to the number of years elapſed ſince the epoch to the given time.

2. Under theſe write down in order the mean motions for the day of the month, and for the hours, minutes, and ſeconds.

3. Add up the numbers of the ſeveral columns, rejecting 12 S. or any multiple thereof, if they ſhould occur, from the two firſt columns, and rejecting thouſands from num. I, II, III, IV, if they ariſe. And thus the mean longitude of the Sun will be obtained to the aſſigned time in the firſt column, the longitude of the Sun's apogee in the ſecond column, and in the others the numbers proper for finding the corrections ariſing from the actions of the Moon, Jupiter, and Venus.

4. Subtract the longitude of the apogee from the mean longitude of the Sun, the remainder is the mean anomaly of the Sun.

5. With this anomaly enter the table of the equation of the Sun's centre, and take out the equation of the Sun's centre with its proper ſign, and place it under the Sun's mean longitude.

6. With the numbers I, II, III, IV, enter the tables, and having found the hundreds at the top or bottom, and the tens on the ſide, take out the correction or leſſer equations, each with their proper number reſpectively, without neglecting the proportional part, and let theſe alſo be written under the Sun's mean longitude.

7. Apply theſe equations according to their titles or ſigns to the mean longitude; the reſult is the true longitude of the Sun required.

Example.

If the Sun's true longitude be required to the year 1756, April 30, 23ʰ 17′. 14″, mean time at Greenwich; the calculation performed according to the foregoing precepts will be as follows:

		Mean Long. ☉	Long. ☉'s apog.	N. I.	N. II.	N. III.	N. IV.
		s ° ′ ″	s ° ′ ″				
Epoch of year 1756		9.10.33.18,8	3. 8.44.10	973	262	605	544
Mean Mot. April 30th		3.28.16.39,7	22	64	301	206	18
23ʰ		56.40,5		32	2	2	0
17′		41,9					
14″		0,6					
		1. 9.47.21,5	3. 8.44.32	69	565	813	562
Equat. of cent.	+	1.37.54,0	Mean an. 10. 1. 2.49				
Equat. ☽ I.	+	3,4					
♃ II.	—	1,3					
♀ III.	—	0,9					
☊ IV.	—	6,8					
True long. of the Sun.		1.11.25. 9,9					

Scholium I.

The longitude thus found is computed from the true vernal equinoctial point, becauſe of the equation of the equinoxes being applied, which was taken out with number IV. But, in computing the planet's and the moon's place, it is better to make uſe of the Sun's longitude as computed from the mean equinox, till their geocentric longitude is found; in which caſe therefore that equation taken out with number IV. ſhould not be applied till then. Thus, in our example, the Sun's longitude reckoned from the mean equinox would be 1ˢ. 11°. 25′. 16″,7.

Scholium II.

When I was conſtructing theſe ſolar tables, I had in my view the tables of that learned aſtronomer Lewis de la Caille (who merits much commendation on this ſubject) publiſhed in the year 1758, and ſent me as a preſent from him. Upon examining them I found that they very nearly agreed with the many and careful obſervations made by myſelf from the year 1756 forward with an excellent mural quadrant. Wherefore it did not ſeem neceſſary for me to conſtruct ſolar tables intirely new, but only (availing myſelf of the labours of this illuſtrious aſtronomer) to correct his tables as far as my obſervations ſeemed to require. Accordingly I found the excentricity of the Sun's orbit, and conſequently the equation of the center, to require no ſenſible correction. But, as to the epoches of the mean motion, particularly thoſe of the Sun's longitude, I could not make them agree with my obſervations, till I had diminiſhed the ſaid epoch by near ſeven ſeconds. Moreover a place of the apogee ſomewhat different from his ſeemed to agree better at leaſt with my obſervations, which why I ſhould confide leſs in than thoſe of others did not appear. Laſtly, I had long before deduced from the theory of gravity the diſturbances of the apparent motion of the Sun cauſed by the Moon, Jupiter and Venus, and found them ſuch as are here repreſented, beſides ſome other ſmaller ones, which, being extremely difficult to obſerve, I thought might be conveniently neglected in calculation. As to the form of the arguments of theſe ſmall corrections, or numbers I, II, III, and IV, I have rendered it more ſimple by ſuppoſing the circle to be divided into 1000 parts.

Scholium III.

I muſt not paſs over without mentioning in this place, that all the mean motions both of the Sun and Moon in theſe tables ſuppoſe the annual motion of the fixed ſtars or of the preceſſion of the equinoxes to be exactly 50″,3, and to depend thereon ſo much, that, if it ſhould appear proper to ſtate the motion of preceſſion ſlower or quicker, the mean motions of the Sun muſt be all made ſlower or quicker by the ſame quantity: and therefore you cannot, without ſubverting the whole fabric of the tables, increaſe or diminiſh one of theſe motions and at the ſame time leave the reſt unaltered. Thus, for inſtance, if the mean motion of the Sun, which I make in 60 Julian years to be 0ˢ. 0°. 27′. 49″,8 over and above the intire revolutions, ſhould ſeem proper to be corrected ſo as to agree with the tables of the learned De la Caille, in which that motion is found leſs by 16″,4, this cannot be done except the preceſſion of the equinoxes in 60 years, inſtead of 50′. 18″ as it is in the tables, be reckoned leſs by the ſame quantity or only 50′. 1″,6; and ſo much ought the Moon's motion alſo to be corrected. To explain the matter briefly, I would have it obſerved, that the mean motions of the Sun and Moon with reſpect to the fixed ſtars are laid down truly in theſe tables, ſo that there ſcarce remains a doubt of a few ſeconds in 60 years; but whether they are alſo laid down juſtly with reſpect to the equinoctial points muſt be judged of from the motion of their preceſſion, which being 50′. 18″ in 60 years, according to the opinion of moſt modern aſtronomers, the affirmative of the queſtion cannot be doubted.

Scholium IV.

Whenever therefore any phenomenon is concerned depending on the relative ſituation of a fixed ſtar and the Sun and Moon; as for inſtance, the occulation of a fixed ſtar, the motion of preceſſion aſſumed in theſe tables muſt be made uſe of in computing the place of the ſtar. For this purpoſe that motion is added to the mean motion of the Sun, that the calculator may not be left in any uncertainty, nor have any occaſion to ſeek for it elſewhere, or loſe any time in computing it.

Scholium V.

To the ſame tables of the mean motions of the Sun, there is alſo added the motion of decreaſe of the obliquity of the ecliptic, according to the quantity deduced from the theory of gravity. Hence the mean obliquity of the ecliptic is eaſily found to any time, provided it be known for any one year. Now, from my obſervations made with great care with an excellent mural quadrant, at both ſolſtices, in the years 1756, 57, and 58, I find the mean obliquity of the ecliptic to the beginning of the year 1756 to be 23°. 28′. 16″, which therefore ſhould be made uſe of in the preſent caſe.

Problem IV.

To find the mean and true obliquity of the ecliptic to any aſſigned time.

1. From the column that lies fartheſt to the right hand, take out the decreaſe of the obliquity of the ecliptic, anſwering to the number of years intervening between the given time and the year 1756; which add to 23°. 28′. 16″, if the given time precedes 1756, but ſubſtract, if it follows the ſame, and the mean

obliquity of the ecliptic will be obtained to the beginning of the year; which is eaſily reduced to the elapſed time of the given year, by ſubſtracting one tenth of a ſecond for every three months.

2. By means of the tables of epoches and mean motions, find num. IV. with which take out the equation from the table intitled Nutation, and apply it according to its ſign to the mean obliquity juſt found, and you have the true or apparent obliquity.

EXAMPLE.

What was the true obliquity of the ecliptic in the beginning of September 1671.

Becauſe from this year to the year 1756 there are elapſed 85 years, the decreaſe of the obliquity will be found for 80 years	36″,8
For 5 years	2,3
And conſequently for 85 years	39,1

Which added to 23°. 28′. 16″,0 gives the mean obliquity of the ecliptic 23°. 28′ 55″,1, and in the month of September 23°. 28′. 54″,8.

Now num. IV. to the epoch 1660 is	386
The motion for 11 years	591
For the beginning of September	36
Therefore num. IV. to the given time, rejecting 1000, is	13

To which the correſponding correction or nutation is +9″,6, which, being added to the mean obliquity 23°. 28′. 54″,8, gives the true obliquity 23°. 29′. 4″,4.

SCHOLIUM I.

But if the mean obliquity is to be found from the true, it is evident that the nutation muſt be applied with a contrary ſign.

SCHOLIUM II.

The maximum of nutation 9″,6, according to which this table is conſtructed, exceeds a little that which is commonly aſſumed, the laws of attraction requiring ſuch increaſe, and the obſervations at the ſame time favouring it.

PROBLEM V.

To find the logarithm of the Sun's diſtance from the earth at any aſſigned time.

1. If the mean anomaly of the Sun, with the numbers I, II, III, are not already known from a calculation of the Sun's longitude, they muſt be found by prob. III. 1. 2. 3. 4.

2. With the mean anomaly take out the logarithm of the diſtance in the ecliptic hypotheſis.

3. To this apply the corrections taken with the numbers I. II. III, out of their reſpective tables, the reſult is the true logarithm of the diſtance.

EXAMPLE.

In the example of prob. III. the mean anomaly of the Sun was 10^{s}. 1°. 2′. 49″, wherefore the uncorrected logarithm is		0.003836
Num. I. 69. gives	+	15
Num. II. 565.	—	8
Num. III. 813.	—	5
Therefore the logarithm of the true diſtance		0.003838

SCHOLIUM.

Theſe logarithms are adapted to a mean diſtance = 1, wherefore to prevent the logarithms of numbers leſs than unity from coming out negative, their index is ſuppoſed to be increaſed by ten, which therefore muſt be again rejected, when the caſe requires it.

PROBLEM VI.

To find the apparent ſemidiameter, and alſo the hourly motion of the Sun, to any aſſigned time.

Both are readily had, if the mean anomaly of the Sun to the given time be known or firſt found by prob. III.

EXAMPLE.

	^{s} ° ′ ″
In the example of prob. III. the mean anomaly of the Sun was	10. 1. 2. 49
Wherefore the apparent ſemidiameter of the Sun is	15. 54,3
And his true hourly motion	2. 25,2

SCHOLIUM.

The ſemidiameter of the Sun, as here given, is ſuited to the ſuppoſition of the ſemidiameter at the mean diſtance being 16′. 2″,8; which quantity I have inferred from above 130 obſervations made with the mural quadrant, which did not ſeem ill-adapted for this purpoſe.

PROBLEM VII.

The longitude of the Sun or any point of the ecliptic, and the obliquity of the ecliptic being given, to find the correſponding right aſcenſion.

1. With the given longitude look for the reduction and its mutation or change.

2. Say, as 60″ : is to this mutation : : ſo is the difference between 23°. 28′. 15″,0 and the given obliquity, to a fourth number, which added to the reduction juſt found, if the given obliquity be greater than 23°. 28′. 15″,0, or ſubſtracted from it, if the obliquity be leſs, will give the reduction corrected.

3. Therefore apply this according to its ſign to the longitude, and you will have the right aſcenſion required.

EXAMPLE.

Let the longitude of the Sun be given 1^{s}. 11°. 25′. 10″,3, and the obliquity 23°. 28′. 7″,0, the right aſcenſion is required.

With the given longitude the reduction is found	—2°. 26′. 19″,0
And its mutation	12,7

Since therefore the given obliquity differs 8″ from 23°. 28′. 15″,0, ſay, as 60″ : is to 12″,7 : : ſo is 8″,0 : to a 4th number, 1″,7, which being ſubſtracted, leaves the true reduction—0^{s}. 2° 26.′17″,3

And therefore the right aſcenſion required	1 .8 .58 .53 ,0
Or,	38 .58 .53 ,0

PROBLEM VIII.

The right aſcenſion of the Sun or a point of the ecliptic, and the obliquity of the ecliptic being given, to find the correſponding longitude.

1. With the right aſcenſion increaſed by three ſigns, find the proper reduction in the very ſame manner as in the preceding problem, for the given obliquity of the ecliptic, and from the ſame table.

2. Apply this according to its ſign to the given right aſcenſion, and the required longitude will be found.

EXAMPLE.

If the given obliquity be 23°. 28′. 7″,0, and the right aſcenſion 38°. 58′. 53″,0, or 1^{s}. 8°. 58′. 53″,0, adding three ſigns to this we ſhall have 4^{s}. 8°. 58′. 53″,0, and therefore by the reduction + 2°. 26′. 19″,1, with the mutation 12″,9. Then ſay, as 60″ : is to 12″,9 : : ſo is the difference of the obliquities, 8″ : to a fourth number, 1″,7, which, ſubſtracted from + 2°. 26′. 19″,1, leaves the true reduction + 2°. 26′. 17″,4; hence the longitude required is 1^{s}. 11°. 25′. 10″,4.

PROBLEM IX.

The obliquity of the ecliptic, and the longitude of the Sun or a point of the ecliptic being given, to find the correſponding declination.

1. With the given longitude find the declination with its mutation or change.

2. Say, as 60″ : is to this mutation : : ſo is the difference between 23°. 28′. 15″,0, and the given obliquity: to a fourth number, which added to or ſubſtracted from the declination juſt found, according as the given obliquity is greater or leſs than 23°. 28′. 15″,0, will give the declination required; which will be north if marked in the table with the ſign +, but ſouth if diſtinguiſhed with the ſign —.

EXAMPLE.

EXAMPLE.

Let the logitude be 1^{s}. 11°. 25′. 10″,3, and the obliquity 23°. 28′. 7″,0, the declination is + 15°. 16′. 38″,0, and the mutation 37″,7. And as 60″ : is to 37″,7 : : ſo is 8″,0 to a fourth number, 5″,0; which, becauſe the given obliquity is leſs than 23°. 28′ 15″,0, muſt be ſubſtracted from 15°. 16′. 38″,0; Hence the true declination is 15°. 16′. 33″,0 +, or north.

PROBLEM X.

The obliquity of the ecliptic and declination of the Sun being given, to find his longitude.

1. Enter the table, with the given declination, and take out the mutation anſwering to it.

2. With this mutation and the difference of the obliquities find, as in the preceding problems, a fourth number, which ſubſtract from the given declination, if the given obliquity be greater than 23°. 28′. 15″,0, or add, if it be leſs; the reſult will be the declination, ſuch as it would be if the obliquity was 23°. 28′. 15″.

3. With this declination enter the ſame table again, and by making proportion find the longitude.

EXAMPLE.

On the firſt day of May 1756, the Sun's declination was obſerved 15°. 16′. 34″,2 north, and the obliquity of the ecliptic was 23°. 28′. 7″.0, the longitude of the Sun is required.

Since this declination has the mutation 37″,7 aſcribed to it in the table: ſay, as 60″ : is to 37″,7 : : ſo is 8″ : to a fourth number, 5″,0; therefore the declination would be + 15° 16′.39″,2, if the obliquity was as great as it is ſuppoſed in the table; wherefore from the ſame table the longitude of the Sun will be found either 1s. 11°. 25′. 11″,4 or 4s. 18°. 34′. 48″,6; but ſince in the month of May the Sun is in the aſcending ſigns, the firſt only in this caſe is the true one.

PROBLEM XI.

The obliquity of the ecliptic, and the longitude or right aſcenſion of any point of the ecliptic being given, to find the angle between the ecliptic and the parallel to the equator paſſing thro' that point.

1. If it be the longitude which is given, firſt find the right aſcenſion by problem VII.

2. With the right aſcenſion ſo found, or given, and increaſed by three ſigns, find the declination by problem IX. which, only with the change of its name, will repreſent the angle between the ecliptic and the parallel. And according as the ſign is + or —, the ecliptic will aſcend above, or deſcend below the parallel.

EXAMPLE.

Let the given right aſcenſion be 38°. 58′. 53″,0, which, increaſed by three ſigns, becomes 4^{s}. 8°. 58′. 53″,0. Hence by problem IX. for the obliquity 23°. 28′. 7″,0, there will be found 18°. 2′. 1″,4 +, wherefore ſo much the ecliptic is inclined to the parallel, and aſcends above it, or towards the north.

PROBLEM XII.

The Sun's diſtance from the zenith being given to find his parallax in a vertical circle.

This, which is alſo called the parallax in altitude, is eaſily found from its proper table, and is uſeful either for converting the obſerved diſtance from the zenith into the true, or the contrary. In the firſt caſe it is to be ſubſtracted from, and in the latter added to, the diſtance from the zenith.

USE *and* EXPLANATION *of the* TABLE *of* ASTRONOMICAL REFRACTIONS.

PROBLEM XIII.

The apparent diſtance of a celeſtial object from the zenith, and the temperature of the air ſhewn by the barometer and thermometer being given, to find the refraction.

IT is not the buſineſs of this place to treat largely of the nature of the aſtronomical refractions, or to explain the whole theory of them. But ſo much it ſeems proper to premiſe, that the refractions greatly depend on the viciſſitudes of the atmoſphere, and on its heat and elaſticity; and therefore it is neceſſary for obſervers, at the ſame time that they obſerve the altitude or zenith diſtance of a ſtar, to take notice alſo of the ſtate of the atmoſphere as ſhewn by the barometer and thermometer, and write it down in their journal. For ſince the modern practical aſtronomy is brought to this pitch, as to be almoſt wholly employed in ſearching out little niceties, and correcting ſmall errors, formerly overlooked, ſo neither is it proper to diſregard thoſe, which may affect obſervations from the variableneſs of the refractions. My table, which ſerves for computing the true refractions to any temperature of the air, in any part of the earth, requires the height of the barometer to be noted to twelfths of an inch or lines of the Paris foot, and the height of the thermometer according to Reaumur's ſcale: ſo that if the obſerver ſhould make uſe of a different meaſure, it muſt be firſt reduced to this before the refraction is computed†.

The firſt column of the table of refraction contains the refraction anſwering to every degree of zenith-diſtance, for that ſtate of the air, in which the height of the mercury in the barometer is 28 inch. 0 lin. and that of Reaumur's thermometer 10 degrees above the freezing point. The ſecond and third columns ſhew the variations of the refraction, the former for 10 lines of the barometer, and the latter for as many degrees of the thermometer; whence the proportional part is eaſily had for any other number of lines or degrees. Now the refraction is greater than the tabular one, and therefore the proportional part is to be added if the barometer is higher than 28 inches; the refraction is alſo greater if the thermometer is lower than 10+; but in the oppoſite caſes the refraction is leſs than the tabular one. But the uſe of the table will better appear by an example than by any further explanation.

EXAMPLE.

Let the obſerved zenith-diſtance be 70°. 20′. 5″, the height of the barometer being 27 inc. 5 l. and that of the thermometer 4 degrees above the freezing point; the refraction is required.

By the table, the refraction anſwering to the
zenith diſtance 70°. 20′. 5″ is - - - } 2′. 39″,2
And the variation hereof, for 10 lines of the barometer 4, 8
For 10 degrees of the thermometer 7, 4

But as the given height of the barometer wants 7 lines of 28 inc. 0 l. ſay, as 10 l. is to 4″,8, ſo is 7 l. to a fourth number, 3″,4; further, ſince four degrees of the thermometer differ 6 degrees from 10 degrees, ſay, as 10 is to 7″,4, ſo is 6 to a fourth number, 4″,4. Hence the true refraction will be 2′. 39″,2 — 3″,4, + 4″,4, or 2′. 40″,2; the firſt correction being ſubſtracted on account of the given height of the barometer being leſs, and the ſecond correction additive, becauſe the thermometer was lower than the tabluar ones.

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† A note is added, at the bottom of the table, ſhewing its relation to the Engliſh meaſure of length, and to the ſcale of Fahrenheit's thermometer.

In a note at the bottom of the table of aſtronomical refractions, we have referred that table to the height of the barometer expreſſed in Engliſh meaſure, and to the ſcale of Fahrenheit's thermometer, to the following effect: "This table alſo anſwers to the height of "the barometer 29,6 inches, Engliſh meaſure, and to 50° of Fah"renheit's thermometer; or to the height of the barometer 30 "Engliſh inches, and 55° of Fahrenheit's thermometer. And the "column of variation of refraction for 10 lines of the barometer, "Paris meaſure, anſwers to a difference of 9-10ths of an inch Eng"liſh meaſure, from the given height 29,6 or 30,00 inches; and "the column of variation of refraction of 10° of Reaumur's ther"mometer anſwers to a difference of 20° of Fahrenheit's thermo"meter from the given degree 50 or 55°." But the author, in the 1ſt ſcholium of this problem, having obſerved, that it is not ſafe to uſe proportional parts in zenith-diſtances exceeding 80 degrees, and having therefore delivered the algebraic formula of refraction upon which the table was conſtructed, directs the refraction to be thence deduced by direct calculation in that caſe; it may therefore be uſeful to reduce the formula to the Engliſh meaſure of length, and the ſcale of Fahrenheit's thermometer. Therefore,

Let the apparent zenith-diſtance be put $=\delta$

The height of the barometer expreſſed in Engliſh inches $=\beta$

And the height of Fahrenheit's thermometer $=\theta$.

And ſubſtituting the values of $b=,9383\,\beta$, and $t=\frac{\theta\ -\ 32}{2}$ in the formula, we ſhall have

$$\text{Refr.}=\frac{74'',408\,\beta\ \text{ſin.}\,\delta}{(1+0,002483\theta)^{\frac{3}{2}}}\left[\sqrt{\left(1+\frac{(17,143\ \text{coſ.}\,\delta)^2}{1+0,002483\,\theta}\right)}-\frac{17,143\ \text{coſ.}\,\delta}{(1+0,002483\theta)^{\frac{1}{2}}}\right]$$

$$=\frac{74'',408\,\beta\ \text{ſin.}\,\delta}{\left(1+\frac{\theta}{400}-\frac{\theta}{60000}\right)^{\frac{3}{2}}}\left[\sqrt{\left(1+\frac{(17,143.\ \text{coſ.}\,\delta)^2}{1+\frac{\theta}{400}-\frac{\theta}{60000}}\right)}-\frac{17,143\ \text{coſ.}\,\delta}{\left(1+\frac{\theta}{400}-\frac{\theta}{60000}\right)^{\frac{1}{2}}}\right]$$

The computation may be very conveniently made from this formula (in a ſimilar manner to what Mayer has ſhewn with reſpect to the other formula) as follows: find an angle ω whoſe tangent is

$$=\frac{\left(1+\frac{\theta}{400}-\frac{\theta}{60000}\right)^{\frac{1}{2}}}{17,143\ \text{coſ.}\,\delta};\ \text{and the refraction is}=\frac{74'',408\,\beta\ \text{ſin.}\,\delta\ \text{tang.}\,\frac{1}{2}\,\omega}{\left(1+\frac{\theta}{400}-\frac{\theta}{60000}\right)^{\frac{3}{2}}}.$$

EXAMPLE.

On the 5th day of July 1756, the barometer ſtanding at 29,485 Engliſh inches, and Fahrenheit's thermometer at 56 degrees, the zenith-diſtance of λ ♏ was obſerved at Gottingen 88°. 7'. 34",0; the refraction is required.

$$\theta\ \text{being}=56,\left(1+\frac{\theta}{400}-\frac{\theta}{60000}\right)^{\frac{1}{2}}=(1+,14-,00093)^{\frac{1}{2}}=\sqrt{(1,13907)}\ \text{and}$$

Log. $\sqrt{1,13907}$ = 0.02827
Compl. ar. log. 17,143 = 8.76592
Compl. ar. log. coſ. δ = 1.48546

Therefore tang. ω = 10.27965
And hence ω - - - - - - - = 62°. 17'. 26"
and $\frac{1}{2}\,\omega$ - - - - - - - = 31. 8. 43
Moreover log. tang. $\frac{1}{2}\,\omega$ - - - 9.78126
log. 74",408 - - - - 1.87162
log. β or log. 29,485 - - 1.46960
log. ſin. δ - - - - 9.99977
Compl. ar. log. $(1.13907)^{\frac{3}{2}}$ - - 9.91519

Whence log. refr. - - - - = 3.03744
And the refraction ſought - = 1090",0 or = 18'. 10",0

CH. MASON'S MAXIMA OF EQUATIONS for Long. ☽.

Let ς= Sun's mean anomaly. p=Moon's mean anomaly. *p*=Moon's anomaly corrected. ω=Moon's mean diſtance from the Sun's true place. ω̃=Moon's equated place from Sun's true place. δ=Moon's mean diſtance from the place of node corrected. ρ=Moon's equated diſtance corrected by the variation from the correct place of the node.

Annual Eq. ☽ M. An. -	+ 21′. 41″,5 S. Arg. — 16″,3 S. twice Arg.	Arg. ☉ Anom.
An. Eq. ☽ ☊ - -	+ 9′. 11″,6 S. Arg. — 6″,7 S. twice Arg.	Arg. ☉ Anom.
1. Eq. Long. - -	+ 11′. 8″,6 S. Arg. — 8″,9 S. twice Arg.	Arg. ☉ Anom.
2. Eq. Long. -	— 55″,9 S. 2 ω + ς - - -	Arg. 2 ☽ á ☉ + ☉ Anom.
3. Eq. Long. - -	— 1′. 15″,3 S. 2 ω — ς - - - -	Arg. 2 ☽ á ☉ — ☉ Anom.
4. Eq. Long. -	+ 57″,8 S. 2 ω + p - - - -	Arg. 2 ☽ á ☉ + ☽ M. Anom.
5. Eq. Long. - -	— 80′. 28″,4 S. 2 ω — p + 35″,1 S. 4 ω — 2 p	Arg. 2 ☽ á ☉ — ☽ M. Anom.
6. Eq. Long. -	+ 2′. 3″,5 S. 2 ω — p + ς - - -	Arg. 2 ☽ á ☉ — ☽ An. + ☉ Anom.
7. Eq. Long. - -	+ 46″,5 S. 2 ω — p — ς - -	Arg. 2 ☽ á ☉ — ☽ An. — ☉ An.
8. Eq. Long. -	+ 42″, S. p — ς - - -	Arg. ☽ M. An. — ☉ M. Anom.
9. Eq. Long. - -	+ 22″,7 S. ω — p — 57″,4 S. 2 ω — 2 p	Arg. ☽ á ☉ — ☽ M. Anom.
10. Eq. Long. -	— 64″, S. 2 δ — 2 ω - - -	Arg. ☉ — ☊ or Long. ☉ — Long. ☊
11. Eq. Long. - -	— 17″, S. ω + ς - - -	Arg. ☽ á ☉ + ☉ Anom.
12. Eq. Long. -	— 3″,1 S. ω — ς - - -	Arg. ☽ á ☉ — ☉ Anom.
13. Eq. Long. - -	— 3″,7 S. 2 ω + 2 p - -	Arg. 2 ☽ á ☉ + 2 ☽ M. Anom.
14. Eq. Long. -	+ 12″,4 S. 4 ω — p - -	Arg. 4 ☽ á ☉ — ☽ Anom.
15. Eq. Long. - -	— 6″,3 S. 2 δ — 2 p - -	Arg. 2 ☽ á ☊ — 2 ☽ Amom.
16. Eq. Long. -	+ 8″,3 S. 2 ω — 2 δ + p - -	Arg. 2 ☽ á ☉ — 2 ☽ á ☊ + ☽ Anom.
17. Eq. Long, - -	— 5″,3 S. 2 ω — 2 δ — p - - -	Arg. 2 ☽ á ☉ — 2 ☽ á ☊ — ☽ Anom.
18. Eq. Long. -	+ 7″,7 S. δ - - - - -	Arg. ☽ ☊
19. Eq. Long. or Eq. ☽'s Center	— 6°. 18′. 14″,2 S. *p* - - + 12′. 56″,9 S. 2 *p* - - - — 36″,2 S. 3 *p* - -	Arg. ☽ Anom. corrected by all the foregoing Eq. and the Ann. Eq. of ☽ Anom.
20. Eq. Variation ☽	— 1′. 56″,4 S. Arg. or S. ω̃ - - + 35′. 41″,2 × S. 2 Arg. or S. 2 ω̃ - - + 5″,2 × S. 3 Arg. or S. 3 ω̃ - + 8″,6 × S. 4 Arg. or S. 4 ω̃ - -	Arg. ☽ Long. corrected by all the preceding Equations — ☉ Long.
21. Eq. gives ☽ place in her orbit	+ 1′. 24″,1 S. 2 ρ — *p* - - - -	Arg. 2 ☽ á ☊ — ☽ Anom. correct.
22. Eq. Reduct. to the Ecliptic	— 6′. 47″,7 S. Arg. or S. 2 ρ - ,	Arg. ☽ correct. — ☊ correct.
23. Equinoxes - -	18′, S. δ - - - -	Arg. ☽ ☊

CH. MASON'S MAXIMA OF EQUATIONS OF ☽'s LATITUDE.

1 Eq Lat.	+ 5°. 8′. 44″,5 S. ρ — 4″,4 S. 3 ρ - - -	Arg. ☽ in Orbit — ☊ correct.
2 Eq. -	+ 8′. 48″,4 S. 2 ω̃ — δ - - -	Arg. 2 ☽ in Orbit á ☉ — Arg. 1.
3 Eq. -	+ 3″,1 S. ρ — ς - - -	Arg. Arg. 1 — ☉ Anom.
4 Eq. -	— 17″,6 S. ρ — p - - -	Arg. Arg. 1 — ☽ Mean Anom.
5 Eq. -	— 25″,1 S. ρ — 2 p - - -	Arg. Arg. 4 — ☽ M. Anom.
6 Eq. -	+ 1″,9 S. ρ — 3 p - -	Arg. Arg. 5 — ☽ M. Anom.
7 Eq. -	— 9″, S. 2 ω̃ — ρ + ς - -	Arg. Arg. 2 + ☉ Anom.
8 Eq. -	— 3″,7 S. 2 ω̃ — ρ — ς - -	Arg. Arg. 2 — ☉ Anom.
9 Eq. -	— 2″,2 S. 2 ω̃ — ρ + p - -	Arg. Arg. 2 + ☽ M. Anom.
10 Eq. -	+ 15″,9 S. 2 ω̃ — ρ — 2 p -	Arg. Arg. 2 — ☽ M. Anom.
11 Eq. -	— 5″,2 S. 2 ω̃ — ρ — 2 p - -	Arg. Arg. 10 — ☽ M. Anom.

PRECEPTS *for Calculating the* MOON'S PLACE *by Mr Maſon's* LUNAR TABLES.

EXAMPLE.

Let it be required to find the ☽'s longitude and latitude, with her horary motion and parallax for the year 1791 N. S. on the 4th of Feb. at 0h. 5′. 3″ mean time at Greenwich.

PRECEPTS.

1. Find the true longitude of the Sun, by the ſolar tables preceding, to the aſſigned time, reckoned from the mean equinox; by omitting the laſt of the four ſmall equations or the equation of the equinoxes, together with his mean anomaly. By theſe tables you will find the true longitude of the Sun for the given inſtant to be

10ˢ. 15°. 43′. 2″. = ☉ long. and
7 5 12 30 = ☉ mean anomaly.

2. From the tables of the epochs, take out the mean motions of the moon's mean longitude, mean anomaly, and mean long. of her aſcending node, for the year, month, day, hour, minute and ſecond of the given-time; placing each in their reſpective columns, and under the moon's mean-longitude, place her acceleration found in the table of Epochs.

Add up the the numbers in the columns of mean long. and mean anomaly, rejecting twelve ſigns whenever they occur and ſetting down the remainder, and you will have the mean longitude of the moon and her mean anomaly. But from the epoch of the node in the third column, ſubſtract the ſum of all the numbers placed under it, which you have collected from the tables for months, days, hours, &c. and you will have the mean longitude of the moon's aſcending node. Thus you will have in the propoſed example.

10^s. 26°. 8′. 12″,2 = m. Long. ☽
9 12 58 36 5 = m. Anom.
6 25 28 33 = ☽'s ☊.

3. Make two columns for receiving the poſitive and negative equations of the moon's longitude to be collected from the tables with their proper arguments placing each in their proper columns, according to the ſigns of the tables.

4. The argument of the firſt table for the ☽'s long. is the mean anomaly of the Sun, viz. in this example 7^s. 5°. 12′. 30″, with which you will find — 6′. 31″,9 to be placed in the column of negative equations.

5. If you ſubſtract the true longitude of the Sun, viz. 10^s. 15°. 43′. 2″. from the mean long. of the Moon, you will have the mean diſtance of the Moon from the Sun = 0^s. 10°. 25′. 10″.; to and from the double of which, viz. 0^s. 20°. 50′. 20″, add and ſubſtract the firſt argument, or ☉'s m. anom. = 7^s. 5°. 12′. 30″. and you will have the ſecond and third arguments reſpectively; that is, for the ſecond argument 7^s. 26°. 2′. 50″, by which you will find in the ſecond table for the Moon's longitude the equation + 46″,4 to be placed in the column of poſitive equations in this example; and for the third argument you will have 5^s. 15°. 37′. 50″, with which, you will find in table the third = — 18″.7, for the column of negative equations.

6. To and from twice the Moon's mean diſtance from the Sun = 0^s. 20°. 50′. 20″, add and ſubſtract the mean anomaly of the Moon and you have the fourth and fifth argument; that is, for argument 4th in this caſe, 10^s. 3°. 49′. 65″, to which you will find — 48″. in the fourth table; and for the fifth argument you will have 3s. 7°. 51′. 3″,3, by which you will have — 3°. 19′. 52″,5 from table 5th, called the Evections.

7. To and from the fifth argument, viz. 3^s. 7°. 51′ 33″.5, add and ſubſtract the firſt argument, and you will have 10^s. 13°. 4′. 6″5 for the ſixth argument, and 8^s. 2°. 39′. 3″,5, for the ſeventh argument by the firſt of which you will find — 1^s. 30″,2, and by the latter — 41″,3.

8. From the mean anomaly of the Moon ſubſtract the firſt argument or the Sun's mean anomaly, and you will have 2^s. 7°. 46′. 16″,5, for the eighth argument, with which, entering table 8th, you will find + 38″,9, for the equation.

9. From the mean diſtance of the Moon from the Sun, ſubſtract the moon's mean anomaly and you will have 2^s. 27°. 26′. 24″. for the ninth argument, with which in table 9th, you will have + 17″,6.

10. From the mean long. of the Moon's node ſubſtract the true long. of the Sun and you will have the tenth argument, viz. 8^s. 19°. 45′. 31″, with which you have in table 10th, + 39″2.

11. To the Moon's mean diſtance from the Sun add the Sun's anomaly, and you will have 7^s. 15°. 37′. 40″, for the eleventh argument, with which entering table 11th, you will find + 12″,1.

12. From the Moon's mean diſtance from the Sun ſubſtract the Sun's mean anomaly, and you will have 5^s. 5°. 12′ 40″, for the twelfth argument, with which you will find in table 12th, — 1″,3.

13. To twice the Moon's mean diſtance from the Sun add twice the Moon's mean anomaly, and you will have the thirteenth argument, viz. 7^s. 16°. 48′, with which you will find in table 13th, the equation + 2″,7.

14. From four times the Moon's mean diſtance from the Sun ſubſtract the Moon's mean anomaly, and you will have 3^s. 28°. 42′ for the fourteenth argument, with which you will find in table 14th, the equation, + 10″,9.

15. Subſtract the longitude of the Moon's node from the ☽'s mean longitude, and you will have her mean diſtance from her node, viz. 4^s. 0°. 39′. 39″, from the double of which, viz. 8^s. 10° 19′. 18″, ſubſtract the double of the Moon's mean anomaly, viz. 6^s. 25°. 57′. 33″, and you will have 1^s. 5°. 21′ 45″, for the fifteenth argument, with which you will find — 3″,6 for the equation in table 15th.

16. From the fourth argument, viz. 10^s. 3°. 49′. 7″, ſubſtract twice the Moon's mean diſtance from her node, and you will have 2^s. 2°. 29′ 49″, for the ſixteenth argument, with which you will find + 7″,4, for the equation in table 16th.

17. From the fifth argument 3^s. 7°. 57′. 33″,5 ſubſtract twice the Moon's mean diſtance from her node, viz. 8^s. 1°. 19′. 18″, and you will have 7^s. 6°. 32′. 15″,5 for the ſeventeenth argument, with which you will find + 3″,2 for the equation in table 17th.

18. The mean longitude of the Moon's node is the eighteenth argument, viz. 6^s. 25°. 28′. 33″, with which take out the equation 3″,3 from table 18th.

19. Now add up the two columns of poſitive and negative equations ſeparately and the difference of theſe ſums with the ſign of the greater is the ſum of theſe eighteen equations of longitude. In the preſent caſe, the ſum of the poſitive equations is + 2′. 58″,4, and the ſum of the negative equations is — 1°. 29′. 52″,8, and their difference with the ſign of the greater is — 1°. 26′. 54″,4 for the reſult of the whole eighteen preceding equations.

20. The next thing to be done is to corrct the ☽'s mean anomaly, for which purpoſe you have a table at the beginning of the lunar tables, (the argument being the Sun's mean anomaly), which is called *the Annual Equation* of the Moon's mean anomaly. Enter this table with its proper argument, the Sun's mean anomaly, viz. 7^s. 5°. 12′. 30″, and you will find — 12′. 46″, which added to — 1°. 26′. 54″,4, the ſum of the eighteen preceding equations found before, will give — 1°. 39′. 40″,40 for the total correction, which applied according to its ſign to the Moon's mean anomaly will give 9^s. 11°. 19′. 6″,1 the Moon's anomaly corrected, which is the argument of table 19th, entitled, the Equation of the Moon's center, where you will find the equation of the center = + 6°. 5′. 23″,0, which add to the reſult of the eighteeen equations, and you will have + 4°. 38′. 28″,4 for the reſult of the nineteen preceding equations.

21. Apply this amount of the nineteen equations, viz. 4s. 38′. 28″,4 to the mean diſt. of the Moon from the Sun, viz. 0^s. 10°. 25′. 10″, and you will have the argument of table 20th, entitled the Variation, viz. 0^s. 15°. 3′. 38″,4; or, which is the ſame thing, apply this reſult of the nineteen equations to the Moon's mean longitude, and from the corrected longitude ſubſtract the Sun's true longitude, and you will have the ſame argument of table 20th, with which enter table 20th, and you will find + 17′. 35″,4, which apply to the aforeſaid ſum + 4°. 38′. 28″,4, and the ſum will be 4°. 56′, 3″,8, which applied to the mean longitude of the Moon, viz. 10^s. 26°. 8′. 12″,2 according to its ſign, will give 11^s. 1°. 4′. 16″, for the correct longitude of the Moon, in her orbit.

22. Now correct the longitude of the Moon's node, by entering the table for this purpoſe at the beginning of the lunar tables, entitled, the annual equation of the Moon's node, with it proper argument, viz. the Sun's mean anomaly, viz. 7^s. 5°. 12′. 30″, and you will have 5′. 24″,7, which applied to the mean longitude of the node 6^s. 25°. 28′. 33″,4, according to its ſign will give 6^s. 25°. 23′. 8″,3 for the equated long. of the Moon's aſc. node.

23. From the correct longitude of the Moon, viz. 11^s. 1°. 4. 16″, ſubſtract the equated longitude of the Moon's node, viz. 6^s. 25°. 23′. 8″.3, and the remainder, viz. 4^s. 5°. 41′. 7″,7, will be the equated diſtance of the Moon from her node; from the double of which, viz. 8^s. 11°. 22′. 15″,4 ſubſtract the Moon's corrected anomaly, viz. 9^s. 11°. 19′. 6″,1, there will remain 11^s. 0°. 3′. 9″,3 for the twenty-firſt argument, with which enter

the 21ſt table, and you will find — 42″,0 for the equation, which apply to the correct longitude of the Moon, viz. 11s. 1°. 4′. 16″, and you will have her longitude in her orbit farther corrected, viz. 11s. 1°. 3′. 34″.

24. From her longitude in her orbit now found, 11s. 1°. 3′. 34″. ſubſtract the equated or correct longitude of her aſcending node, found by the 22d precept, viz. 6s. 25°. 23′. 8″,3, and you will have 4s. 5°. 40′. 25″.7 for the argument of the 22d table, entitled Reduction, in which you will find the equation + 6. 26″,3.

25. Laſtly, with the mean longitude of the Moon's node, not corrected, viz. 6s. 25°. 28′. 33″ as the argument, enter the table entitled, the equation of the equinoctial points, and you will find + 7″,7, which together with the equation laſt found + 6′. 26″,3 being added to the Moon's laſt corrected longitude in her orbit, viz. 11s. 1°. 3′. 34″, will give 11s. 1°. 10′.8″ for the true longitude of the Moon reduced to the ecliptic, and computed from the apparent equinox.

See the Arguments and Equations in the following Table for finding the Longitude of the Moon at the time propoſed.

						Equat. +	Equat. —	
☉ Mean Anomaly	Arg. I.	7s,	5°,	12′,	30″,		— 0°, 6′, 31″,9	
2 ☽ á ☉ + ☉ M. Anom.	Arg. II.	7	26	2	50	+ 00′ 46″,4		
2 ☽ á ☉ — ☉ M. Anom.	Arg. III.	5	15	37	50		— 18 7	
2 ☽ á ☉ + ☽'s M. Anom.	Arg. IV.	10	3	49	6,5		— 48	
2 ☽ á ☉ — ☽'s M. Anom.	Arg. V.	3	7	51	33,5		— 1 19 52 5	
2 ☽ á ☉ — ☽'s M. Anom. + ☉ An.	Arg. VI.	10	13	4	6,5		— 1 30 2	
2 ☽ á ☉ — ☽'s M. Anom. —☉'s M. An.	Arg. VII.	8	2	39	3,5		— 41 3	
☽ M. Anom. — ☉'s M. Anom.	Arg. VIII.	2	7	46	16,5	+ 38,9		
M. Diſt. ☽ á ☉ — ☽'s M. Anom.	Arg. IX.	2	27	26	24	+ 17,6		
Mean Long. ☊ — M. Long. ☉	Arg. X.	8	9	45	31	+ 39,2		
☽ á ☉ + ☉ Anom.	Arg. XI.	7	15	37	40	+ 12,1		
☽ á ☉ — ☉ Anom.	Arg. XII.	5	5	12	40		— 1 3	
2 ☽ á ☉ + 2 ☽ M. Anom.	Arg. XIII.	7	16	48		+ 2,7		
4 ☽ á ☉ — ☽'s M. Anom.	Arg. XIV.	3	28	42		+ 10,9		
2 ☽ á ☊ — 2 ☽'s M. Anom.	Arg. XV.	1	5	21	45		— 3 6	
2 ☽ á ☉ — 2 ☽ á ☊ + ☽'s M. Anom.	Arg. XVI.	2	2	29	49	+ 7,4		
2 ☽ á ☉ — 2 ☽ á ☊ — ☽'s M. Anom.	Arg. XVII.	7	6	32	15,5	+ 3,2		
Mean Longitude ☽'s ☊	Arg. XVIII.	6	25	28	33	′ ″	— 3 3	
						+ 2 58,4	— 1 29 52 8	Dif. = — 1°, 26′, 54″6
☽'s correct anomaly	Arg. XIX.	9	11	19	6,1	+ 6 5 23		+ 6 5 23
☽'s equation long — ☉ true longitude	Arg. XX.	0	15	3	38,4	+ 17 35,4		+ 17 35 4
Double Eq. Diſt. ☽ á ☊ — ☽'s cor. An.	Arg. XXI.	11	0	3	9.3		— 42	
☽ Long. in orbit — correct longitude ☊	Arg. XXII.	4	5	40	25,7	+ 6 26,3		+ 0 4 56 4
Mean longitude ☊ ☉	Arg. XXIII.	6	25	28	33	+ 7,7		10 26 8 12,2

☽ Long. in Orbit 11 1 4 16,2
— 42

11 1 3 34,2
+ 6 26,3
+ 7,7

☽'s true Long. = 11 1 10 8,2

PRECEPT for computing the MOON's LATITUDE.

1. The 22d argument of longitude 4s. 5°. 40′. 25″,7 found by precept 24th is the 1ſt argument of latitude, by which you have from the 1ſt table of latitude the equation + 4°. 10′. 46″,4.

2. To the 20th argument of longitude apply the ſum of the 20th and 21ſt equations of longitude, having regard to their ſigns, viz.+ 16′. 53″,4 and you have the true diſtance of the Moon in her orbit from the Sun, viz. 0s. 15°. 20′. 31″,8, from the double of which is. 0°. 41′. 3″,6, ſubſtract the 1ſt argument of latitude 4s. 5°. 40′. 27″,5, and you will have 8s. 25°. 0′. 37″,9 for the 2d argument of latitude, by which you get in table 2d — 8′. 46″,4 for the 2d equation of latitude.

3. From the 1ſt argument of latitude 4s. 5°. 40′. 25″,7, ſubſtract the mean anomaly of the Sun 7s. 5°. 12. 30″, and there will remain 9s. 0°. 27′. 55″,7 for the 3d argument which gives — 3″,1.

4. From 1ſt argument 4s. 5°. 40′. 25″,7, ſubſtract the mean anomaly of the Moon 9s. 12°. 58′. 46″,5, and there remains 6s. 22°. 41′. 39″,2 for the 4th argument, with which you get from table 4th + 6″.8.

5. From the 4th argument ſubſtract the Moon's mean anomaly, or from the firſt argument ſubſtract twice the Moon's mean anomaly, and you have 9s. 9°. 42′. 52″,7 for the fifth argument of latitude, with which you find in table 5th + 24″,7.

6. From the 5th argument ſubſtract the Moon's mean anomaly; or, from the firſt argument ſubſtract three times the Moon's mean anomaly, and there remains 11s. 26°. 44′. 6″,2 for the 6th argument, with which you get — 0″,1 from table 6th.

7. To argument the 2d 8s. 25°. 0′. 37″,9 of latitude, add the mean anomaly of the Sun 7s. 5°. 12′. 30″ and their ſum 4s. 0°. 13′. 7″,9 will be the 7th argument; with which you get — 7″,8.

8. From the 2d argument of latitude 8s. 25°. 0′. 37″.9 ſubſtract the mean anomaly of the Sun, and the remainder 1s. 19°. 48′. 7″,9 will be the 8th argument, with which you get — 2″,8.

9. To the 2d argument of latitude 8s. 25°. 0′. 37″,9, add the Moon's mean anomaly, 9s, 12°. 58′. 46″,5, and the Sum 6s. 7°. 59′. 24″,4 is the 9th argument, with which you have + 0″,3.

10. From the ſecond argument ſubſtract the Moon's mean anomaly, and the remainder 11s. 12°. 1′. 51″.4 is the 10th argument, with which you get — 4″,9.

11. From the 10th argument ſubſtract the mean anomaly of the Moon, and the remainder 1s. 29°. 3′. 4″,9 is the 11th argument, with which you find — 4″,5.

The ſum of the additive equations is 4°. 11′. 18″,2, and the ſum of the ſubſtractive equations is 9′. 9″,6 and their amount or difference + 4°. 2′. 8″,6 is the true latitude of the Moon; and it is north latitude, becauſe the ſum of the poſitive equations exceeds the ſum of the ſubſtractive or negative equations. Had the negative equations exceeded the poſitive the latitude would have been ſouth.

PROBLEM.

To find the EQUATORIAL PARALLAX *of the* MOON.

Precepts for finding the horizontal Parallax of the Mooon at the Equator.

With the firſt ten arguments for the Moon's longitude take out ſo many equations from the firſt ten tables of parallax, and the three other equations from the remaining three tables, with the 19th, 20th, and 21ſt arguments of longitude, with their proper ſigns. From the ſum of the affirmative numbers ſubſtract the ſum of the negative numbers, and the remainder is the moon's equatorial parallax, or her horizontal parallax for a place under the equator. In our example you will find the ſum of the poſitive numbers + 56′. 54″,3, and of the negative numbers — 2″,5, and their difference is 56′. 51″,8 for the equat. parallax.

To find the horizontal parallax for any latitude, and to reduce that latitude to the center of the earth, when the equat. parallax is given.

PRECEPT.

Enter the table entitled, *for finding the horizontal parallax from the equatorial parallax, and for reducing the latitude to the earth's center*, with its argument, viz. the latitude on the ſide, and the equatorial parallax on the top, and find the reduction of parallax, which ſubſtracted from the equatorial parallax leaves the horizontal parallax required. Take alſo the reduction of the latitude from the ſame table, which ſubſtracted from the given latitude, gives the latitude reduced to the earth's center.

N. B. The parallax and reduced latitude ſhould be uſed in computing the moon's parallaxes in longitude, latitude, right aſcenſion, and declination. For hereby they may be computed by the common rules upon the ſuppoſition of the earth's being a perfect ſphere, as both are hereby referred to the center of the earth.

In our example you will find for the latitude 42°. and the equatorial parallax found above 6″,7 of a reduction to be ſubſtracted from it, to give the horizontal parallax in that latitude; and for the reduction of the latitude to the center of the earth — 14′ 51″.

The next table for finding the Moon's diameter from her equatorial parallax needs no explication, as you have her diameter anſwering to any parallax given. Or it may be found for any latitude from the horizontal parallax, by this proportion: as 54′ 56″. : 30′. 0″. : : the horizontal parallax for any latitude : to the moon's horizontal diameter required.

To find the horary motion of the Moon in longitude.

The firſt ten equations are taken from the tables of horary motion in longitude by the firſt ten arguments of longitude, and the other four with the arguments 19, 20, 21, 22. Find the ſum of the firſt thirteen of theſe equations by ſubſtracting the ſum of the negative from the ſum of the poſitive, and the moon's horary motion in her orbit will be obtained. Then ſay, as 32′. 56″, is to the Moon's horary motion in her orbit juſt found, ſo is the number taken out of the laſt table, to a fourth, which will be the ſame equation corrected, to be applied according to its ſign in the laſt table to the Moon's hourly motion in her orbit, to have her horary motion with reſpect to the ecliptic. In our example, you will find 32′. 40″,3 for the ſum of the thirteen equations, and in the 14th table + 2″,5, the reduction of which by the above proportion will be inſenſible, and therefore, the horary motion with reſpect to the ecliptic will be 32′. 42,″8.

To find the Moon's horary motion in latitude.

With argument I. and II. of latitude, take out the two equations from the two tables of the Moon's horary motion in latitude, and the ſum, if they have the ſame ſign, or their difference, if they have contrary ſigns, with the ſign of the greater will be the Moon's mean hourly motion in latitude. Then ſay, as 32′, 56″, is to the Moon's horary motion in her orbit, found by the laſt problem, ſo is the mean horary motion in latitude to her true hourly motion in latitude, which will be north, if marked with the ſign +, but ſouth if marked with the ſign —.

EQUATION of TIME.

Sun's apogee in 8°. Cancer, agreeing with the year A. C. 1716.

Argu. Sun's true Longitude.

S.	0	1	2	3	4	5	6	7	8	9	10	11	S.
	±	—	+	+	+	±	—	—	—	+	+	+	
°	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	°
0	7 37	1 13	3 58	1 5	5 51	2 17	7 38	15 30	13 27	1 4	11 37	14 25	0
1	7 18	1 26	3 54	1 19	5 53	2 1	7 59	15 37	13 10	0 35	11 54	14 19	1
2	6 59	1 39	3 50	1 32	5 54	1 45	8 20	15 44	12 53	0 5	12 10	14 12	2
										+			
3	6 41	1 52	3 45	1 46	5 55	1 28	8 40	15 50	12 35	0 25	12 25	14 5	3
4	6 22	2 4	3 40	1 59	5 55	1 11	9 0	15 55	12 16	0 54	12 39	13 57	4
5	6 2	2 16	3 34	2 12	5 54	0 53	9 20	15 59	11 57	1 24	12 53	13 48	5
6	5 43	2 27	3 27	2 25	5 53	0 35	9 40	16 3	11 37	1 53	13 6	13 39	6
7	5 24	2 38	3 20	2 38	5 51	0 17	10 0	16 6	11 16	2 22	13 19	13 29	7
						—							
8	5 5	2 48	3 12	2 51	5 49	0 2	10 19	16 8	10 55	2 51	13 31	13 18	8
9	4 46	2 58	3 4	3 3	5 46	0 21	10 38	16 9	10 33	3 20	13 42	13 7	9
10	4 27	3 7	2 55	3 15	5 42	0 40	10 57	16 10	10 10	3 48	13 52	12 55	10
11	4 8	3 15	2 46	3 27	5 37	1 0	11 15	16 10	9 47	4 16	14 1	12 43	11
12	3 49	3 23	2 37	3 38	5 32	1 20	11 33	16 9	9 23	4 44	14 9	12 31	12
13	3 30	3 30	2 27	3 50	5 26	1 40	11 50	16 7	8 59	5 11	14 17	12 18	13
14	3 12	3 37	2 17	4 1	5 20	2 0	12 7	16 4	8 34	5 38	14 24	12 4	14
15	2 53	3 43	2 6	4 11	5 13	2 21	12 24	16 0	8 8	6 4	14 30	11 50	15
16	2 35	3 48	1 55	4 21	5 5	2 42	12 40	15 56	7 42	6 30	14 35	11 35	16
17	2 17	3 53	1 44	4 31	4 57	3 2	12 56	15 51	7 15	6 56	14 39	11 20	17
18	1 59	3 57	1 32	4 40	4 48	3 23	13 11	15 45	6 48	7 21	14 42	11 5	18
19	1 42	4 0	1 20	4 49	4 39	3 44	13 26	15 38	6 21	7 46	14 44	10 49	19
20	1 24	4 3	1 8	4 57	4 29	4 5	13 40	15 30	5 53	8 10	14 46	10 33	20
21	1 7	4 5	0 55	5 5	4 18	4 27	13 54	15 21	5 25	8 34	14 47	10 17	21
22	0 50	4 7	0 42	5 12	4 7	4 48	14 7	15 12	4 57	8 57	14 48	10 0	22
23	0 33	4 8	0 29	5 19	3 55	5 10	14 20	15 2	4 28	9 19	14 48	9 43	23
24	0 17	4 8	0 16	5 25	3 43	5 31	14 32	14 51	3 59	9 41	14 47	9 26	24
25	0 1	4 8	0 3	5 31	3 30	5 53	14 43	14 39	3 30	10 2	14 45	9 8	25
	—		+										
26	0 15	4 7	0 11	5 36	3 16	6 14	14 54	14 26	3 1	10 22	14 42	8 50	26
27	0 30	4 6	0 24	5 41	3 2	6 35	15 4	14 12	2 32	10 42	14 39	8 32	27
28	0 45	4 4	0 38	5 45	2 47	6 56	15 13	13 58	2 3	11 1	14 35	8 14	28
29	0 59	4 1	0 52	5 48	2 32	7 17	15 22	13 43	1 34	11 19	14 30	7 56	29
30	1 13	3 58	1 5	5 51	2 17	7 38	15 30	13 27	1 4	11 37	14 25	7 37	30

☞ + Added to the apparent time
— Subtracted } to have the mean time.

EQUATION of TIME.

Sun's apogee in 9°. Cancer, agreeing with the year A. C. 1771.

Argu. Sun's true Longitude.

S.	0	1	2	3	4	5	6	7	8	9	10	11	S.
	±	—	+	+	+	±	—	—	—	+	+	+	
°	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	°
0	7 36	1 10	3 52	1 13	5 58	2 21	7 37	15 33	13 33	1 12	11 29	14 20	0
1	7 17	1 23	3 48	1 27	6 0	2 5	7 58	15 41	13 17	0 42	11 46	14 14	1
2	6 58	1 36	3 44	1 40	6 1	1 49	8 19	15 48	13 0	0 13	12 2	14 7	2
										+			
3	6 40	1 49	3 39	1 54	6 2	1 32	8 39	15 53	12 42	0 17	12 18	14 0	3
4	6 21	2 1	3 33	2 7	6 2	1 15	8 59	15 58	12 23	0 46	12 33	13 52	4
5	6 2	2 13	3 27	2 20	6 2	0 57	9 19	16 3	12 3	1 16	12 47	13 43	5
6	5 43	2 24	3 20	2 33	6 1	0 39	9 39	16 7	11 43	1 45	13 0	13 34	6
7	5 24	2 34	3 13	2 46	5 59	0 21	9 59	16 10	11 22	2 14	13 12	13 24	7
8	5 5	2 43	3 5	2 59	5 56	0 2	10 19	16 12	11 1	2 43	13 24	13 14	8
						—							
9	4 46	2 52	2 57	3 11	5 53	0 17	10 38	16 13	10 39	3 11	13 35	13 3	9
10	4 27	3 1	2 48	3 23	5 49	0 36	10 57	16 14	10 16	3 40	13 45	12 52	10
11	4 8	3 9	2 39	3 35	5 44	0 56	11 15	16 14	9 53	4 8	13 54	12 40	11
12	3 50	3 17	2 30	3 47	5 39	1 16	11 33	16 13	9 29	4 36	14 2	12 27	12
13	3 31	3 25	2 20	3 58	5 33	1 37	11 51	16 11	9 5	5 3	14 10	12 14	13
14	3 13	3 32	2 10	4 9	5 26	1 57	12 8	16 8	8 40	5 30	14 17	12 0	14
15	2 54	3 38	1 59	4 19	5 19	2 18	12 25	16 5	8 15	5 56	14 23	11 46	15
16	2 36	3 43	1 48	4 29	5 11	2 39	12 41	16 1	7 49	6 22	14 28	11 32	16
17	2 18	3 47	1 36	4 39	5 3	3 0	12 57	15 56	7 22	6 48	14 32	11 17	17
18	2 0	3 51	1 24	4 48	4 54	3 21	13 13	15 50	6 55	7 13	14 36	11 2	18
19	1 42	3 54	1 12	4 57	4 44	3 42	13 28	15 43	6 28	7 38	14 39	10 47	19
20	1 25	3 57	1 0	5 5	4 34	4 3	13 43	15 35	6 0	8 2	14 41	10 31	20

EQUATION of TIME.

Sun's apogee in 9° Cancer, agreeing with the year A. C. 1771.

Argu. Sun's true Longitude.

S.	0	1	2	3	4	5	6	7	8	9	10	11	S.
	±	—	+	+	+	±	—	—	—	+	+	+	
°	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	°
21	1 8	3 59	0 47	5 13	4 23	4 25	13 57	15 26	5 32	8 26	14 42	10 15	21
22	0 51	4 1	0 34	5 20	4 12	4 46	14 10	15 17	5 4	8 49	14 42	9 58	22
23	0 35	4 2	0 21	5 27	4 0	5 8	14 22	15 7	4 36	9 11	14 42	9 41	23
24	0 19	4 2	0 8	5 33	3 48	5 29	14 34	14 56	4 7	9 33	14 41	9 24	24
			+										
25	0 3	4 2	0 5	5 39	3 35	5 51	14 45	14 44	3 38	9 54	14 39	9 7	25
	—												
26	0 12	4 1	0 19	5 44	3 21	6 12	14 56	14 31	3 9	10 14	14 37	8 49	26
27	0 27	4 0	0 32	5 48	3 7	6 34	15 6	14 18	2 40	10 34	14 34	8 31	27
28	0 42	3 58	0 46	5 52	2 52	6 55	15 16	14 4	2 11	10 53	14 30	8 13	28
29	0 56	3 55	0 59	5 55	2 37	7 16	15 25	13 49	1 41	11 11	14 25	7 55	29
30	1 10	3 52	1 13	5 58	2 21	7 37	15 33	13 33	1 12	11 29	14 20	7 36	30

☞ + Added to the apparent time
— Subtracted } to have the mean time.

Difference of Time from the Meridian of Greenwich of the following Places, with the Elevation of the Pole.

Names of Places.		Difference of Meridians		Latitude.
		h ′ ″		° ′ ″
Abo,	*Finland*	1 28 50	—	60 27 10
Aix,	*France*	0 21 39	—	43 31 35
Alexandria,	*Egypt*	2 1 2	—	31 11 20
Amſterdam,	*Holland*	0 19 2	—	52 22 45
Antwerp,	*Flanders*	0 17 31	—	51 13 15
Avignon	*France*	0 19 8	—	43 57 25
Baſil,	*Switzerland*	0 29 58	—	47 35 0
Bayonne,	*France*	0 6 1	+	43 29 21
Berlin	*Germany*	0 53 44	—	52 32 30
Bologna,	*Italy*	0 45 21	—	44 29 36
Bourdeaux,	*France*	0 2 20	+	44 50 18
Breſt,	*France*	0 18 0	+	48 23 0
Bruſſels,	*Germany*	0 17 21	—	50 51 0
Cadiz,	*Spain*	0 24 9	+	36 31 7
Cairo,	*Egypt*	2 5 41	—	30 2 30
Calais,	*France*	0 7 20	—	50 57 31
Cape of Good Hope,	*Africa*	1 13 56	—	33 55 15A.
Canton,	*China*	7 32 6	—	23 8 0
Carthagena,	*America*	5 1 49	+	10 26 35
Caſſel,	*Germany*	0 37 52	—	51 19 4
Cayenne,	*America*	3 29 4	+	4 56 10
Conception,	*America*	4 52 54	+	36 42 53A.
Conſtantinople,	*Turkey*	1 55 30	—	41 0 0
Copenhagen,	*Denmark*	0 50 57	—	55 40 45
Dantzick,	*Poland*	1 14 26	—	54 22 0
Edinburgh,	*Scotland*	0 12 25	+	55 58 0
Florence,	*Italy*	0 44 4	—	43 46 30
Genoa,	*Italy*	0 34 19	—	44 25 0
Gottenburgh,	*Sweden*	0 45 31	—	57 42 0
Gottingen,	*Germany*	0 39 32	—	51 31 54
Greenwich,	*England*	0 0 0		51 28 39
Gripſwald,	*Germany*	0 54 30	—	54 4 25
Ingoldſtadt,	*Germany*	1 45 26	—	59 21 40
Leipſic,	*Germany*	0 49 16	—	48 45 45
Lima,	*America*	5 7 22	+	12 1 15A.
Liſbon,	*Portugal*	0 36 34	+	38 42 20
London,	*England*	0 0 26	+	51 31 0
Louiſburg,	*America*	3 59 44	+	45 53 45
Lyons,	*France*	0 19 12	—	45 45 51
Macao,	*China*	7 35 1	—	22 12 44

Difference of Time from the Meridian of Greenwich of the following Places with the Elevation of the Pole.

Names of Places.		Difference of Meridian. h	′	″		Latitude. °	′	″
Madrid,	*Spain*	0	15	2	+	40	25	0
Malta,	*Africa*	0	57	50	—	35	54	0
Marſeilles,	*France*	0	21	21	—	43	17	45
Milan,	*Italy*	0	37	2	—	45	25	0
Mons,	*Germany*	0	45	56	—	48	9	55
Montpelier,	*France*	0	15	25	—	43	36	33
Moſcow,	*Ruſſia*	2	31	1	—	55	45	20
Nantes,	*France*	0	6	15	+	47	13	17
Naples,	*Italy*	0	56	51	—	40	50	45
Narbonne,	*France*	0	11	56	—	43	11	13
Nuremberg,	*Germany*	0	44	28	—	49	27	10
Orleans,	*France*	0	7	34	—	47	54	4
Paris,	*France*	0	9	16	—	48	50	14
Pekin,	*China*	7	45	26	—	39	55	16
Peterſburgh,	*Ruſſia*	2		13	—	59	56	0
Philadelphia,	*America*	5	0	35	+	39	56	54
Quebec,	*America*	4	39	36	+	46	55	0
Quito,	*America*	5	11	44	+	0	13	17 A.
Rimini,	*Italy*	0	50	13	—	44	3	43
Rome,	*Italy*	0	49	49	—	41	53	54
Siam,	*India*	6	43	16	—	14	18	0
Smyrna,	*Aſia*	1	49	15	—	38	28	7
Straſburg,	*Germany*	0	30	56	—	48	34	35
Stockholm,	*Sweden*	1	12	26	—	59	21	40
Toulon,	*France*	0	23	39	—	43	7	24
Turin,	*Italy*	0	30	36	—	45	5	20
Venice,	*Italy*	0	49	16	—	45	27	0
Vienna,	*Germany*	1	5	32	—	48	11	20
Upſal,	*Sweden*	1	10	53	—	59	51	50
Uraniburg,	*Sweden*	0	51	26	—	55	54	15
Wittenberg,	*Germany*	0	50	46	—	51	49	0

+ Add } the given time of thoſe places } to have the time at
—Subtract } } Greenwich.

TABLE of the Sun's mean motion, preceſſion of the Equinoxes, and decreaſe of the obliquity of the Ecliptic, in Julian years.

Julian Years.	Mean Long. ☉ s	°	′	″	Mean Apo. s	°	′	″	I. ☽ N.	II. ♃ N.	III. ♀ N.	IV. ☊ N.	Prec. Equi. s	°	′	″	Decre. ob. Ec. ′	″
1	11	29	45	40,7	0	0	1	6	360	915	625	54	0	0	0	50,3	0	0,5
2	11	29	31	21,5	0	0	2	12	720	830	250	107	0	0	1	40,6	0	0,9
3	11	29	17	2,2	0	0	3	18	80	745	875	161	0	0	2	30,9	0	1,4
B. 4	0	0	1	51,3	0	0	4	24	474	663	502	215	0	0	3	21,2	0	1,8
5	11	29	47	32,1	0	0	5	30	834	578	127	268	0	0	4	11,5	0	2,3
6	11	29	33	12,8	0	0	6	36	194	493	752	322	0	0	5	1,8	0	2,8
7	11	29	18	53,6	0	0	7	42	554	408	377	376	0	0	5	52,1	0	3,2
B. 8	0	0	3	42,6	0	0	8	48	948	325	4	430	0	0	6	42,4	0	3,7
9	11	29	49	23,4	0	0	9	54	308	240	629	483	0	0	7	32,7	0	4,1
10	11	29	35	4,1	0	0	11	0	668	155	254	537	0	0	8	23,0	0	4,6
11	11	29	20	44,9	0	0	12	6	28	70	879	591	0	0	9	13,3	0	5,1
B. 12	0	0	5	34,0	0	0	13	12	422	988	506	645	0	0	10	3,6	0	5,5
13	11	29	51	14,7	0	0	14	18	782	903	131	698	0	0	10	53,9	0	6,0
14	11	29	36	55,5	0	0	15	24	142	818	756	752	0	0	11	44,2	0	6,4
15	11	29	22	36,2	0	0	16	30	502	733	381	806	0	0	12	34,5	0	6,9
B. 16	0	0	7	25,3	0	0	17	36	896	651	8	860	0	0	13	24,8	0	7,4
17	11	29	53	6,0	0	0	18	42	257	566	633	913	0	0	14	15,1	0	7,8
18	11	29	38	46,8	0	0	19	48	617	481	258	967	0	0	15	5,4	0	8,3
19	11	29	24	27,5	0	0	20	54	977	396	883	21	0	0	15	55,7	0	8,7
B. 20	0	0	9	16,6	0	0	22	0	371	314	510	75	0	0	16	46,0	0	9,2
B. 40	0	0	18	33,2	0	0	44	0	741	627	21	149	0	0	33	32,0	0	18,4
B. 60	0	0	27	49,8	0	1	6	0	112	941	531	224	0	0	50	18,0	0	27,6

TABLE of the Sun's mean motion, preceſſion of the Equinoxes, and decreaſe of the obliquity of the Ecliptic in Julian years.

Julian Years.	Mean Lon. ☉ s	°	′	″	Mean Apo. s	°	′	″	I. ☽ N.	II. ♃ N.	III. ♀ N.	IV. ☊ N.	Preceſ. Equi. s	°	′	″	Decre. ob. Ec.	″
B. 80	0	0	37	6,4	0	1	28	0	482	254	41	298	0	1	7	4,0	0	36,8
B. 100	0	0	46	23,0	0	1	50	0	853	568	551	373	0	1	23	50,0	0	46,0
B. 200	0	1	32	46,0	0	3	40	0	706	136	102	746	0	2	47	40,0	1	32,0
B. 300	0	2	19	9,0	0	5	30	0	559	704	654	118	0	4	11	30,0	2	18,0
B. 400	0	3	5	32,0	0	7	20	0	412	272	205	491	0	5	35	20,0	3	4,0
B. 500	0	3	51	55,0	0	9	10	0	265	840	756	864	0	6	59	10,0	3	50,0
B. 600	0	4	38	18,0	0	11	0	0	119	408	307	237	0	8	23	0,0	4	36,0
B. 700	0	5	24	41,0	0	12	50	0	972	976	858	609	0	9	46	50,0	5	22,0
B. 800	0	6	11	4,0	0	14	40	0	825	544	410	982	0	11	10	40,0	6	8,0
B. 900	0	6	57	27,0	0	16	30	0	678	112	961	355	0	12	34	30,0	6	54,0
B. 1000	0	7	43	50,0	0	18	20	0	531	680	512	27	0	13	58	20,0	7	40,0
B. 2000	0	15	27	40,0	1	6	40	0	62	359	24	455	0	27	56	40,0	15	20,0
B. 3000	0	23	11	30,0	1	25	0	0	593	39	536	182	1	11	55	0,0	23	0,0
B. 4000	1	0	55	20,0	2	13	20	0	124	718	48	910	1	25	53	20,0	30	40,0
B. 5000	1	8	39	10,0	3	1	40	0	654	398	560	637	2	9	51	40,0	38	20,0
B. 6000	1	16	23	0,0	3	20	0	0	186	78	72	365	2	23	50	0,0	46	0,0

Epochs of the Sun's mean motion.

Mean time under the meridian of Greenwich Obſervatory.

Julian Style.		Mean Long. ☉. s	°	′	″	Long. Apogee. s	°	′	″	I. ☽ N.	II. ♃ N	III. ♀ N.	IV ☊. N.
Years before Chriſt.	600	9	3	11	2,9	1	25	32	36	87	951	918	964
	500	9	3	57	25,9	1	27	22	36	940	519	469	387
	400	9	4	43	48,9	1	29	12	36	793	87	20	709
	300	9	5	30	11,9	2	1	2	36	646	655	571	82
	200	9	6	16	34,9	2	2	52	36	499	223	122	454
	100	9	7	2	57,9	2	4	42	36	352	791	674	827
	0	9	7	49	20,9	2	6	32	36	206	359	225	200
Years after Chriſt.	100	9	8	35	43,9	2	8	22	36	59	927	776	573
	200	9	9	22	6,9	2	10	12	36	912	495	327	946
	300	9	10	8	29,9	2	12	2	36	765	63	878	318
	400	9	10	54	52,9	2	13	52	36	618	631	430	691
	500	9	11	41	15,9	2	15	42	36	471	199	981	64
	600	9	12	27	38.9	2	17	32	36	325	767	532	437
	700	9	13	14	1,9	2	19	22	36	178	335	83	809
	800	9	14	0	24,9	2	21	12	36	31	903	635	182
	900	9	14	46	47 9	2	23	2	36	884	471	186	555
	1000	9	15	33	10,9	2	24	52	36	737	39	737	927
	1100	9	16	19	33,9	2	26	42	36	590	607	288	300
	1200	9	17	5	56,9	2	28	32	36	443	175	839	673
	1300	9	17	52	19,9	3	0	22	36	296	743	381	46
	1400	9	18	38	42,9	3	2	12	36	150	311	942	418
	1460	9	19	6	32,7	3	3	18	36	262	252	473	642
	1480	9	19	15	49,3	3	3	40	36	632	565	983	716
	1500	9	19	25	5,9	3	4	2	36	3	879	493	791
	1520	9	19	34	22,5	3	4	24	36	374	193	3	866
	1540	9	19	43	39,1	3	4	46	36	744	506	514	940
	1560	9	19	52	55,7	3	5	8	36	115	820	24	15
	1580	9	20	2	12,3	3	5	30	36	485	133	534	89
	1600	9	20	11	28,9	3	5	32	36	856	444	44	163
	1620	9	20	20	45,5	3	6	14	36	227	758	554	238
	1640	9	20	30	2,1	3	6	36	36	597	71	64	313
	1660	9	20	39	18,7	3	6	58	36	968	385	574	387
	1680	9	20	48	35,3	3	7	20	36	338	698	85	462
	1700	9	20	57	51,9	3	7	42	36	708	12	595	537
	1701	9	20	43	32,6	3	7	43	42	68	927	220	591
	1702	9	20	29	13,4	3	7	44	48	428	842	845	644
	1703	9	20	14	54,1	3	7	45	54	788	757	470	698
	1704	9	20	59	43,2	3	7	47	0	182	675	97	752
	1705	9	20	45	24,0	3	7	48	6	542	590	722	806
	1706	9	20	31	4,7	3	7	49	12	902	505	347	859
	1707	9	20	16	45,5	3	7	50	18	262	420	972	913
	1708	9	21	1	34,5	3	7	51	24	656	337	599	967
	1709	9	20	47	15,3	3	7	52	30	16	252	224	20
	1710	9	20	32	56,0	3	7	53	36	376	167	849	74
	1711	9	20	18	36,8	3	7	54	42	736	82	474	128

Epochs of the Sun's mean motion.
Mean time under the Meridian of Greenwich Obſervatory.

Julian Style.		MeanLong. ☉				Long. Apo.				I. ☽	II. ♃	III. ♀	IV. ☊
		s	o	′	″	s	o	′	″	N.	N.	N.	N.
Years	1712	9	21	3	25,9	3	7	55	48	130	0	101	182
after	1713	9	20	49	6,6	3	7	56	54	490	915	726	235
Chriſt.	1714	9	20	34	47,4	3	7	58	0	850	830	351	289
	1715	9	20	20	28,1	3	7	59	6	210	745	976	343
	1716	9	21	5	17,2	3	8	0	12	604	663	603	397
	1717	9	20	50	57,9	3	8	1	18	965	578	228	450
	1718	9	20	36	38,7	3	8	2	24	325	493	853	504
	1719	9	20	22	19,4	3	8	3	30	685	408	478	558
	1720	9	21	7	8,5	3	8	4	36	79	326	105	612
	1721	9	20	52	49,2	3	8	5	42	439	241	730	665
	1722	9	20	38	30,0	3	8	6	48	799	156	355	719
	1723	9	20	24	10,7	3	8	7	54	159	71	980	773
	1724	9	21	8	59,8	3	8	9	0	553	989	607	827
	1725	9	20	54	40,6	3	8	10	6	913	904	232	880
	1726	9	20	40	21,3	3	8	11	12	273	819	857	934
	1727	9	20	26	2,1	3	8	12	18	633	734	482	988
	1728	9	21	10	51,1	3	8	13	24	27	651	109	41
	1729	9	20	56	31,9	3	8	14	30	387	566	734	95
	1730	9	20	42	12,6	3	8	15	36	747	481	359	149
	1731	9	20	27	53,4	3	8	16	42	107	396	984	203
	1732	9	21	12	42,5	3	8	17	48	501	314	611	256
	1733	9	20	58	23,2	3	8	18	54	861	229	236	310
	1734	9	20	44	4,0	3	8	20	0	221	144	861	364
	1735	9	20	29	44,7	3	8	21	6	581	59	487	418
	1736	9	21	14	33,8	3	8	22	12	975	977	114	471
	1737	9	21	0	14,5	3	8	23	18	335	892	739	525
	1738	9	20	45	55,3	3	8	24	24	695	807	364	579
	1739	9	20	31	36,0	3	8	25	30	55	722	989	633
	1740	9	21	16	25,1	3	8	26	36	449	639	616	686
	1741	9	21	2	5,8	3	8	27	42	809	554	241	740
	1742	9	20	47	46,6	3	8	28	48	169	469	866	794
	1743	9	20	33	27,3	3	8	29	54	529	384	491	848
	1744	9	21	18	16,4	3	8	31	0	923	302	118	901
	1745	9	21	3	57,2	3	8	32	6	283	217	742	955
	1746	9	20	49	37,9	3	8	33	12	643	132	368	9
	1747	9	20	35	18,7	3	8	34	18	3	47	993	62
	1748	9	21	20	7,7	3	8	35	24	397	964	620	116
	1749	9	21	5	48,5	3	8	36	30	757	879	245	170
	1750	9	20	51	29,2	3	8	37	36	117	794	870	224
	1751	9	20	37	10,0	3	8	38	42	477	709	495	277
	1752	9	21	21	59,1	3	8	39	48	871	627	122	331

Gregorian Style.		MeanLong. ☉				Long. Apo.				I. ☽	II. ♃	III. ♀	IV. ☊
		s	o	′	″	s	o	′	″	N.	N.	N.	N.
Years	1600	9	10	20	5,6	3	5	52	34	517	419	27	162
after	1620	9	10	29	22,2	3	6	14	34	888	733	537	237
Chriſt.	1640	9	10	38	38,8	3	6	36	34	258	46	47	312
	1660	9	10	47	55,4	3	6	58	34	629	360	557	386
	1680	9	10	57	12,0	3	7	20	34	999	673	68	461
	1700	9	10	7	20,3	3	7	42	34	336	984	576	535
	1701	9	9	53	1,0	3	7	43	40	596	899	201	589
	1702	9	9	38	41,8	3	7	44	46	56	814	826	642
	1703	9	9	24	22,5	3	7	45	52	416	729	451	696
	1704	9	10	9	11,6	3	7	46	58	810	647	78	750
	1705	9	9	54	52,4	3	7	48	4	170	562	703	804
	1706	9	9	40	33,1	3	7	49	10	530	477	328	857
	1707	9	9	26	13,9	3	7	50	16	890	392	953	911
	1708	9	10	11	2,9	3	7	51	22	284	309	580	965
	1709	9	9	56	43,7	3	7	52	28	644	224	205	18
	1710	9	9	42	24,4	3	7	53	34	4	139	830	72

Epochs of the Sun's mean motion.
Mean time under the Meridian of Greenwich Obſervatory.

Gregorian Style.		MeanLong. ☉				Long. Apo.				I. ☽	II. ♃	III. ♀	IV. ☊
		s	o	′	″	s	o	′	″	N.	N.	N.	N.
Years	1711	9	9	28	5,2	3	7	54	40	364	54	455	126
after	1712	9	10	12	54,3	3	7	55	46	758	972	82	180
Chriſt.	1713	9	9	58	35,0	3	7	56	52	118	887	707	233
	1714	9	9	44	15,8	3	7	57	58	478	802	332	287
	1715	9	9	29	56,5	3	7	59	4	838	717	957	341
	1716	9	10	14	45,6	3	8	0	10	232	635	584	395
	1717	9	10	0	26,3	3	8	1	16	593	550	209	448
	1718	9	9	46	7,1	3	8	2	22	953	465	834	502
	1719	9	9	31	47,8	3	8	3	28	313	380	459	556
	1720	9	10	16	36,9	3	8	4	34	707	298	86	610
	1721	9	10	2	17,6	3	8	5	40	67	213	711	663
	1722	9	9	47	58,4	3	8	6	46	427	128	336	717
	1723	9	9	33	39,1	3	8	7	52	787	43	961	771
	1724	9	10	18	28,2	3	8	8	58	181	961	588	825
	1725	9	10	4	9,0	3	8	10	4	541	876	213	878
	1726	9	9	49	49,7	3	8	11	10	901	791	838	932
	1727	9	9	35	30,5	3	8	12	16	261	706	463	986
	1728	9	10	20	19,5	3	8	13	22	655	623	90	39
	1729	9	10	6	0,3	3	8	14	28	15	538	715	93
	1730	9	9	51	41,0	3	8	15	34	375	453	340	147
	1731	9	9	37	21,8	3	8	16	40	735	368	965	201
	1732	9	10	22	10,9	3	8	17	46	129	286	592	254
	1733	9	10	7	51,6	3	8	18	52	489	201	217	308
	1734	9	9	53	32,4	3	8	19	58	849	116	842	362
	1735	9	9	39	13,1	3	8	21	4	209	31	468	416
	1736	9	10	24	2,2	3	8	22	10	603	949	95	469
	1737	9	10	9	42,9	3	8	23	16	963	864	720	523
	1738	9	9	55	23,7	3	8	24	22	323	779	345	577
	1739	9	9	41	4,4	3	8	25	28	683	694	970	631
	1740	9	10	25	53,5	3	8	26	34	77	611	597	684
	1741	9	10	11	34,2	3	8	27	40	437	526	222	738
	1742	9	9	57	15,0	3	8	28	46	797	441	847	792
	1743	9	9	42	55,7	3	8	29	52	157	356	472	846
	1744	9	10	27	44,8	3	8	30	58	551	274	99	899
	1745	9	10	13	25,6	3	8	32	4	911	189	724	953
	1746	9	9	59	6,3	3	8	33	10	271	104	349	7
	1747	9	9	44	47,1	3	8	34	16	631	19	974	60
	1748	9	10	29	36,1	3	8	35	22	25	936	601	114
	1749	9	10	15	16,9	3	8	36	28	385	851	226	168
	1750	9	10	0	57,6	3	8	37	34	745	766	851	222
	1751	9	9	46	38,4	3	8	38	40	105	681	476	275
	1752	9	10	31	27,5	3	8	39	46	499	599	103	329
	1753	9	10	17	8,2	3	8	40	52	859	514	728	383
	1754	9	10	2	49,0	3	8	41	58	219	429	353	437
	1755	9	9	48	29,7	3	8	43	4	579	344	978	490
	1756	9	10	33	18,8	3	8	44	10	973	262	605	544
	1757	9	10	18	59,5	3	8	45	16	334	177	230	598
	1758	9	10	4	40,3	3	8	46	22	694	92	855	652
	1759	9	9	50	21,0	3	8	47	28	54	7	480	705
	1760	9	10	35	10,1	3	8	48	34	448	925	107	759
	1761	9	10	20	50,8	3	8	49	40	808	840	732	813
	1762	9	10	6	31,6	3	8	50	46	168	755	357	866
	1763	9	9	52	12,3	3	8	51	52	528	670	982	920
	1764	9	10	37	1,4	3	8	52	58	922	588	609	974
	1765	9	10	22	42,2	3	8	54	4	282	503	234	27
	1766	9	10	8	22,9	3	8	55	10	642	418	859	81
	1767	9	9	54	3,7	3	8	56	16	2	333	484	135
	1768	9	10	38	52,7	3	8	57	22	396	250	111	189
	1769	9	10	24	33,5	3	8	58	28	756	165	736	242
	1770	9	10	10	14,2	3	8	59	34	116	80	361	296
	1771	9	9	55	55,0	3	9	0	40	476	995	986	350
	1772	9	10	40	44,1	3	9	1	46	870	912	613	404

Epochs of the Sun's mean motion for the meridian of Philadelphia.

New Style.		☉ mean Long.				Long. Apog.				I. ☽	II. ♃	III. ♀	IV. ☊
		s	°	′	″	s	°	′	″	N.	N.	N.	N.
Years of Chriſt.	1765	9	10	35	2,8	3	8	54	4	289	504	234	27
	1766	9	10	20	43,5	3	8	55	10	649	419	859	81
	1767	9	10	6	24,3	3	8	56	16	9	334	484	135
	1768	9	10	51	13,3	3	8	57	22	403	251	111	189
	1769	9	10	36	54,1	3	8	58	28	763	166	736	242
	1770	9	10	22	34,8	3	8	59	34	123	81	361	296
	1771	9	10	8	15,6	3	9	0	40	483	996	986	350
	1772	9	10	53	4,7	3	9	1	46	877	914	613	404
	1773	9	10	38	45,4	3	9	2	52	237	829	238	458
	1774	9	10	24	26,2	3	9	3	58	597	744	863	511
	1775	9	10	10	6,9	3	9	5	4	957	659	488	565
	1776	9	10	54	56,0	3	9	6	10	351	577	115	619
	1777	9	10	40	36,7	3	9	7	16	712	492	740	672
	1778	9	10	26	17,5	3	9	8	22	72	407	365	726
	1779	9	10	11	58,2	3	9	9	28	432	322	990	780
	1780	9	10	56	47,3	3	9	10	34	826	240	617	834
	1781	9	10	42	28,0	3	9	11	40	186	155	242	887
	1782	9	10	28	8,8	3	9	12	46	546	70	867	941
	1783	9	10	13	49,5	3	9	13	52	906	985	492	994
	1784	9	10	58	38,6	3	9	14	58	300	903	119	48
	1785	9	10	44	19,4	3	9	16	4	660	818	744	102
	1786	9	10	30	0,1	3	9	17	10	20	733	369	156
	1787	9	10	15	40,9	3	9	18	16	380	648	994	209
	1788	9	11	0	29,9	3	9	19	22	774	565	621	263
	1789	9	10	46	10,7	3	9	20	28	134	480	246	317
	1790	9	10	31	51,4	3	9	21	34	494	395	871	371
	1791	9	10	17	32,2	3	9	22	40	854	310	496	424
	1792	9	11	2	21,3	3	9	23	46	248	228	123	478
	1793	9	10	48	2,0	3	9	24	52	608	143	748	532
	1794	9	10	33	42,8	3	9	25	58	968	58	373	585
	1795	9	10	19	23,5	3	9	27	4	328	973	998	639
	1796	9	11	4	12,6	3	9	28	10	722	891	625	693
	1797	9	10	49	53,3	3	9	29	16	82	806	250	747
	1798	9	10	35	34,1	3	9	30	22	442	721	875	800
	1799	9	10	21	14,8	3	9	31	28	802	636	500	854
	1800	9	10	6	55,6	3	9	32	34	162	551	125	907
	1801	9	9	52	36,3	3	9	33	40	522	466	750	961
	1802	9	9	38	17,0	3	9	34	46	882	381	375	15
	1803	9	9	23	57,7	3	9	35	52	242	296	0	69
	1804	9	10	8	46,9	3	9	36	58	636	213	627	123
	1805	9	9	54	27,7	3	9	38	4	996	128	252	176
	1806	9	9	40	8,4	3	9	39	10	356	43	877	230
	1807	9	9	25	49,1	3	9	40	16	716	958	502	284
	1808	9	10	10	38,2	3	9	41	22	110	876	129	338
	1809	9	9	56	19,0	3	9	42	28	470	791	755	391
	1810	9	9	41	59,7	3	9	43	34	830	706	380	445
	1811	9	9	27	40,5	3	9	44	40	190	621	5	499
	1812	9	10	12	29,6	3	9	45	46	584	539	632	553
	1813	9	9	58	10,3	3	9	46	52	944	454	257	606
	1814	9	9	43	51,1	3	9	47	58	304	369	882	660
	1815	9	9	29	31,8	3	9	49	4	664	284	507	714
	1816	9	10	14	20,9	3	9	50	10	58	201	134	768
	1817	9	10	0	1,6	3	9	51	16	418	116	759	821
	1818	9	9	45	42,4	3	9	52	22	778	31	384	875
	1819	9	9	31	23,1	3	9	53	28	138	946	09	929
	1820	9	10	16	12,2	3	9	54	34	532	864	636	983
	1821	9	10	1	52,9	3	9	55	40	892	779	261	36
	1822	9	9	47	33,7	3	9	56	46	252	684	886	90
	1823	9	9	33	14,4	3	9	57	52	612	609	511	144
	1824	9	10	18	3,5	3	9	58	58	6	527	138	198
	1825	9	10	3	44,3	3	10	0	4	366	442	763	251
	1826	9	9	49	25,0	3	10	1	10	726	357	388	305

Epochs of the Sun's mean motion for the meridian of Philadelphia.

New Style.		☉ mean Long.				Long. Apo.				I. ☽	II. ♃	III. ♀	IV. ☊
		s	°	′	″	s	°	′	″	N.	N.	N.	N.
Years of Chriſt.	1827	9	9	35	5,8	3	10	2	16	86	272	13	359
	1828	9	10	19	54,9	3	10	3	22	480	190	640	413
	1829	9	10	5	35,6	3	10	4	28	840	105	265	466
	1830	9	9	51	16,3	3	10	5	34	200	20	890	520
	1831	9	9	36	57,1	3	10	6	40	560	935	515	574
	1832	9	10	21	46,2	3	10	7	46	954	852	142	628
	1833	9	10	7	26,9	3	10	8	52	314	767	767	681
	1834	9	9	53	7,7	3	10	9	58	674	682	392	735

Table of the Sun's mean motion, in Months and Days.

JANUARY.

Days.	Longitude ☉				Apo.	I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	°	′	″	″	N.	N.	N.	N.	″
1	0	0	59	8,3	0	34	3	2	0	0,1
[illegible]	0	1	58	16,7	0	68	5	3	0	0,3
3	0	2	57	25,0	1	102	8	5	0	0,4
4	0	3	56	33,3	1	135	10	7	1	0,6
5	0	4	55	41,7	1	169	13	9	1	0,7
6	0	5	54	50,0	1	203	15	10	1	0,8
7	0	6	53	58,3	1	237	18	12	1	1,0
8	0	7	53	6,6	1	271	20	14	1	1,1
9	0	8	52	15,0	[illegible]	305	23	15	1	1,2
10	0	9	51	23,3	2	339	25	17	1	1,4
11	0	10	50	31,6	2	372	28	19	2	1,5
12	0	11	49	40,0	2	406	30	21	2	1,7
13	0	12	48	48,3	[illegible]	440	33	22	2	1,8
14	0	13	47	56,6	3	474	35	24	2	1,9
15	0	14	47	5,0	3	508	38	26	2	2,1
16	0	15	46	13,3	3	542	40	27	2	2,2
17	0	16	45	21,6	3	576	43	29	3	2,3
18	0	17	44	30,0	3	610	45	31	3	2,5
19	0	18	43	38,3	3	643	48	33	3	2,6
20	0	19	42	46,6	4	677	50	34	3	2,8
21	0	20	41	54,9	4	710	53	36	3	2,9
22	0	21	41	3,3	4	745	55	38	3	3,0
23	0	22	40	11,6	4	779	58	39	3	3,2
24	0	23	39	19,9	4	813	60	41	4	3,3
25	0	24	38	28,3	5	847	63	43	4	3,4
26	0	25	37	36,6	5	880	65	45	4	3,6
27	0	26	36	44,9	5	914	68	46	4	3,7
28	0	27	35	53,3	5	948	70	48	4	3,9
29	0	28	35	1,6	5	982	73	50	4	4,0
30	0	29	34	9,9	5	16	75	51	4	4,1
31	1	0	33	18,3	6	50	78	53	5	4,3

FEBRUARY.

Days.	Longitude ☉				Apo.	I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	°	′	″	″	N.	N.	N.	N.	″
1	1	1	32	26,6	6	84	80	55	5	4,4
[illegible]	1	2	31	34,9	6	117	83	57	5	4,5
3	1	3	30	43,2	6	151	85	58	5	4,7
4	1	4	29	51,6	6	185	88	60	5	4,8
5	1	5	28	59,9	7	219	90	62	5	5,0
6	1	6	28	8,2	7	253	93	63	5	5,1
7	1	7	27	16,6	7	287	95	65	6	5,2

Table of the Sun's mean motion, In Months and Days.

FEBRUARY.

Days.	Longitude ☉				Apo.	I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	o	′	″	″	N.	N.	N.	N.	″
8	1	8	26	24,9	7	321	98	67	6	5,4
9	1	9	25	33,2	7	355	100	69	6	5,5
10	1	10	24	41,6	7	388	103	70	6	5,6
11	1	11	23	49,9	8	422	105	72	6	5,8
12	1	12	22	58,2	8	456	108	74	6	5,9
13	1	13	22	6,6	8	490	110	75	6	6,1
14	1	14	21	14,9	8	524	113	77	7	6,2
15	1	15	20	23,2	8	558	115	79	7	6,3
16	1	16	19	31,5	8	592	118	80	7	6,5
17	1	17	18	39,9	9	625	120	82	7	6,6
18	1	18	17	48,2	9	659	123	84	7	6,7
19	1	19	16	56,5	9	693	125	86	7	6,9
20	1	20	16	4,9	9	727	128	87	8	7,0
21	1	21	15	13,2	9	761	130	89	8	7,2
22	1	22	14	21,5	10	795	133	91	8	7,3
23	1	23	13	29,9	10	829	135	92	8	7,4
24	1	24	12	38,2	10	862	138	94	8	7,6
25	1	25	11	46,5	10	896	140	96	8	7,7
26	1	26	10	54,9	10	930	143	98	8	7,8
27	1	27	10	3,2	11	964	145	99	9	8,0
28	1	28	9	11,5	11	998	148	101	9	8,1

MARCH.

Days.	Longitude ☉				Apo.	I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	o	′	″	″	N.	N.	N.	N.	″
1	1	29	8	19,8	11	32	150	103	9	8,3
2	2	0	7	28,2	11	66	153	104	9	8,4
3	2	1	6	36,5	11	100	155	106	9	8,5
4	2	2	5	44,8	11	133	158	108	9	8,7
5	2	3	4	53,2	12	167	160	110	9	8,8
6	2	4	4	1,5	12	201	163	111	10	9,0
7	2	5	3	9,8	12	235	165	113	10	9,1
8	2	6	2	18,2	12	269	168	115	10	9,2
9	2	7	1	26,5	12	303	170	116	10	9,4
10	2	8	0	34,8	13	337	173	118	10	9,5
11	2	8	59	43,2	13	370	175	120	10	9,6
12	2	9	58	51,5	13	404	178	122	10	9,8
13	2	10	57	59,8	13	438	181	123	11	9,9
14	2	11	57	8,1	13	472	183	125	11	10,1
15	2	12	56	16,5	13	506	186	127	11	10,2
16	2	13	55	24,8	14	540	188	128	11	10,3
17	2	14	54	33,1	14	574	191	130	11	10,5
18	2	15	53	41,5	14	607	193	132	11	10,6
19	2	16	52	49,8	14	641	196	134	11	10,7
20	2	17	51	58,1	14	675	198	135	12	10,9
21	2	18	51	6,5	15	709	201	137	12	11,0
22	2	19	50	14,8	15	743	203	139	12	11,2
23	2	20	49	23,1	15	777	206	140	12	11,3
24	2	21	48	31,5	15	811	208	142	12	11,4
25	2	22	47	39,8	15	844	211	144	12	11,6
26	2	23	46	48,1	15	878	213	146	13	11,7
27	2	24	45	56,4	16	912	216	147	13	11,8
28	2	25	45	4,8	16	946	218	149	13	12,0
29	2	26	44	13,1	16	980	221	151	13	12,1
30	2	27	43	21,4	16	14	223	152	13	12,3
31	2	28	42	29,8	16	48	226	154	13	12,4

Table of the Sun's mean motion, In Months and Days.

APRIL.

Days.	Longitude ☉				Apo.	I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	o	′	″	″	N.	N.	N.	N.	″
1	2	29	41	38,1	16	82	228	156	13	12,5
2	3	0	40	46,4	16	115	231	158	14	12,7
3	3	1	39	54,8	17	149	233	159	14	12,8
4	3	2	39	3,1	17	183	236	161	14	12,9
5	3	3	38	11,4	17	217	238	163	14	13,1
6	3	4	37	19,8	17	251	241	164	14	13,2
7	3	5	36	28,1	17	285	243	166	14	13,4
8	3	6	35	36,4	18	319	246	168	14	13,5
9	3	7	34	44,8	18	352	248	170	15	13,6
10	3	8	33	53,1	18	386	251	171	15	13,8
11	3	9	33	1,4	18	420	253	173	15	13,9
12	3	10	32	9,7	18	454	256	175	15	14,0
13	3	11	31	18,1	19	488	258	176	15	14,2
14	3	12	30	26,4	19	522	261	178	15	14,3
15	3	13	29	34,7	19	556	263	180	15	14,5
16	3	14	28	43,1	19	589	266	182	16	14,6
17	3	15	27	51,4	19	623	268	183	16	14,7
18	3	16	26	59,7	20	657	271	185	16	14,9
19	3	17	26	8,1	20	691	273	187	16	15,0
20	3	18	25	16,4	20	725	275	188	16	15,1
21	3	19	24	24,7	20	759	278	190	16	15,3
22	3	20	23	33,1	20	793	281	192	16	15,4
23	3	21	22	41,4	20	827	283	194	17	15,6
24	3	22	21	49,7	21	860	286	195	17	15,7
25	3	23	20	58,0	21	894	288	197	17	15,8
26	3	24	20	6,4	21	928	291	199	17	16,0
27	3	25	19	14,7	21	962	293	200	17	16,1
28	3	26	18	23,0	21	996	296	202	17	16,2
29	3	27	17	31,4	22	30	298	204	18	16,4
30	3	28	16	39,7	22	64	301	206	18	16,5

MAY.

Days.	Longitude ☉				Apo.	I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	o	′	″	″	N.	N.	N.	N.	″
1	3	29	15	48,0	22	97	303	207	18	16,7
2	4	0	14	56,4	22	131	306	209	18	16,8
3	4	1	14	4,7	22	165	308	211	18	16,9
4	4	2	13	13,0	22	199	311	212	18	17,1
5	4	3	12	21,4	23	233	313	214	18	17,2
6	4	4	11	29,7	23	267	316	216	19	17,4
7	4	5	10	38,0	23	301	318	217	19	17,5
8	4	6	9	46,3	23	334	321	218	19	17,6
9	4	7	8	54,7	23	368	323	221	19	17,8
10	4	8	8	3,0	24	402	326	223	19	17,9
11	4	9	7	11,3	24	436	328	224	19	18,0
12	4	10	6	19,7	24	470	331	226	19	18,2
13	4	11	5	28,0	24	504	333	228	20	18,3
14	4	12	4	36,3	24	538	336	229	20	18,5
15	4	13	3	44,7	24	572	338	231	20	18,6
16	4	14	2	53,0	25	605	341	233	20	18,7
17	4	15	2	1,3	25	639	343	235	20	18,9
18	4	16	1	9,7	25	673	346	236	20	19,0
19	4	17	0	18,0	25	707	348	238	20	19,1
20	4	17	59	26,3	25	741	351	240	21	19,3
21	4	18	58	34,6	25	775	353	241	21	19,4
22	4	19	57	43,0	26	809	356	243	21	19,6
23	4	20	56	51,3	26	842	359	245	21	19,7
24	4	21	55	59,6	26	876	361	247	21	19,8

Table of the Sun's mean motion, In Months and Days.

MAY.

Days.	Longitude ☉				Apo.	I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	°	′	″	″	N.	N.	N.	N.	″
25	4	22	55	8,0	26	910	364	248	21	20,0
26	4	23	54	16,3	26	944	366	250	21	20,1
27	4	24	53	24,6	27	978	369	252	22	20,2
28	4	25	52	33,0	27	12	371	253	22	20,4
29	4	26	51	41,3	27	46	374	255	22	20,5
30	4	27	50	49,6	27	79	376	257	22	20,7
31	4	28	49	58,0	27	113	379	259	22	20,8

JUNE.

Days.	Longitude ☉				Apo.	I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	°	′	″	″	N.	N.	N.	N.	″
1	4	29	49	6,3	27	147	381	260	22	20,9
2	5	0	48	14,6	28	181	384	262	23	21,1
3	5	1	47	22,9	28	215	386	264	23	21,2
4	5	2	46	31,3	28	249	389	265	23	21,3
5	5	3	45	39,6	28	283	391	267	23	21,5
6	5	4	44	47,9	28	317	394	269	23	21,6
7	5	5	43	56,3	29	350	396	271	23	21,8
8	5	6	43	4,6	29	384	399	272	23	21,9
9	5	7	42	12,9	29	418	401	274	24	22,0
10	5	8	41	21,3	29	452	404	276	24	22,2
11	5	9	40	29,6	29	486	406	277	24	22,3
12	5	10	39	37,9	30	520	409	279	24	22,4
13	5	11	38	46,3	30	554	411	281	24	22,6
14	5	12	37	54,6	30	587	414	283	24	22,7
15	5	13	37	2,9	30	621	416	284	24	22,9
16	5	14	36	11,2	30	655	419	286	25	23,0
17	5	15	35	19,6	30	689	421	288	25	23,1
18	5	16	34	27,9	31	723	424	289	25	23,3
19	5	17	33	36,2	31	757	426	291	25	23,4
20	5	18	32	44,6	31	791	429	293	25	23,5
21	5	19	31	52,9	31	824	431	295	25	23,7
22	5	20	31	1,2	31	858	434	296	25	23,8
23	5	21	30	9,6	31	892	436	298	26	24,0
24	5	22	29	17,9	32	926	439	300	26	24,1
25	5	23	28	26,2	32	960	441	301	26	24,2
26	5	24	27	34,6	32	994	444	303	26	24,4
27	5	25	26	42,9	32	28	446	305	26	24,5
28	5	26	25	51,2	32	62	448	307	26	24,6
29	5	27	24	59,5	33	95	451	308	26	24,8
30	5	28	24	7,9	33	129	454	310	27	24,9

JULY.

Days.	Longitude ☉				Apo.	I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	°	′	″	″	N.	N.	N.	N.	″.
1	5	29	23	16,2	33	163	456	312	27	25,1
2	6	0	22	24,5	33	197	459	313	27	25,2
3	6	1	21	32,9	33	231	461	315	27	25,3
4	6	2	20	41,2	33	265	464	317	27	25,5
5	6	3	19	49,5	34	299	466	319	27	25,6
6	6	4	18	57,9	34	332	469	320	28	25,8
7	6	5	18	6,2	34	366	471	322	28	25,9
8	6	6	17	14,5	34	400	474	324	28	26,0
9	6	7	16	22,9	34	434	476	325	28	26,2
10	6	8	15	31,2	35	468	479	327	28	26,3
11	6	9	14	39,5	35	502	481	329	28	26,4

Table of the Sun's mean motion, In Months and Days.

JULY.

Days.	Longitude ☉				Apo.	I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	°	′	″	″	N.	N.	N.	N.	″
12	6	10	13	47,8	35	536	484	331	28	26,6
13	6	11	12	56,2	35	569	486	332	29	26,7
14	6	12	12	4,5	35	603	489	334	29	26,9
15	6	13	11	12,8	35	637	491	336	29	27,0
16	6	14	10	21,2	36	671	494	337	29	27,1
17	6	15	9	29,5	36	705	496	339	29	27,3
18	6	16	8	37,8	36	739	499	341	29	27,4
19	6	17	7	46,2	36	773	501	343	29	27,5
20	6	18	6	54,5	36	806	504	344	30	27,7
21	6	19	6	2,8	37	840	506	346	30	27,8
22	6	20	5	11,2	37	874	509	348	30	28,0
23	6	21	4	19,5	37	908	511	349	30	28,1
24	6	22	3	27,8	37	942	514	351	30	28,2
25	6	23	2	36,1	37	976	516	353	30	28,4
26	6	24	1	44,5	37	10	519	354	30	28,5
27	6	25	[illegible]	52,8	38	44	521	356	31	28,6
28	6	26	0	1,1	38	77	524	358	31	28,8
29	6	26	59	9,5	38	111	526	360	31	28,9
30	6	27	58	17,8	38	145	529	361	31	29,1
31	6	28	57	26,1	38	179	531	363	31	29,2

Table of the Sun's mean motion, In Months and Days.

AUGUST.

Days.	Longitude ☉				Apo.	I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	°	′	″	″	N.	N.	N.	N.	″
1	6	29	56	34,5	39	213	534	365	31	29,3
2	7	0	55	42,8	39	247	536	366	31	29,5
3	7	1	54	51,1	39	281	539	368	32	29,6
4	7	2	53	59,5	39	314	542	370	32	29,7
5	7	3	53	7,8	39	348	544	372	32	29,9
6	7	4	52	16,1	39	382	547	373	32	30,0
7	7	5	51	24,4	40	416	549	375	32	30,2
8	7	6	50	32,8	40	450	552	377	32	30,3
9	7	7	49	41,1	40	484	554	378	33	30,4
10	7	8	48	49,4	40	518	557	380	33	30,6
11	7	9	47	57,8	40	551	559	382	33	30,7
12	7	10	47	6,1	41	585	562	384	33	30,8
13	7	11	46	14,4	41	619	564	385	33	31,0
14	7	12	45	22,8	41	653	567	387	33	31,1
15	7	13	44	31,1	41	687	569	389	33	31,3
16	7	14	43	39,4	41	721	572	390	34	31,4
17	7	15	42	47,8	41	755	574	392	34	31,5
18	7	16	41	56,1	42	789	577	394	34	31,7
19	7	17	41	4,4	42	822	579	396	34	31,8
20	7	18	40	12,7	42	856	582	397	34	31,9
21	7	19	39	21,1	42	890	584	399	34	32,1
22	7	20	38	29,4	42	924	587	401	34	32,2
23	7	21	37	37,7	43	958	589	402	35	32,4
24	7	22	36	46,1	43	992	592	404	35	32,5
25	7	23	35	54,4	43	26	594	406	35	32,6
26	7	24	35	2,7	43	59	597	408	35	32,8
27	7	25	34	11,1	43	93	599	409	35	32,9
28	7	26	33	19,4	43	127	602	411	35	33,1
29	7	27	32	27,7	44	161	604	413	35	33,2
30	7	28	31	36,1	44	195	607	414	36	33,3
31	7	29	30	44,4	44	229	609	416	36	33,5

Table of the Sun's mean motion, In Months and Days.

SEPTEMBER.

Days.	Longitude ☉				Apo.	I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	°	′	″	″	N.	N.	N.	N.	″
1	8	0	29	52,7	44	263	612	418	36	33,6
2	8	1	29	1,0	44	296	614	420	36	33,7
3	8	2	28	9,4	44	330	617	421	36	33,9
4	8	3	27	17,7	45	364	619	423	36	34,0
5	8	4	26	26,0	45	398	622	425	36	34,2
6	8	5	25	34,4	45	432	624	426	37	34,3
7	8	6	24	42,7	45	466	627	428	37	34,4
8	8	7	23	51,0	45	500	629	430	37	34,6
9	8	8	22	59,4	45	534	632	432	37	34,7
10	8	9	22	7,7	46	567	634	433	37	34,8
11	8	10	21	16,0	46	601	637	435	37	35,0
12	8	11	20	24,4	46	635	639	437	38	35,1
13	8	12	19	32,7	46	669	642	438	38	35,3
14	8	13	18	41,0	46	703	644	440	38	35,4
15	8	14	17	49,4	47	737	647	442	38	35,5
16	8	15	16	57,7	47	771	649	444	38	35,7
17	8	16	16	6,0	47	804	652	445	38	35,8
18	8	17	15	14,3	47	838	654	447	38	35,9
19	8	18	14	22.7	47	872	657	449	39	36,1
20	8	19	13	31,0	48	906	659	450	39	36,2
21	8	20	12	39,3	48	940	662	452	39	36,4
22	8	21	11	47,7	48	974	664	454	39	36,5
23	8	22	10	56,0	48	8	667	456	39	36,6
24	8	23	10	4,3	48	41	669	457	39	36,8
25	8	24	9	12,7	48	75	672	459	39	36,9
26	8	25	8	21,0	49	109	674	461	40	37,0
27	8	26	7	29,3	49	143	677	462	40	37,2
28	8	27	6	37,7	49	177	679	464	40	37,3
29	8	28	5	46,0	49	211	682	466	40	37,5
30	8	29	4	54,3	49	245	684	468	40	37,6

OCTOBER.

Days.	Longitude ☉				Apo.	I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	°	′	″	″	N.	N.	N.	N.	″
1	9	0	4	2,6	50	279	687	469	40	37,8
2	9	1	3	11,0	50	312	689	471	40	37,9
3	9	2	2	19,3	50	346	692	473	41	38,0
4	9	3	1	27,6	50	380	694	474	41	38,1
5	9	4	0	36,0	50	414	697	476	41	38,3
6	9	4	59	44,3	50	448	699	478	41	38,4
7	9	5	58	52,6	51	482	702	480	41	38,6
8	9	6	58	1,0	51	516	704	481	41	38,7
9	9	7	57	9,3	51	549	707	483	41	38,8
10	9	8	56	17,6	51	583	709	485	42	39,0
11	9	9	55	26,0	51	617	712	486	42	39,1
12	9	10	54	34,3	52	651	714	488	42	39,2
13	9	11	53	42,6	52	685	717	490	42	39,4
14	9	12	52	50,9	52	719	720	491	42	39,5
15	9	13	51	59,3	52	753	722	493	42	39,7
16	9	14	51	7,6	52	786	725	495	43	39,8
17	9	15	50	15,9	52	820	727	497	43	39,9
18	9	16	49	24,3	53	854	730	498	43	40,1
19	9	17	48	32,6	53	888	732	500	43	40,2
20	9	18	47	40,9	53	922	735	502	43	40,3
21	9	19	46	49,3	53	956	737	503	43	40,5
22	9	20	45	57,6	53	990	740	505	43	40,6
23	9	21	45	5,9	53	24	742	507	44	40,8
24	9	22	44	14,3	54	57	745	509	44	40,9
25	9	23	43	22,6	54	91	747	510	44	41,0
26	9	24	41	30,9	54	124	750	512	44	41,2
27	9	25	41	39,2	54	159	752	514	44	41,3
28	9	26	40	47,6	54	193	755	515	44	41,5
29	9	27	39	55,9	55	227	757	517	44	41,6
30	9	28	39	4,2	55	261	760	519	45	41,7
31	9	29	38	12,6	55	294	762	521	45	41,9

Table of the Sun's mean motion, In Months and Days.

NOVEMBER.

Days.	Longitude ☉				Apo.		I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	°	′	″	′	″	N.	N.	N.	N.	″
1	10	0	37	20,9		55	328	765	522	45	42,0
2	10	1	36	29,2		55	362	767	524	45	4 ,1
3	10	2	35	37,6		55	396	770	526	45	42,3
4	10	3	34	45,0		56	430	772	527	45	42,4
5	10	4	33	54,2		56	464	775	529	45	42,6
6	10	5	33	2,6		56	498	777	531	46	42,7
7	10	6	32	10,9		56	531	780	533	46	42,8
8	10	7	31	19,2		56	565	782	534	46	43,0
9	10	8	30	27,5		57	599	785	536	46	43,1
10	10	9	29	35,9		57	633	787	538	46	43,2
11	10	10	28	44,2		57	667	790	539	46	43,4
12	10	11	27	52,5		57	701	792	541	46	43,5
13	10	12	27	0,9		57	735	795	543	47	43,7
14	10	13	26	9,2		58	768	797	545	47	43,8
15	10	14	25	17,5		58	802	800	546	47	43,9
16	10	15	24	25,9		58	836	802	548	47	44,1
17	10	16	23	34,2		58	870	805	550	47	44,2
18	10	17	22	42,5		58	904	807	551	47	44,3
19	10	18	21	50,9		58	938	810	553	48	44,5
20	10	19	20	59,2		59	972	812	555	48	44,6
21	10	20	20	7,5		59	6	815	557	48	44,8
22	10	21	19	15,8		59	39	817	558	48	44,9
23	10	22	18	24,2		59	73	820	560	48	45,0
24	10	23	17	32,5		59	107	822	562	48	45,2
25	10	24	16	40,8	1	0	141	825	563	48	45,3
26	10	25	15	49,2	1	0	175	827	565	49	45,4
27	10	26	14	57,5	1	0	209	830	567	49	45,6
28	10	27	14	5,8	1	0	243	832	569	49	45,7
29	10	28	13	14,2	1	0	276	835	570	49	45,9
30	10	29	12	22,5	1	0	310	837	572	49	46,0

DECEMBER.

Days.	Longitude ☉				Apo.		I. ☽	II. ♃	III. ♀	IV. ☊	Pre. Eq.
	s	°	′	″	′	″	N.	N.	N.	N.	″
1	11	0	11	30,8	1	1	344	840	574	49	46,1
2	11	1	10	39,2	1	1	378	842	575	49	46,3
3	11	2	9	47,5	1	1	412	845	577	50	46,4
4	11	3	8	55,8	1	1	446	847	579	50	46,5
5	11	4	8	4,1	1	1	480	850	581	50	46,7
6	11	5	7	12,5	1	1	513	852	582	50	46,8
7	11	6	6	20,8	1	2	547	855	584	50	47,0
8	11	7	5	29,1	1	2	581	857	586	50	47,1
9	11	8	4	37,5	1	2	615	860	587	50	47,2
10	11	9	3	45,8	1	2	649	862	589	51	47,4
11	11	10	2	54,1	1	2	683	865	591	51	47,5
12	11	11	2	2,5	1	3	717	867	593	51	47,6
13	11	12	1	10,8	1	3	751	870	594	51	47,8
14	11	13	0	19,1	1	3	784	872	596	51	47,9
15	11	13	59	27,5	1	3	818	875	598	51	48,1
16	11	14	58	35,8	1	3	852	877	599	51	48,2
17	11	15	57	44,1	1	3	886	880	601	52	48,3
18	11	16	56	52,4	1	4	920	882	603	52	48,5
19	11	17	56	0,8	1	4	954	885	605	52	48,6
20	11	18	55	9,1	1	4	988	887	606	52	48,7
21	11	19	54	17,4	1	4	21	890	608	52	48,9
22	11	20	53	25,8	1	4	55	892	610	52	49,0
23	11	21	52	34,1	1	5	89	895	611	53	49,2
24	11	22	11	42,4	1	5	123	898	613	53	49,3
25	11	23	50	50,8	1	5	157	900	615	53	49,4
26	11	24	49	59,1	1	5	191	903	617	53	49,6
27	11	25	49	7,4	1	5	225	905	618	53	49,7
28	11	26	48	15,8	1	5	258	908	620	53	49,9
29	11	27	47	24,1	1	6	292	910	622	53	50,0
30	11	28	46	32,4	1	6	326	913	623	54	50,1
31	11	29	45	40,7	1	6	360	915	625	54	50,3

Table of the Sun's mean motion, in Hours and Minutes.

In Hours.					In Minutes.				In Seconds.			
	Lon. ☉	I. ☽	II. ♃	III. ♀		Lo. ☉		Lo. ☉		L.☉		L.☉
h	′ ″	N.	N.	N.	′	′ ″	′	′ ″	″	″	″	″
1	2 27,8	1	0	0	1	0 2,5	31	1 16,4	1	0,0	31	1,3
2	4 55,7	[illegible]	0	0	2	0 4,9	32	1 18,8	2	0,1	32	1,3
3	7 23,5	4	0	0	3	0 7,4	33	1 21,3	3	0,1	33	1,4
4	9 51,4	6	0	0	4	0 9,9	34	1 23,8	4	0,2	34	1,4
5	12 19,2	7	1	0	5	0 12,3	35	1 26,2	5	0,2	35	1,4
6	14 47,1	8	1	0	6	0 14,8	36	1 28,7	6	0,2	36	1,5
7	17 14,9	10	1	[illegible]	7	0 17,2	37	1 31,2	7	0,3	37	1,5
8	19 42.8	11	1	1	8	0 19,7	38	1 33,6	8	0,3	38	1,6
6	22 10,6	13	1	1	9	0 22,2	39	1 36,1	9	0,4	39	1,6
10	24 38,5	14	1	1	10	0 24,6	40	1 38,6	10	0,4	40	1,6
11	27 6,3	16	1	1	11	0 27,1	41	1 41,0	11	0,5	41	1,7
12	29 34,2	17	1	1	12	0 29,6	42	1 43,5	12	0,5	42	1,7
13	32 2,0	18	1	1	13	0 32,0	43	1 46,0	13	0,5	43	1,8
14	34 29,9	20	1	1	14	0 34,5	44	1 48,4	14	0,6	44	1,8
15	36 57,7	21	2	1	15	0 37,0	45	1 50,9	15	0,6	45	1,8
16	39 25,6	23	2	1	16	0 39,4	46	1 54,3	16	0,7	46	1,9
17	41 53,4	24	[illegible]	1	17	0 41,9	47	1 55,8	17	0,7	47	1,9
18	44 21,2	25	2	1	18	0 44,4	48	1 58,3	18	0,7	48	2,0
19	46 49,1	27	[illegible]	1	19	0 46,8	49	2 0,7	19	0,8	49	2,0
20	49 16,9	28	2	1	20	0 49,3	50	2 3,2	20	0,8	50	2,1
21	51 44,8	30	[illegible]	1	21	0 51,7	51	2 5,7	21	0,9	51	2,1
22	54 12,6	31	[illegible]	2	22	0 54,2	52	2 8,1	22	0,9	52	2,1
23	56 40,5	32	2	2	23	0 56,7	53	2 10,6	23	0,9	53	2,2
24	59 8,3	34	3	[illegible]	24	0 59,1	54	2 13,1	24	1,0	54	2,2
					25	1 1,6	55	2 15,5	25	,0	55	2,3
					26	1 4,1	56	2 18,0	26	1,1	56	2,3
					27	1 6,5	57	2 20,4	27	1,1	57	2,3
					28	1 9,0	58	2 22,9	28	1,1	58	2,4
					29	1 11,5	59	2 25,4	29	1,2	59	2,4
					30	1 13,9	60	2 27,8	30	1,2	60	2,5

For the Sun's Longitude. Equation of the Centre.

Equation of the Sun's Centre in the Elliptical Hypothesis.

Argu. ☉ mean Longit. —— Longit. ☉ Apogee.

S.	0		1		2		S.
	——	Diff.	——	Diff.	——	Diff.	
°	° ′ ″	′ ″	° ′ ″	′ ″	° ′ ″	′ ″	°
0	0 0 0,0	1 58,6	0 56 43,5	1 43,1	1 38 59,5	1 0,8	30
1	0 1 58,6	1 58,4	0 58 26,6	1 42,0	1 40 0,3	0 59,0	29
2	0 3 57,0	1 58,4	1 0 8,6	1 40,9	1 40 59,3	0 57,3	28
3	0 5 55,4	1 58,2	1 1 49,5	1 39,9	1 41 56,6	0 55,5	27
4	0 7 53,6	1 58,2	1 3 29,4	1 38,7	1 42 52,1	0 53,6	26
5	0 9 51,8	1 58,0	1 5 8,1	1 37,6	1 43 45,7	0 51,7	25
6	0 11 49,8	1 57,7	1 6 45,7	1 36,5	1 44 37,4	0 50,0	24
7	0 13 47,5	1 57,5	1 8 22,2	1 35,2	1 45 27,4	0 48,0	23
8	0 15 45,0	1 57:3	1 9 57,4	1 34,2	1 46 15,4	0 46,2	22
9	0 17 42,3	1 57,0	1 11 31,6	1 32,8	1 47 1,6	0 44,2	21
10	0 19 39,3	1 56,7	1 13 4,4	1 31,6	1 47 45,8	0 42,3	20
11	0 21 36,0	1 56,3	1 14 36,0	1 30,2	1 48 28,1	0 40,3	19
12	0 23 32,3	1 55,7	1 16 6,2	1 29,0	1 49 8,4	0 38,5	18
13	0 25 28,0	1 55,3	1 17 35,2	1 27,6	1 49 46,9	0 36,6	17
14	0 27 23,3	1 54,9	1 19 2,8	1 26,2	1 50 23,5	0 34,4	16
15	0 29 18,2	1 54,4	1 20 29,0	1 24,8	1 50 57,9	0 32,4	15
16	0 31 12,6	1 54,0	1 21 53,8	1 23,4	1 51 30,3	0 30,5	14
17	0 33 6,6	1 53,4	1 23 17,2	1 21,8	1 52 0,8	0 28,5	13
18	0 35 0,0	1 52,7	1 24 39,0	1 20,5	1 52 29,3	0 26,4	12
19	0 36 52,7	1 52,1	1 25 59,5	1 18,9	1 52 55,7	0 24.4	11
20	0 38 44,8	1 51,5	1 27 18,4	1 17,4	1 53 20,1	0 22.4	10
21	0 40 36,3	1 50,6	1 28 35,8	1 15,8	1 53 42,5	0 20,3	9
22	0 42 26,9	1 49,9	1 29 51,6	1 14,3	1 54 2,8	0 18,3	8
23	0 44 16,8	1 49,2	1 31 5,9	1 12,6	1 54 21,1	0 16,2	7
24	0 46 6,0	1 48,5	1 32 18,5	1 11,0	1 54 37,3	0 14,0	6
25	0 47 54,5	1 47,6	1 33 29,5	1 9,4	1 54 51,3	0 12,0	5
26	0 49 42,1	1 46,8	1 34 38.9	1 7,7	1 55 3,3	0 9,9	4
27	0 51 28,9	1 45,8	1 35 46,6	1 6,1	1 55 13,2	0 7,7	3
28	0 53 14,7	1 44,8	1 36 52,7	1 4,3	1 55 20,9	0 5,6	2
29	0 54 59,5	1 44,0	1 37 57,0	1 2,5	1 55 26,5	0 3,6	1
30	0 56 43,5		1 38 59,5		1 55 30,1		0
	+		+		+		
	11		10		9		

For the Sun's Longitude. Equation of the Center.

Equation of the Sun's Center in the Elliptical Hypothesis.

Argu. ☉ mean Longit. —— Longit. ☉ Apogee.

S.	3		4		5		S.
	——	Diff.	——	Diff.	——	Diff.	
°	° ′ ″	′ ″	° ′ ″	′ ″	° ′ ″	′ ″	°
0	1 55 30,1	0 1,5	1 41 5,6	1 0,1	0 58 49,7	1 46,6	30
1	1 55 31,6	0 0,6	1 40 5,5	1 2,0	0 57 3,1	1 47,7	29
2	1 55 31,0	0 2,7	1 39 3,5	1 3,9	0 55 15,4	1 48,8	28
3	1 55 28,3	0 4,9	1 37 59,6	1 5,8	0 53 26,6	1 49,8	27
4	1 55 23,4	0 6,9	1 36 53,8	1 7,5	0 51 36,8	1 50,8	26
5	1 55 16,5	0 9,1	1 35 46,3	1 9,3	0 49 46,0	1 51,7	25
6	1 55 7,4	0 11,2	1 34 37,0	1 11,2	0 47 54,3	1 52,7	24
7	1 54 56,2	0 13,3	1 33 25,8	1 12,9	0 46 1,6	1 53,6	23
8	1 54 42,9	0 15,5	1 32 12,9	1 14,7	0 44 8,0	1 54,5	22
9	1 54 27,4	0 17,7	1 30 58,2	1 16,4	0 42 13,5	1 55,2	21
10	1 54 9,7	0 19,6	1 29 41,8	1 18,1	0 40 18,3	1 56,0	20
11	1 53 50,1	0 21,7	1 28 23,7	1 19,8	0 38 22,3	1 56,9	19
12	1 53 28,4	0 23,9	1 27 3,9	1 21,4	0 36 25,4	1 57,8	18
13	1 53 4,5	0 25,9	1 25 42,5	1 23,1	0 34 27,9	1 58,2	17
14	1 52 38,6	0 28,0	1 24 19,4	1 24,8	0 32 29,7	1 58,7	16
15	1 52 10,6	0 30,1	1 22 54,6	1 26,3	0 30 31,0	1 59,4	15
16	1 51 40,5	0 32,2	1 21 28,3	1 27,8	0 28 31,6	1 59,9	14
17	1 51 8,3	0 34,3	1 20 0,5	1 29,4	0 26 31,7	2 0,5	13
18	1 50 34,0	0 36,4	1 18 31,1	1 30,9	0 24 31;2	2 0,9	12
19	1 49 57,6	0 38,3	1 17 0,2	1 32,4	0 22 30,3	2 1,3	11
20	1 49 19,3	0 40,4	1 15 27,8	1 33,9	0 20 29,0	2 1,8	10
21	1 48 38,9	0 42,5	1 13 53,9	1 35,1	0 18 27,2	2 2,2	9
22	1 47 56,4	0 44,4	1 12 18,8	1 36,6	0 16 25,0	2 2,4	8
23	1 47 12,0	0 46,5	1 10 42,2	1 38,0	0 14 22,6	2 2,6	7
24	1 46 25,5	0 48,3	1 9 4,2	1 39,3	0 12 20,0	2 3,0	6
25	1 45 37,2	0 50,5	1 7 24,9	1 40,6	0 10 17,0	2 3,1	5
26	1 44 46,7	0 52,3	1 5 44,3	1 41,8	0 8 13,9	2 3,3	4
27	1 43 54,4	0 54,4	1 4 2,5	1 43,1	0 6 10,6	2 3,4	3
28	1 43 0,0	0 56,3	1 2 19,4	1 44,3	0 4 7,2	2 3,6	2
29	1 42 3,7	0 58,1	1 0 35,1	1 45,4	0 2 3,6	2 3,6	1
30	1 41 5,6		0 58 49,7		0 0 0,0		0
	+		+		+		
	8		7		6		

For the ☉ Lon. Equa. of ☽

Arg. Num. I. ☽.

N.	0	100	200	300	400	N.
	+	+	+	+	+	
	″	″	″	″	″	
0	0,0	4,7	7,6	7,6	4,7	100
10	0,5	5,1	7,7	7,4	4,3	90
20	1,0	5,5	7,9	7,2	3,9	80
30	1,5	5,8	7,9	7,0	3,4	70
40	2,0	6,2	8,0	6,8	2,9	60
50	2,5	6,5	8,0	6,5	2,5	50
60	2,9	6,8	8,0	6,2	2,0	40
70	3,4	7,0	7,9	5,8	1,5	30
80	3,9	7,2	7,9	5,5	1,0	20
90	4,3	7,4	7,7	5,1	0,5	10
100	4,7	7,6	7,6	4,7	0,0	0
	—	—	—	—	—	
	900	800	700	600	500	

For the ☉ Lon. Equa. of ♃

Arg. Num. II. ♃.

N.	0	100	200	300	400	N.
	+	+	+	+	+	
	″	″	″	″	″	
0	0,0	5,6	7,5	5,3	2,2	100
10	0,6	6,1	7,3	4,9	1,9	90
20	1,2	6,4	7,2	4,6	1,7	80
30	1,8	6,6	7,0	4,3	1,4	70
40	2,5	6,9	6,8	4,0	1,2	60
50	3,1	7,1	6,7	3,6	1,0	50
60	3,7	7,3	6,5	3,3	0,8	40
70	4,2	7,4	6,2	3,0	0,6	30
80	4,7	7,4	5,9	2,8	0,4	20
90	5,2	7,5	5,5	2,5	0,2	10
100	5,6	7,5	5,3	2,2	0,0	0
	—	—	—	—	—	
	900	800	700	600	500	

For the ☉ Lon. Equa. of ♀.

Arg. Num. III. ♀.

N.	0	100	200	300	400	N.
	—	+	+	+	+	
	″	″	″	″	″	
0	0,0	2,0	1,5	5,5	5,1	100
10	0,4	1,9	2,0	5,7	4,7	90
20	0,7	1,7	2,5	5,9	4,3	80
30	1,1	1,5	3,0	6,0	3,9	70
40	1,4	1,2	3,5	6,0	3,4	60
50	1,6	0,8	3,9	6,0	2,9	50
60	1,8	0,4	4,3	5,9	2,4	40
70	2,0	0,0	4,7	5,8	1,8	30
80	2,1	0,5	5,0	5,6	1,2	20
90	2,1	1,0	5,3	5,4	0,6	10
100	2,0	1,5	5,5	5,1	0,0	0
	+	±	—	—	—	
	900	800	700	600	500	

Of a Point in the Equinoctial.

Arg. Num. IV. ☊.

N.	0	100	200	300	400	N.
	+	+	+	+	+	
	′	″	″	″	″	
0	0,0	10,6	17,1	17,1	10,6	100
10	1,2	11,5	17,4	16,7	9,7	90
20	2,3	12,3	17,7	16,3	8,7	80
30	3,4	13,1	17,9	15,8	7,7	70
40	4.5	13,9	18,0	15,2	6,6	60
50	5,6	14,6	18,0	14,6	5,6	50
60	6,6	15,2	18,0	13,9	4,5	40
70	7,7	15,8	17,9	13,1	3,4	30
80	8,7	16,3	17,7	12,3	2,3	20
90	9,7	16,7	17,4	11,5	1,2	10
100	10,6	17,1	17,1	10,6	0,0	0
	—	—	—	—	—	
	900	800	700	600	500	

For the Logarithm of the Sun's diſtance from the Earth.

Logarithm of the Sun's diſtance from the earth in the Elliptic Hypotheſis.

Argu. ☉ mean-Longit. —— Longit. ☉ Apo.

S.	0		1		2		S.
	Log. diſt.	Diff.	Log. diſt.	Diff.	Log. diſt.	Diff.	
o	Part.	Part.	Part.	Part.	Part.	Part.	o
0	0.007236	1	0.006303	62	0.003724	108	30
1	0.007235	3	0.006241	64	0.003616	109	29
2	0.007232	5	0.006177	65	0.003507	110	28
3	0.007227	7	0.006112	67	0.003397	112	27
4	0.007220	10	0.006045	69	0.003285	112	26
5	0.007210	12	0.005976	71	0.003173	113	25
6	0.007198	14	0.005905	73	0.003060	114	24
7	0.007184	16	0.005832	74	0.002946	115	23
8	0.007168	17	0.005758	76	0.002831	116	22
9	0.007151	20	0.005682	78	0.002715	118	21
10	0.007131	22	0.005604	80	0.002597	119	20
11	0.007109	24	0.005524	81	0.002478	119	19
12	0.007085	26	0.005443	83	0.002359	119	18
13	0.007059	29	0.005360	84	0.002240	120	17
14	0.007030	31	0.005276	86	0.002120	121	16
15	0.006999	33	0.005190	88	0.001999	122	15
16	0.006966	35	0.005102	89	0.001877	122	14
17	0.006931	36	0.005013	91	0.001755	123	13
18	0.006895	38	0.004922	92	0.001632	124	12
19	0.006857	40	0.004830	94	0.001508	124	11
20	0.006817	42	0.004736	95	0.001384	125	10
21	0.006775	44	0,004641	97	0.001259	125	9
22	0.006731	47	0.004544	98	0.001134	125	8
23	0.006684	49	0.004446	99	0.001009	125	7
24	0.006635	51	0.004347	100	0.000884	126	6
25	0.006584	53	0.004247	102	0.000758	126	5
26	0.006531	54	0.004145	103	0.000632	127	4
27	0.006477	56	0.004042	105	0.000505	127	3
28	0.006421	58	0.003937	106	0.000378	127	2
29	0.006363	60	0.093831	107	0.000251	128	1
30	0.006303		0.003724		0.000123		0
S.	11		10		9		S.

S.	3		4		5		S.
	Log. diſt.	Diff.	Log. diſt.	Diff.	Log. diſt.	Diff.	
o	Part.	Part.	Part.	Part.	Part.	Part.	o
0	0.000123	127	9.996430	112	9.993664	66	30
1	9.999996	128	9.996318	111	9.993598	63	29
2	9.999868	127	9.996207	110	9.993535	61	28
3	9.999741	127	9.996097	110	9.993474	59	27
4	9.999614	127	9.995987	108	9.993415	58	26
5	9.999487	127	9.995879	107	9.993357	55	25
6	9.999360	127	9.995772	105	9.993302	53	24
7	9.999233	127	9.995667	104	9.993249	51	23
8	9.999106	127	9.995563	103	9.993198	49	22
9	9.998979	127	9.995460	102	9.993149	47	21
10	9.998852	126	9.995358	100	9.993102	45	20
11	9.998726	126	9.995158	98	9.993057	43	19
12	9.998600	126	9.995160	97	9.993014	40	18
13	9.998474	126	9.995063	96	9.992974	37	17
14	9.998348	125	9.994967	94	9.992937	35	16
15	9.998222	125	9.994873	93	9.992902	34	15
16	9 998098	124	9.994780	91	9.992868	32	14
17	9.997974	123	9.994689	90	9.992836	29	13
18	9.997851	122	9.994599	88	9.992807	26	12
19	9.997729	121	9.994511	86	9.992781	24	11
20	9.997608	121	9.994425	83	9.992757	22	10
21	9.997487	120	9.994342	82	9.992735	20	9
22	9.997367	120	9.994260	81	9.992715	18	8
23	9.997247	119	9.994179	80	9.992697	15	7
24	9.997128	119	9.994099	78	9.992682	13	6
25	9.997009	118	9.994021	75	9.992669	11	5
26	9.996891	117	9.993946	73	9.992658	8	4
27	9.996774	116	9.993873	71	9.992850	5	3
28	9.996658	115	9.993802	70	9.992645	3	2
29	9.996543	113	9.993732	68	9.992642	1	1
30	9.996430		9.993664		9.992641		0
S.	8		7		6		S.

For log. of the ☉ diſt. from the Earth. Equa. ☽.

Arg. Num. I. ☽.

	0	100	200	300	400	
	+	+	±	—	—	
N.	P.	P.	P.	P.	P.	N.
0	17	14	5	5	14	100
10	17	13	4	6	14	90
20	17	13	3	7	15	80
30	16	12	2	8	15	70
40	16	11	1	9	16	60
50	16	10	0	10	16	50
60	16	9	1	11	16	40
70	15	8	2	12	16	30
80	15	7	3	13	17	20
90	14	6	4	13	17	10
100	14	5	5	14	17	0
	+	+	±	—	—	
	900	800	700	600	500	

For log. of the ☉ diſt. from the Earth. Equa. ♃.

Arg. Num. II. ♃.

	0	100	200	300	400	
	+	+	+	—	—	
N.	P.	P.	P.	P.	P.	N.
0	4	4	4	0	6	100
10	4	5	4	0	6	90
20	4	5	4	1	7	80
30	4	5	3	2	8	70
40	4	5	3	[illegible]	8	60
50	4	5	3	3	9	50
60	4	5	2	4	9	40
70	4	4	[illegible]	4	9	30
80	4	4	1	5	9	20
90	4	4	1	6	9	10
100	4	4	0	6	9	0
	+	+	+	—	—	
	900	800	700	600	500	

For log. of the ☉ diſt. from the Earth. Equa. ♀.

Arg. Num. III. ♀.

	0	100	200	300	400	
	+	—	—	∓	+	
N.	P.	P.	P.	P.	P.	N.
0	4	0	5	3	3	100
10	4	1	5	3	3	90
20	4	1	5	2	4	80
30	3	2	5	2	4	70
40	3	3	5	1	5	60
50	3	3	4	0	5	50
60	2	4	4	1	5	40
70	2	4	4	2	5	30
80	1	4	4	2	6	20
90	1	5	3	3	6	10
100	0	5	3	3	6	0
	+	—	—	∓	+	
	900	800	700	600	500	

For log. of the ☉ diſt. from the Earth. Equa. ☊.

Arg. Num. IV. ☊.

	0	100	200	00	400	
	+	+	±	—	—	
N	″	″	″	″	″	N.
0	9,6	7,8	3,0	3,0	7,8	100
10	9,6	7,4	2,4	3,5	8,1	90
20	9,5	7,0	1,8	4,1	8,4	80
30	9,4	6,6	1,2	4,6	8,7	70
40	9,3	6,1	0,6	5,2	8,9	60
50	9,1	5,7	0,0	5,7	9,1	50
60	8,9	5,2	0,6	6,1	9,3	40
70	8,7	4,6	1,2	6,6	9,4	30
80	8,4	4,1	1,8	7,0	9,5	20
90	8,1	3,5	2,4	7,4	9,6	10
100	7,8	3,0	3,0	7,8	9,6	0
	+	+	±	—	—	
	900	800	700	600	500	

For the apparent ſemidiameter and hourly motion of the Sun.

Argument. ☉ mean Longit. —— Longit. ☉ Apogee.

S.	0		1		2		3		4		5		S.
	Sem. ☉	H. M. ☉	Sem. ☉	H. M. ☉	Sem. ☉	H. M. ☉	Sem. ☉	H. M. ☉	Sem. ☉	H. M. ☉	Sem. ☉	H. M. ☉	
°	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	°
0	15 46,9	2 23,0	15 48,9	2 23,6	15 54,6	2 25,3	16 2,5	2 27,7	16 10,7	2 30,2	16 16,9	2 32,2	30
1	15 46,9	2 23,0	15 49,0	2 23,6	15 54,8	2 25,3	16 2,8	2 27,8	16 11,0	2 30,3	16 17,1	2 32,2	29
2	15 46,9	2 23,0	15 49,2	2 23,7	15 55,1	2 25,4	16 3,1	2 27,9	16 11,2	2 30,4	16 17,2	2 32,3	28
3	15 46,9	2 23,0	15 49,3	2 23,7	15 55,3	2 25,4	16 3,3	2 28,0	16 11,5	2 30,4	16 17,4	2 32,3	27
4	15 46,9	2 23,0	15 49,5	2 23,8	15 55,6	2 25,5	16 3,6	2 28,1	16 11,7	2 30,5	16 17,5	2 32,3	26
5	15 46,9	2 23,0	15 49,6	2 23,8	15 55,8	2 25,6	16 3,9	2 28,2	16 12,0	2 30,6	16 17,6	2 32,4	25
6	15 47,0	2 23,0	15 49,8	2 23,9	15 56,1	2 25,6	16 4,2	2 28,3	16 12,2	2 30,7	16 17,8	2 32.4	24
7	15 47,0	2 33,0	15 49,9	2 23,6	15 56,3	2 25,7	16 4,5	2 28,4	16 12,5	2 30,8	12 17,9	2 32,5	23
8	15 47,0	2 23,0	15 50,1	2 24,0	15 56,6	2 25,8	16. 4,7	2 28,5	16 12,7	2 30,8	16 18,0	2 32.5	22
9	15 47,1	2 23,0	15 50,3	2 24,0	15 56,8	2 25,9	16 5,0	2 28,5	16 12,9	2 30,9	16 18,1	2 32,5	21
10	15 47,1	2 23,0	15 50,5	2 24,1	15 57,1	2 26,0	16 5,3	2 28,6	16 13,1	2 31,0	16 18,2	2 32,6	20
11	15 47,1	2 23,0	15 50,7	2 24,1	15 57,4	2 26,1	16 5,6	2 28,7	16 13,3	2 31,1	16 18,3	2 32,6	19
12	15 47,2	2 23,1	15 50,8	2 24,2	15 57,6	2 26,1	16 5,9	2 28,8	16 13,6	2 31,1	16 18,4	2 32,7	18
13	15 47,2	2 23,1	15 51,0	2 24,3	15 57,9	2 26,2	16 6,1	2 28,9	16 13,8	2 31,2	16 18,5	2 32,7	17
14	15 47,3	2 23,1	15 51,2	2 24,3	15 58,1	2 26,3	16 6,4	2 28,9	16 14,0	2 31,3	16 18,6	2 32,7	16
15	15 47,4	2 23,1	15 51,4	2 24,4	15 58,4	2 26,4	16 6,7	2 29,0	16 14,2	2 31,4	16 18,7	2 32,8	15
16	15 47,4	2 23,1	15 51,6	2 24,5	15 58,7	2 26,5	16 7,0	2 29,1	16 14,4	2 31,5	16 18,8	2 32,8	14
17	15 47,5	2 23,2	15 51,8	2 24,5	15 58,9	2 26,5	16 7,3	2 29,2	16 14,6	2 31,5	16 18,9	2 32,8	13
18	15 47,6	2 23,2	15 52,0	2 24,6	15 59,2	2 26,6	16 7,5	2 29,2	16 14,8	2 31,6	16 18,9	2 32,8	12
19	15 47,7	2 23,2	15 52,2	2 24,6	15 59,4	2 26,7	16 7,8	2 29,3	16 15,0	2 31,7	16 19,0	2 32,8	11
20	15 47,8	2 23,2	15 52,4	2 24,7	15 59,7	2 26,8	16 8,1	2 29,4	16 15,2	2 31,7	16 19,0	2 32,8	10
21	15 47,6	2 23,3	15 52,6	2 24,7	16 0,0	2 26,9	16 8,4	2 29,5	16 15,4	2 31,8	16 19,1	2 32,8	9
22	15 48,0	2 23,3	15 52,8	2 24,8	16 0,3	2 27,0	16 8,6	2 29,6	16 15,6	2 31,8	16 19,1	2 32,8	8
23	15 48,1	2 23,3	15 53,0	2 24,8	16 0,5	2 27,1	16 8,9	2 29,7	16 15,8	2 31,9	16 19,1	2 32,9	7
24	15 48,2	2 23,4	15 53,2	2 24,9	16 0,8	2 27,2	16 9,2	2 29,7	16 16,0	2 32,0	16 19,2	2 32,9	6
25	15 48,3	2 23,4	15 53,4	2 25,0	16 1,1	2 27,3	16 9,5	2 29,8	16 16,1	2 32,0	16 19,2	2 32,9	5
26	15 48,4	2 23,4	15 53,6	2 25,1	16 1,4	2 27,3	16 9,8	2 29,9	16 16,3	2 32,1	16 19,2	2 32,9	4
27	15 48,5	2 23,5	15 53,8	2 25,1	16 1,7	2 27,4	16 10,0	2 30,0	16 16,4	2 32,1	16 19,2	2 32,9	3
28	15 48,6	2 23,5	15 54,1	2 25,2	16 1,9	2 27,5	16 10,3	2 30,1	16 16,6	2 32,2	16 19,2	2 32,9	2
29	15 48,8	2 23,6	15 54,3	2 25,2	16 2,2	2 27,6	16 10,5	2 30,1	16 16,8	2 32,2	16 19,3	2 32,9	1
30	15 48,9	2 23,6	15 54,6	2 25,3	16 2,5	2 27,7	16 10,7	2 30,2	16 16,9	2 32,2	16 19,3	2 32,9	0
S.	11		10		9		8		7		6		S.

For right Aſcenſion of a Point of the Ecliptic. Reduction of the Ecliptic to the Equator.

According to the obliquity of the Ecliptic 23° 28′ 15″,

With the change of reduction for the change of the obliquity one minute.

Argument. Longitude of a point in the Ecliptic.

S.	0	6		1	7		2	8		S.
	——	Diff.	Change.	——	Diff.	Change.	——	Diff.	Change.	
° ′	° ′ ″	′ ″	″	° ′ ″	′ ″	″	° ′ ″	′ ″	″	° ′
0 0	0 0 0,0	2 28,9	0,0	2 5 42,4	1 19,7	10,8	2 11 14,7	1 15,3	11,7	30 0
0 30	0 2 28,9	2 28,9	0,2	2 7 2,1	1 17,5	10,9	2 9 59,4	1 17,7	11,6	29 30
1 0	0 4 57,8	2 28,8	0,4	2 8 19,6	1 15,3	11,0	2 8 41,6	1 20,4	11,5	29 0
1 30	0 7 26,6	2 28,7	0,6	2 9 34,9	1 13,0	11,1	2 7 21,2	1 22,8	11,4	28 30
2 0	0 9 55,3	2 28,5	0,8	2 10 47,9	1 10,8	11,2	2 5 58,4	1 25,2	11,3	28 0
2 30	0 12 23,8	2 28,3	1,0	2 11 58,7	1 8,6	11,3	2 4 33,2	1 27,8	11,2	27 30
3 0	0 14 52,1	2 28,1	1,3	2 13 7,3	1 6,3	11,5	2 3 5.4	1 30,1	11,1	27 0
3 30	0 17 20,2	2 27,8	1,5	2 14 13,6	1 4,0	11,6	2 1 35,3	1 32,6	10,9	26 30
4 0	0 19 48,0	2 27,5	1,7	2 15 17,6	1 1,5	11,7	2 0 2,7	1 35,0	10,8	26 0
4 30	0 22 15,5	2 27.1	1,9	2 16 19,1	0 59,1	11,8	1 58 27,7	1 37,2	10,7	25 30
5 0	0 24 42,6	2 26,7	2,1	2 17 18,2	0 56,9	11,8	1 56 50,5	1 39,6	10,5	25 0
5 30	0 27 9,3	2 26,3	2,3	2 18 15,1	0 54,4	11,9	1 55 10,9	1 41,9	10,4	24 30
6 0	0 29 35,6	2 25,9	2,5	2 19 9,5	0 51,9	12,0	1 53 29,0	1 44,2	10,2	24 0
6 30	0 32 1,5	2 25,3	2,7	2 20 1,4	0 49,6	12,1	1 51 44,8	1 46,3	10,1	23 30
7 0	0 34 26,8	2 24,7	2,9	2 20 51,0	0 47,1	12,2	1 49 58,5	1 48,5	9,9	23 0
7 30	0 36 51,5		3,1	2 21 38,1		12,2	1 48 10,0		9,8	22 30

For right Aſcenſion of a Point of the Ecliptic. Reduction of the Ecliptic to the Equator.

According to the obliquity of the Ecliptic, 23° 28′ 15″,
With the change of reduction for the change of the Obliquity one minute.

Argument. Longitude of a point in the Ecliptic.

S.		0			6			1			7			2			8			S.	
			——		Diff.		Change.		——		Dff.		Change.		——		Diff.		Change.		
°	′	°	′	″	′	″	″	°	′	″	′	″	″	°	′	″	′	″	″	°	′
8	0	0	39	15,6	2	25,8	3,3	2	22	22,6	0	44,5	12,3	1	46	19,3	1	50,7	9,6	22	0
8	30	0	41	39,1	2	23,5	3,5	2	23	4,6	0	42,0	12,4	1	44	26,5	1	52,8	9,4	21	30
9	0	0	44	2,0	2	22,9	3,7	2	23	44,1	0	39,5	12,5	1	42	31,5	1	55,0	9,3	21	0
9	30	0	46	24,2	2	22,2	3,9	2	24	21,0	0	36,9	12,5	1	40	34,5	1	57,0	9,1	20	30
10	0	0	48	45,5	2	21,3	4,1	2	24	55,5	0	34,5	12,6	1	38	35,5	1	59,0	8,9	20	0
10	30	0	51	6,1	2	20,6	4,3	2	25	27,3	0	31,8	12,6	1	36	34,5	2	1,0	8,8	19	30
11	0	0	53	25,9	2	19,8	4,5	2	25	56,6	0	29,3	12,7	1	34	31,5	2	3,0	8,6	19	0
11	30	0	55	44,8	2	18,9	4,7	2	26	23,2	0	26,6	12,7	1	32	26,7	2	4,8	8,4	18	30
12	0	0	58	2,8	2	18,0	4,9	2	26	47,2	0	24,0	12,8	1	30	19,9	2	6,8	8,2	18	0
12	30	1	0	19,9	2	17,1	5,1	2	27	8,7	0	21,5	12,8	1	28	11,2	2	8,7	8,0	17	30
13	0	1	2	35,9	2	16,0	5,3	2	27	27,3	0	18,6	12,9	1	26	1,0	2	10,2	7,8	17	0
13	30	1	4	50,9	2	15,0	5,5	2	27	43,3	0	16,0	12,9	1	23	48,9	2	12,1	7,6	16	30
14	0	1	7	4,9	2	14,0	5,7	2	27	56,8	0	13,5	12,9	1	21	35,1	2	13,1	7,4	16	0
14	30	1	9	17,8	2	12,9	5,8	2	28	7,6	0	10,8	13,0	1	19	19,7	2	15,4	7,2	15	30
15	0	1	11	29,6	2	11,8	6,0	2	28	15,6	0	8,0	13,0	1	17	2,6	2	17,1	7,0	15	0
15	30	1	13	40,2	2	10,6	6,2	2	28	20,9	0	5,3	13,0	1	14	44,0	2	18,6	6,8	14	30
16	0	1	15	49,6	2	9,4	6,4	2	28	23,9	0	2,7	13,0	1	12	23,7	2	20,3	6,6	14	0
16	30	1	17	57,8	2	8,2	6,6	2	28	23,6	0	0,0	13,0	1	10	1,9	2	21,8	6,4	13	30
17	0	1	20	4,6	2	6,8	6,8	2	28	20,7	0	2,9	13,0	1	7	38,9	2	23,0	6,2	13	0
17	30	1	22	10,1	2	5,5	7,0	2	28	15,0	0	5,7	13.0	1	5	14,5	2	24.5	6,0	12	30
18	0	1	24	14,4	2	4,3	7,1	2	28	6,9	0	8,1	13,0	1	2	48,6	2	25,9	5,7	12	0
18	30	1	26	17,3	2	2,9	7,3	2	27	56,1	0	10,8	13,0	1	0	21.4	2	27,2	5,5	11	30
19	0	1	28	18,7	2	1,4	7,5	2	27	42,3	0	13,8	13,0	0	57	53,1	2	28,3	5,3	11	0
19	30	1	30	18,7	2	0,0	7,6	2	27	25,8	0	16,5	13,0	0	55	23,5	2	29,6	5,1	10	30
20	0	1	32	17,1	1	58,4	7,8	2	27	6,6	0	19,2	13,0	0	52	52,8	2	30,7	4,8	10	0
20	30	1	34	14,1	1	57,0	8,0	2	26	44,7	0	21,9	12,9	0	50	21,0	2	31,8	4,6	9	30
21	0	1	36	9,4	1	55,3	8,2	2	26	20,1	0	24,6	12,9	0	47	48,1	2	32,9	4,4	9	0
21	30	1	38	3,2	1	53,8	8,3	2	25	52,6	0	27,5	12.9	0	45	14,3	2	33,8	4,2	8	30
22	0	1	39	55,4	1	52,2	8,5	2	25	22,6	0	30,0	12,9	0	42	39,5	2	34,8	3,9	8	0
22	30	1	41	45,8	1	50,4	8,7	2	24	49,9	0	32,7	12,8	0	40	3,8	2	35,7	3,6	7	30
23	0	1	43	34,7	1	48,9	8,8	2	24	14,2	0	35,7	12,8	0	37	27,4	2	36,4	3,4	7	0
23	30	1	45	21,8	1	47,1	9,0	2	23	35,8	0	38,4	12,7	0	34	50,2	2	37,2	3,1	6	30
24	0	1	47	7,1	1	45,3	9,1	2	22	54,9	0	40,9	12,7	0	32	12,1	2	38,1	2,9	6	0
24	30	1	48	50,6	1	43,5	9,3	2	22	11,3	0	43,6	12,6	0	29	33,4	2	38,7	2,7	5	30
25	0	1	50	32,3	1	41,7	9,4	2	21	24,8	0	46,5	12,6	0	26	54,2	2	39,2	2,5	5	0
25	30	1	52	12,2	1	39,9	9,6	2	20	35,6	0	49,2	12,5	0	24	14,5	2	39,7	2,2	4	30
26	0	1	53	50,1	1	37,9	9,7	2	19	43,9	0	51,7	12,4	0	21	34,1	2	40,4	2,0	4	0
26	30	1	55	26,1	1	36,0	9,9	2	18	49,6	0	54,3	12,4	0	18	53,3	2	40,8	1,8	3	30
27	0	1	57	0,3	1	34,2	10,0	2	17	52,4	0	57,2	12,3	0	16	12,1	2	41,2	1,5	3	0
27	30	1	58	32,4	1	32,1	10,1	2	16	52,6	0	59,8	12,2	0	13	30,6	2	41,5	1,3	2	30
28	0	2	0	2,5	1	30,1	10,3	2	15	50,2	1	2,4	12,1	0	10	48,8	2	41,8	1,0	2	0
28	30	2	1	30,6	1	28,1	10,4	2	14	45,2	1	5,0	12,0	0	8	6,8	2	42,0	0,7	1	30
29	0	2	2	56,6	1	26,0	10,5	2	13	37,7	1	7,5	11,9	0	5	24,6	2	42,2	0,5	1	0
29	30	2	4	20,6	1	24,0	10,7	2	12	27,5	1	10,2	11,8	0	2	42,3	2	42,3	0,3	0	30
30	0	2	5	42,4	1	21,8	10,8	2	11	14,7	1	12,8	11,7	0	0	0,0	2	42,3	0,0	0	0
			+						+						+						
S.			5		11				4		10				3		9			S.	

Declination of the Points of the Ecliptic.

According to the Obliquity of the Ecliptic, 23°. 28′. 15″.
With the Change of Reduction, for the Change of the Obliquity, one Minute.

Argument. Longitude of the Point in the Ecliptic.

S.		0 + 6 —						1 + 7 —						2 + 8 —						S.	
		Declination.			Diff.		Change.	Declination.			Diff.		Change.	Declination.			Diff.		Change.		
°	′	°	′	″	′	″	″	°	′	″	′	″	″	°	′	″	′	″	″	°	′
0	0	0	0	0,0			0,0	11	29	12,3			28,1	20	10	37,4			50,8	30	0
0	30	0	11	57,0	11	57,0	0,5	11	39	44,4	10	32,1	28,5	20	16	56,6	6	19,2	51,1	29	30
1	0	0	23	53,8	11	56,8	1,0	11	50	13,7	10	29,3	29,0	20	23	10,1	6	13,5	51,4	29	0
1	30	0	35	50,5	11	56,7	1,4	12	0	40,1	10	26,4	29,4	20	29	18,1	6	8,0	51,7	28	30
2	0	0	47	47,1	11	56,6	1,9	12	11	3,6	10	23,5	29,9	20	35	20,5	6	2,4	51,9	28	0
2	30	0	59	43,5	11	56,4	2,4	12	21	24,1	10	20,5	30,3	20	41	17,2	5	56,7	52,2	27	30
3	0	1	11	39,8	11	56,3	2,9	12	31	41,5	10	17,4	30,7	20	47	8,2	5	51,0	52,4	27	0
3	30	1	23	35,7	11	55,9	3,4	12	41	55,8	10	14,3	31,2	20	52	53,4	5	45,2	52,7	26	30
4	0	1	35	31,3	11	55,6	3,8	12	52	7,1	10	11,3	31,6	20	58	32,9	5	39,5	53,0	26	0
4	30	1	47	26,6	11	55,3	4,3	13	2	15,2	10	8,1	32,0	21	4	6,6	5	33,7	53,2	25	30
5	0	1	59	21,4	11	54,8	4,8	13	12	20,0	10	4,8	32,4	21	9	34,4	5	27,8	53,5	25	0
5	30	2	11	15,9	11	54,5	5,3	13	22	21,5	10	1,5	32,8	21	14	56,3	5	21,9	53,7	24	30
6	0	2	23	9,7	11	53,8	5,8	13	32	19,8	9	58,3	33,3	21	20	12,3	5	16,0	54,0	24	0
6	30	2	35	3,0	11	53,3	6,2	13	42	14,7	9	54,9	33,7	21	25	22,4	5	10,1	54,2	23	30
7	0	2	46	55,7	11	52,7	6,7	13	52	6,2	9	51,5	34,1	21	30	26,5	5	4,1	54,5	23	0
7	30	2	58	47,9	11	52,2	7,2	14	1	54,2	9	48,0	34,5	21	35	24,7	4	58,2	54,7	22	30
8	0	3	10	39,2	11	51,3	7,7	14	11	38,6	9	44,4	35,0	21	40	16,6	4	51,9	54,9	22	0
8	30	3	22	29,9	11	50,7	8,2	14	21	19,4	9	40,8	35,4	21	45	2,5	4	45,9	55,2	21	30
9	0	3	34	19,7	11	49,8	8,6	14	30	56,9	9	37,5	35,8	21	49	42,3	4	39,8	55,4	21	0
9	30	3	46	8,6	11	48,9	9,1	14	40	30,6	9	33,7	36,2	21	54	15,9	4	33,6	55,6	20	30
10	0	3	57	56,9	11	48,3	9,6	14	50	0,6	9	30,0	36,6	21	58	43,5	4	27,6	55,8	20	0
10	30	4	9	44,2	11	47,3	10,1	14	59	26,7	9	26,1	37,0	22	3	4,8	4	21,3	56,0	19	30
11	0	4	21	30,4	11	46,2	10,6	15	8	49,2	9	22,5	37,4	22	7	19,9	4	15,1	56,2	19	0
11	30	4	33	15,7	11	45,3	11,0	15	18	7,8	9	18,6	37,8	22	11	28,9	4	9,0	56,4	18	30
12	0	4	44	59,9	11	44,2	11,5	15	27	22,6	9	14,8	38,2	22	15	31,3	4	2,4	56,6	18	0
12	30	4	56	43,0	11	43,1	12,0	15	36	33,3	9	10,7	38,6	22	19	27,4	3	56,1	56,8	17	30
13	0	5	8	24,9	11	41,9	12,4	15	45	40,1	9	6,8	39,0	22	23	17,3	3	49,9	57,0	17	0
13	30	5	20	5,7	11	40,8	12,9	15	54	42,9	9	2,8	39,4	22	27	0,8	3	43,5	57,1	16	30
14	0	5	31	45,2	11	39,5	13,4	16	3	4 ,6	8	58,7	39,8	22	30	38,0	3	37,2	57,3	16	0
14	30	5	43	23,4	11	38,2	13,9	16	12	36,2	8	54,6	40,2	22	34	8,6	3	30,6	57,5	15	30
15	0	5	55	0,2	11	36,8	14,3	16	21	26,6	8	50,4	40,6	22	37	32,9	3	24,3	57,6	15	0
15	30	6	6	35,8	11	35,6	14,8	16	30	12,8	8	46,2	41,0	22	40	50,6	3	17,7	57,8	14	30
16	0	6	18	9,8	11	34,0	15,3	16	38	54,8	8	42,0	41,4	22	44	2,0	3	11,4	57,9	14	0
16	30	6	29	42,4	11	32,6	15,7	16	47	32,4	8	37,6	41,7	22	47	6,8	3	4,8	58,0	13	30
17	0	6	41	13,4	11	31,0	16,2	16	56	5,7	8	33,3	42,1	22	50	5,0	2	58,2	58,2	13	0
17	30	6	52	42,9	11	29,5	16,7	17	4	34,5	8	28,8	42,5	22	52	56,8	2	51,8	58,3	12	30
18	0	7	4	10,8	11	27,9	17,1	17	12	59,0	8	24,5	42,9	22	55	41,9	2	45,1	58,4	12	0
18	30	7	15	36,9	11	26,1	17,6	17	21	19,4	8	20,4	43,2	22	58	20,4	2	38,5	58,6	11	30
19	0	7	27	1,5	11	24,6	18,1	17	29	34,4	8	15,0	43,6	23	0	52,3	2	31,9	58,7	11	0
19	30	7	38	24,1	11	22,6	18,5	17	37	45,2	8	10,8	43,9	23	3	17,6	2	25,3	58,8	10	30
20	0	7	49	45,1	11	21,0	19,0	17	45	51,5	8	6,3	44,3	23	5	36,3	2	18,7	58,9	10	0
20	30	8	1	4,3	11	19,2	19,4	17	53	53,0	8	1,5	44,6	23	7	48,3	2	12,0	59,0	9	30
21	0	8	12	21,4	11	17,1	19,9	18	1	49,8	7	56,8	45,0	23	9	53,6	2	5,3	59,1	9	0
21	30	8	23	36,7	11	15,3	20,4	18	9	41,9	7	52,1	45,3	23	11	52,2	1	58,6	59,2	8	30
22	0	8	34	49,9	11	13,2	20,8	18	17	29,2	7	47,3	45,7	23	13	44,2	1	52,0	59,3	8	0
22	30	8	46	1,0	11	11,1	21,3	18	25	11,6	7	42,4	46,0	23	15	29,4	1	45,2	59,4	7	30
23	0	8	57	10,2	11	9,2	21,7	18	32	49,2	7	37,6	46,4	23	17	7,9	1	38,5	59,5	7	0
23	30	9	8	17,3	11	7,1	22,2	18	40	21,8	7	32,6	46,7	23	18	39,6	1	31,7	59,5	6	30
24	0	9	19	22,0	11	4,7	22,7	18	47	49,4	7	27,6	47,1	23	20	4,6	1	25,0	59,6	6	0
24	30	9	30	24,6	11	2,6	23,2	18	55	12,1	7	22,7	47,4	23	21	22,8	1	18,2	59,6	5	30
25	0	9	41	24,8	11	0,2	23,6	19	2	29,6	7	17,5	47,7	23	22	34,3	1	11,5	59,7	5	0
25	30	9	52	22,8	10	58,0	24,1	19	9	42,0	7	12,4	48,0	23	23	39,0	1	4,7	59,7	4	30
26	0	10	3	18,4	10	55,6	24,5	19	16	49,3	7	7,3	48,4	23	24	36,9	0	57,9	59,8	4	0
26	30	10	14	11,6	10	53,2	25,0	19	23	51,4	7	2,1	48,7	23	25	28,0	0	51,1	59,8	3	30
27	0	10	25	2,3	10	50,7	25,5	19	30	48,3	6	56,9	49,0	23	26	12,3	0	44,3	59,8	3	0
27	30	10	35	50,6	10	48,3	25,9	19	37	39,9	6	51,6	49,3	23	26	49,8	0	37,5	59,9	2	30
28	0	10	46	36,2	10	45,6	26,3	19	44	26,2	6	46,3	49,6	23	27	20,4	0	30,6	59,9	2	0
28	30	10	57	19,1	10	42,9	26,8	19	51	7,3	6	41,1	49,9	23	27	44,3	0	23,9	59,9	1	30
29	0	11	7	59,6	10	40,5	27,2	19	57	42,8	6	35,5	50,2	23	28	1,4	0	17,1	60,0	1	0
29	30	11	18	37,4	10	37,8	27,7	20	4	12,8	6	30,0	50,5	23	28	11,6	0	10,2	60,0	0	30
30	0	11	29	12,3	10	34,9	28,1	20	10	37,4	6	24,6	50,8	23	28	15,0	0	3,4	60,0	0	0
S.		5 + 11 —						4 + 10 —						3 + 9 —						S.	

ASTRONOMICAL REFRACTIONS.

For the height of the barometer 28°. 0′ Paris, and the graduation of Reaumur's thermometer, 10°. above freezing, with variations for 10 lines in the height of the barometer, and 10 degrees of the thermometer.*

Sun's parallax, In the vertical circle.													
Diſt. from vert.	Sun's Parallax	Diſt. from vert.	Refract for bar. 28^d th. + 10	Var. for 10 lin. bar.	Var. for 10 d. ther.	Diſt. from vert.	Refract for bar $28^d 0'$ th. + 10	Var. for 10 lin. bar.	Var. for 10 d. ther.	Diſt. from vert.	Refract. for bar. $28^d 0'$ ther. + 10.	Var. for 10 lin. bar.	Var. for 10 d. ther.
°	″	°	′ ″	″	″	°	′ ″	″	″	°	″	″	″
0	0,0	0	0 0,0	0,0	0,0	30	0 33,1	1,0	1,5	60	1 39,0	2,9	4,5
3	0,4	1	0 1,0	0,0	0,0	31	0 34,4	1,0	1,5	61	1 43,2	3,0	4,7
6	0,9	2	0 2,0	0,1	0,1	32	0 35,8	1,1	1,6	62	1 47,6	3,1	4,9
9	1,4	3	0 3,0	0,1	0,1	33	0 37,2	1,1	1,7	63	1 52,3	3,2	5,1
12	1,8	4	0 4,0	0,1	0,2	34	0 38,7	1,2	1,7	64	1 57,2	3,4	5,3
15	2,3	5	0 5,0	0,2	0,2	35	0 40,2	1,2	1,8	65	2 2,4	3,5	5,6
18	2,7	6	0 6,1	0,2	0,2	36	0 41,7	1,2	1,9	66	2 8,0	3,7	5,9
21	3,1	7	0 7,1	0,2	0,3	37	0 43,3	1,3	2,0	67	2 14,2	4,0	6,3
24	3,6	8	0 8,1	0,2	0,3	38	0 44,9	1,3	2,0	68	2 20,9	4,2	6,6
27	4,0	9	0 9,2	0,3	0,4	39	0 46,5	1,4	2,1	69	2 28,3	4,4	6,9
30	4,4	10	0 10,2	0,3	0,4	40	0 48,1	1,4	2,2	70	2 36,3	4,7	7,3
33	4,8	11	0 11,2	0,3	0,5	41	0 49,8	1,5	2,2	71	2 45,1	5,0	7,7
36	5,2	12	0 12,3	0,4	0,5	42	0 51,6	1,5	2,3	72	2 54,7	5,3	8,2
39	5,5	13	0 13,3	0,4	0,6	43	0 53,4	1,6	2,4	73	3 5,5	5,6	8,7
42	5,9	14	0 14,4	0,4	0,6	44	0 55,3	1,6	2,5	74	3 17,5	5,9	9,3
45	6,2	15	0 15,4	0,5	0,7	45	0 57,3	1,7	2,6	75	3 31,0	6,3	9,9
48	6,5	16	0 16,5	0,5	0,7	46	0 59,3	1,8	2,7	76	3 46,4	6,8	10,6
51	6,8	17	0 17,6	0,5	0,8	47	1 1,4	1,9	2,8	77	4 3,8	7,3	11,5
54	7,1	18	0 18,7	0,6	0,8	48	1 3,6	2,0	2,9	78	4 24,0	7,9	12,5
57	7,4	19	0 19,8	0,6	0,9	49	1 5,9	2,0	3,0	79	4 46,6	8,6	13,7
60	7,6	20	0 20,9	0,6	0,9	50	1 8,2	2,1	3,1	80	5 15,6	9,4	14,9
63	7,8	21	0 22,0	0,7	1,0	51	1 10,6	2,2	3,2	81	5 49,0	10,4	16,5
66	8,0	22	0 23,2	0,7	1,0	52	1 13,2	2,3	3,4	82	6 29,7	11,6	18,5
69	8,2	23	0 24,3	0,7	1,1	53	1 15,9	2,3	3,5	83	7 20,3	13,1	21,3
72	8,4	24	0 25,5	0,8	1,2	54	1 18,7	2,4	3,7	84	8 24,7	15,0	24,9
75	8,5	25	0 26,7	0,8	1,2	55	1 21,6	2,5	3,8	85	9 48,8	17,5	29,6
78	8,6	26	0 28,0	0,8	1,3	56	1 24,7	2,5	3,9	86	11 41,8		
81	8,7	27	0 29,2	0,9	1,3	57	1 28,0	2,6	4,1	87	14 18,4		
84	8,7	28	0 30,5	0,9	1,4	58	1 31,5	2,7	4,2	88	18 1,3		
87	8,8	29	0 31,8	1,0	1,4	59	1 35,2	2,8	4,3	89	23 21,4		
90	8,8	30	0 33,1	1,0	1,5	60	1 39,0	2,9	4,5	90	30 50,8	55,0	129,2

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* This table alſo anſwers to the height of the barometer 29,6 inches, Engliſh meaſure, and to 50° of Fahrenheit's thermometer; or to the height of the barometer 30 Engliſh inches, and 55° of Fahrenheit's thermometer. And the column of variation of refraction for 10 lines of the barometer, Paris meaſure, anſwers to a difference of 9-10ths of an inch, Engliſh meaſure, from the given height 29,6 or 30,00 inches; and the column of variation of refraction of 10° of Reaumur's thermometer anſwers to a difference of 20° of Fahrenheit's thermometer from the given degree 50 or 55°.

Epochs of the mean Motion of the Moon.

Years current. Mean Time, for the Meridian of the Royal Obſervatory at Greenwich.

Greg. Style.	Mean Long. m				Accel. +	Mean Ano. ☽				Long. ☊			
Yrs. ſince C.	s	°	'	"	"	s	°	'	"	s	°	'	"
B. 1600	3	16	17	51,0	9,0	9	8	59	46	10	1	32	6
B. 20	7	29	52	34,0	5,8	10	18	44	14	9	4	41	51
B. 40	0	13	27	17,0	3,2	11	28	28	42	8	7	51	36
B. 60	4	27	2	0,0	1,4	1	8	13	10	7	11	1	21
B. 80	9	10	36	43,0	0,4	2	17	57	38	6	14	11	6
B. 1700	1	11	0	51,0	0,0	3	14	38	12	5	17	24	1
1	5	20	23	56,4	0,0	6	13	21	26	4	28	4	18
2	9	29	47	1,8	0,0	9	12	4	41	4	8	44	35
3	2	9	10	7,2	0,0	0	10	47	56	3	19	24	52
B. 4	7	1	43	47,6	0,0	3	22	35	5	3	0	1	58
5	11	11	6	53,0	0,0	6	21	18	20	2	10	42	15
6	3	20	29	58,4	0,0	9	20	1	35	1	21	22	32
7	7	29	53	3,8	0,0	9	18	44	50	1	2	2	49
B. 8	0	22	26	44,2	0,1	4	0	31	59	0	12	39	55
9	5	1	49	49,6	0,1	6	29	15	14	11	23	20	12
1710	9	11	12	55,0	0,1	9	27	58	29	11	4	0	29
11	1	20	36	0,4	0,1	0	26	41	43	10	14	40	46
B. 12	6	13	9	40,8	0,1	4	8	28	52	9	25	17	52
13	10	22	32	46,2	0,2	7	7	12	7	9	5	53	9
14	3	1	55	51,6	0,2	10	5	55	22	8	16	38	26
15	7	11	18	57,0	0,2	1	4	38	37	7	27	18	43
B. 16	0	3	52	37,4	0,2	4	16	25	46	7	7	55	49
17	4	13	15	42,8	0,3	7	15	9	1	6	18	36	6
18	8	22	38	48,2	0,3	10	13	52	16	5	29	16	23
19	1	2	1	53,6	0,3	1	12	35	31	5	9	56	40
B. 1720	5	24	35	34,0	0,4	4	24	22	40	4	20	33	46
21	10	3	58	39,4	0,4	7	23	5	54	4	1	14	3
[illegible]	2	13	21	44,8	0,4	10	21	49	9	3	11	54	20
23	6	22	44	50,2	0,5	1	20	32	24	2	22	34	37
B. 24	11	15	18	30,6	0,5	5	2	19	33	2	3	11	42
25	3	24	41	36,0	0,6	8	1	2	48	1	13	52	0
26	8	4	4	41,4	0,6	10	29	46	3	0	24	32	17
27	0	13	27	46,8	0,7	1	28	29	18	0	5	12	34
B. 28	5	6	1	27,2	0,7	5	10	16	27	11	15	49	40
29	9	15	24	32,6	0,8	8	8	59	42	10	26	29	57
1730	1	24	47	38,0	0,8	11	7	42	57	10	7	10	14
31	6	4	10	43,4	0,9	2	6	26	11	9	17	50	31
B. 32	10	26	44	23,8	0,9	5	18	13	20	8	28	27	37
33	3	6	7	29,2	1,0	8	16	56	35	8	9	7	54
34	7	15	30	34,6	1,0	11	15	39	50	7	19	48	11
1735	11	24	53	40,0	1,1	2	14	23	5	7	0	28	28
B. 36	4	17	27	20,4	1,2	5	26	10	14	6	11	5	34
37	8	26	50	25,8	1,2	8	24	53	29	5	21	45	51
38	1	6	13	31,2	1,3	11	23	36	44	5	2	26	8
39	5	15	36	36,6	1,4	2	22	19	59	4	13	6	25
B. 1740	10	8	10	17,0	1,4	6	4	7	8	3	23	43	31
41	2	17	33	22,4	1,5	9	2	50	22	3	4	23	48
42	6	26	56	27,8	1,6	0	1	33	37	2	15	4	5
43	11	6	19	33,2	1,7	3	0	16	52	1	25	44	22
B. 44	3	28	53	13,6	1,7	6	12	4	1	1	6	21	28
1745	8	8	16	19,0	1,8	9	10	47	16	0	17	1	45
46	0	17	39	24,4	1,9	0	9	30	31	11	27	42	2
47	4	27	2	29,8	2,0	3	8	13	46	11	8	22	19
B. 48	9	19	36	10,2	2,1	6	20	0	55	10	18	59	25
49	1	28	59	15,6	2,2	9	18	44	10	9	29	39	42
1750	6	8	22	21,0	2,2	0	17	27	25	9	10	19	59
51	10	17	45	26,4	2,3	3	16	10	39	8	21	0	16
B. 52	3	10	19	6,8	2,4	6	27	57	48	8	1	37	22
53	7	19	42	12,2	2,5	9	26	41	3	7	12	17	39
54	11	29	5	17,6	2,6	0	25	24	18	6	22	57	56
1755	4	8	28	23,0	2,7	3	24	7	33	6	3	38	13
B. 56	9	1	2	3,4	2,8	7	5	54	42	5	14	15	19
57	1	10	25	8,8	2,9	10	4	37	57	4	24	55	36
58	5	19	48	14,2	3,0	1	3	21	12	4	5	35	53
59	9	29	11	19,6	3,1	4	2	4	27	3	16	16	10

Greg. Style.	Mean Long. ☽				Accel. +	Mean Ano. ☽				Long. ☊			
Yrs. ſince C.	s	°	'	"	"	s	°	'	"	s	°	'	"
B. 1760	2	21	45	0,0	3,2	7	13	51	36	2	26	53	16
61	7	1	8	5,4	3,4	10	12	34	50	2	7	33	33
62	11	10	31	10,8	3,5	1	11	18	5	1	18	13	50
63	3	19	54	16,2	3,6	4	10	1	20	0	28	54	7
B. 64	8	12	27	56,6	3,7	7	21	48	29	0	9	31	13
1765	0	21	51	2,0	3,8	10	20	31	44	11	20	11	30
66	5	1	14	7,4	3,9	1	19	14	59	11	0	51	47
67	9	10	37	12,8	4,0	4	17	58	14	10	11	32	4
B. 68	2	3	10	53,2	4,2	7	29	45	25	9	22	9	10
69	6	12	33	58,6	4,3	0	28	28	38	9	2	49	27
1770	10	21	57	4,0	4,4	1	27	11	53	8	13	29	44
71	3	1	20	9,4	4,5	4	25	55	7	7	24	10	1
B. 72	7	23	53	49,8	4,7	8	7	42	16	7	4	47	7
73	0	3	16	55,2	4,8	11	6	25	31	6	15	27	24
74	4	12	40	0,6	4,9	2	5	8	46	5	26	7	41
1775	8	22	3	6,0	5,1	5	3	52	1	5	6	47	58
B. 76	1	14	36	46,4	5,2	8	15	39	10	4	17	25	4
77	5	23	59	51,8	5,3	11	14	22	25	3	28	5	21
78	10	3	22	57,2	5,5	2	13	5	40	3	8	45	38
79	2	12	46	2,6	5,6	5	11	48	55	2	19	25	55
B. 1780	7	5	19	43,0	5,8	8	23	36	4	2	0	3	1
81	11	14	42	48,4	5,9	11	22	19	18	1	10	43	18
82	3	24	5	53,8	6,1	2	21	2	33	0	21	23	35
83	8	3	28	59,2	6,2	5	19	45	48	0	2	3	52
B. 84	0	26	2	39,6	6,4	9	1	32	57	11	12	40	58
1785	5	5	25	45,0	6,5	0	0	16	12	10	23	21	15
86	9	14	48	50,4	6,7	2	28	59	27	10	4	1	32
87	1	24	11	55,8	6,8	5	27	42	42	9	14	41	49
B. 88	6	16	45	36,2	7,0	9	9	29	51	8	25	18	55
89	10	26	8	41,6	7,1	0	8	13	6	8	5	59	12
1790	3	5	31	47,0	7,3	3	6	56	21	7	16	39	29
91	7	14	54	52,4	7,5	6	5	39	35	6	27	19	46
B. 92	0	7	28	32,8	7,6	9	17	26	44	6	7	56	52
93	4	16	51	38,2	7,8	0	16	9	59	5	18	37	9
94	8	26	14	43,6	8,0	3	14	53	14	4	29	17	26
1795	1	5	37	49,0	8,1	6	13	36	29	4	9	57	43
B. 96	5	28	11	29,4	8,3	9	25	23	38	3	20	34	49
97	10	7	34	34,8	8,5	0	24	6	53	3	1	15	6
98	2	16	57	40,2	8,6	3	22	50	8	2	11	55	23
99	6	26	20	45,6	8,8	6	21	33	23	1	22	35	40
C. 1800	11	5	43	51,0	9,0	9	20	16	38	1	3	15	57
1	3	15	6	56,4	9,2	0	18	59	52	0	13	56	14
2	7	24	30	1,8	9,4	3	17	43	7	11	24	36	31
3	0	3	53	7,2	9,6	6	16	26	22	11	5	16	48
B. 4	4	26	26	47,6	9,7	9	28	13	31	10	15	53	54
1805	9	5	49	53,0	9,9	0	26	56	46	9	26	34	11
6	1	15	12	58,4	10,1	3	25	40	1	9	7	14	28
7	5	24	36	3,7	10,3	6	24	23	16	8	17	54	45
B. 8	10	17	9	44,2	10,5	10	6	10	25	7	28	31	51
9	2	26	32	49,6	10,7	1	4	53	40	7	9	12	8
1810	7	5	55	55,0	10,9	4	3	36	55	6	19	52	25
11	11	15	19	0,3	11,1	7	2	20	9	6	0	32	42
B. 12	4	7	52	40,8	11,3	10	14	7	18	5	11	9	48
13	8	17	15	46,2	11,5	1	12	50	33	4	21	50	5
14	0	26	38	51,6	11,7	4	11	33	48	4	2	30	22
1815	5	6	1	56,9	11,9	7	10	17	3	3	13	10	39
B. 16	9	28	35	37,4	12,1	10	22	4	12	2	23	47	45
17	2	7	58	42,8	12,3	1	20	47	27	2	4	28	2
18	6	17	21	48,2	12,5	4	19	30	42	1	15	8	19
19	10	26	44	53,5	12,7	7	18	13	57	0	25	48	36
B. 1820	3	19	18	34,0	13,0	11	0	1	6	0	6	25	42
B. 40	8	2	53	17,0	17,6	0	9	45	34	11	9	35	27
B. 60	0	16	28	0,0	23,0	1	19	30	2	10	12	45	12
B. 1880	5	0	2	43,0	29,2	2	29	14	30	9	15	54	57

Epochs of the mean Motion of the Moon.

Years current. Mean Time for the Meridian of Philadelphia,

Greg. Style.		Mean Long. ☽				Accel. +	Mean Ano. ☽				Long. ☊			
	Yrs. ſince C.	s	°	′	″	″	s	°	′	″	s	°	′	″
	1765	0	24	36	3,5	3,8	10	22	15	22	11	20	10	50
	66	5	3	59	8,9	3,9	1	21	58	37	11	0	51	7
	67	9	13	22	14,3	4,0	4	20	41	52	10	11	31	24
B.	68	2	5	55	54,7	4,2	8	2	29	1	9	22	8	30
	69	6	14	19	0,1	4,3	11	1	12	16	9	2	48	47
	1707	10	24	42	5,5	4,4	1	29	55	31	8	13	29	4
	71	3	4	5	10,9	4,5	4	28	38	45	7	24	9	21
B.	72	7	26	38	51,3	4,7	8	10	25	54	7	4	46	27
	73	0	6	1	56,7	4,8	11	7	9	9	6	15	26	44
	74	4	15	25	2,1	4,9	2	7	52	24	5	26	7	1
	1775	8	24	48	7,5	5,1	5	6	35	39	5	6	47	18
B.	76	1	17	21	47,9	5,2	8	18	22	48	4	17	24	24
	77	5	26	44	53,3	5,3	11	17	6	3	3	28	4	41
	78	10	6	7	58,7	5,5	2	15	49	18	3	8	44	58
	79	2	15	31	4,1	5,6	5	14	32	33	2	19	25	15
B.	1780	7	8	4	44,5	5,8	8	26	19	42	2	0	2	21
	81	11	17	27	49,9	5,9	11	25	2	56	1	10	42	38
	82	3	26	50	55,3	6,1	2	23	46	11	0	21	22	55
	83	8	6	14	0,7	6,2	5	22	29	26	0	2	3	12
B.	84	0	28	47	41,1	6,4	9	4	16	35	11	12	40	18
	1785	5	8	10	46,5	6,5	0	2	59	50	10	23	20	35
	86	9	17	33	51,9	6,7	3	1	43	5	10	4	0	52
	87	1	26	56	57,3	6,8	6	0	26	20	9	14	41	9
B.	88	6	18	30	37,7	7,0	9	12	13	29	8	25	18	15
	89	10	28	53	43,1	7,1	0	10	56	44	8	5	58	32
	1790	3	8	16	48,5	7,3	3	9	39	59	7	16	38	49
	91	7	17	39	53,9	7,5	6	8	23	13	6	27	19	6
B.	92	0	10	13	34,3	7,6	9	20	10	22	6	7	56	12
	93	4	19	36	39,7	7,8	0	18	53	37	5	18	36	29
	94	8	28	59	45,1	8,0	3	17	36	52	4	29	16	46
	1795	1	8	22	50,5	8,1	6	16	20	7	4	9	57	3
B.	96	6	0	56	30,9	8,3	9	28	7	16	3	20	34	9
	97	10	10	19	36,3	8,5	0	26	56	31	3	1	14	26
	98	2	19	42	41,7	8,6	3	25	33	46	2	11	54	43
	99	6	29	5	47,1	8,8	6	23	17	1	1	22	35	0
C.	1800	11	8	28	52,5	9,0	9	23	0	16	1	3	15	17
	1	3	17	51	57,9	9,2	0	21	43	30	0	13	55	34
	2	7	27	15	3,3	9,4	3	20	26	45	11	24	35	51
	3	0	6	38	8,7	9,6	6	19	10	0	11	5	16	8
B.	4	4	29	11	49,1	9,7	10	0	57	9	10	15	53	14
	1805	9	8	34	54,5	9,9	0	29	40	24	9	26	33	31
	6	1	17	57	59,9	10,1	3	28	23	39	9	7	13	58
	7	5	27	21	5,3	10,3	6	27	6	54	8	17	54	5
B.	8	10	19	54	45,7	10,5	10	8	54	3	7	28	31	11
	9	2	29	17	51,1	10,7	1	7	37	18	7	9	11	25
	1810	7	8	40	56,5	10,9	4	6	20	33	6	19	51	45
	11	11	18	4	1,8	11,1	7	5	3	47	6	0	32	2
B.	12	4	10	37	42,3	11,3	10	16	50	56	5	11	9	8
	13	8	20	0	47,7	11,5	1	15	34	11	4	21	49	25
	14	0	29	23	53,1	11,7	4	14	17	26	4	2	29	52
	1815	5	8	46	58,4	11,9	7	13	0	41	3	13	9	59
B.	16	10	1	20	38,9	12,1	10	24	47	50	2	23	47	5
	17	2	10	43	44,3	12,3	1	23	31	5	2	4	27	22
	18	6	20	6	49,7	12,5	4	22	14	20	1	15	7	39
	19	10	29	29	55,0	12,7	7	20	57	35	0	25	47	56
B.	1820	3	22	3	35,5	13,0	11	2	44	44	0	6	25	2
	21	8	1	26	41,9	13,2	2	1	27	59	11	17	5	19
	22	0	10	49	47,3	13,4	5	0	11	14	10	27	45	56
	23	4	20	12	52,7	13,6	7	28	54	29	10	8	25	53
B.	24	9	12	46	33,1	13,8	11	10	41	38	9	19	2	19
	1825	1	22	9	38,5	14,1	2	9	24	53	8	29	43	36
	26	6	1	32	43,9	14,3	5	8	8	8	8	10	23	53
	27	10	10	55	49,3	14,5	8	6	51	22	7	21	3	50

Greg. Style.		Mean Long. ☽				Accel. +	Mean Ano. ☽				Long. ☊			
	Yrs. ſince C.	s	°	′	″	″	s	°	′	″	s	°	′	″
B.	1828	3	3	29	29,7	14,7	11	18	38	31	7	1	40	56
	29	7	12	52	35,1	14,9	2	17	21	46	6	12	21	13
	30	11	22	15	40,5	15,2	5	16	5	1	5	23	1	30
	31	4	1	38	45,9	15,4	8	14	48	16	5	3	41	47
B.	32	8	24	12	26,3	15,6	11	26	35	25	4	14	18	53
	33	1	3	35	31,7	15,8	2	25	18	40	3	24	59	10
	34	5	12	58	36,1	16,1	5	24	1	54	3	5	39	27

Mean motion of the Moon in Years.

Ju. Years.		Long. ☽					Mean Anom. ☽					Motion ☊ ☽ Retro.				
		s	°	′	″	‴	s	°	′	″	‴	s	°	′	″	‴
	1	4	9	23	5	23,5	2	28	43	14	54,5	0	19	19	43	5,5
	2	8	18	46	10	47,0	5	27	26	29	49,0	1	8	39	26	11,0
	3	0	28	9	16	10,5	8	26	9	44	43,5	1	27	59	9	16,5
B.	4	5	20	42	56	36,0	0	7	56	53	36,0	2	17	22	3	0,5
	5	10	0	6	1	59,5	3	6	40	8	30,5	3	6	41	46	6,0
	6	2	9	29	7	23,0	6	5	23	23	25,0	3	26	1	29	11,5
	7	6	18	52	12	45,5	9	4	6	38	19,5	4	15	21	12	17,0
B.	8	11	11	25	53	12,0	0	15	53	47	12,0	5	4	44	6	1,0
	9	3	20	48	58	35,5	3	14	37	2	6,5	5	24	3	49	6,5
	10	8	0	12	3	59,0	6	13	20	17	1,0	6	13	23	32	12,0
B.	20	4	13	34	43	8,0	1	9	44	28	0,0	0	26	50	15	0,0
B.	40	8	27	9	26	0,0	2	19	28	56	0,0	1	23	40	30	0,0
B.	60	1	10	44	9	0,0	3	29	13	24	0,0	2	20	30	45	0,0
B.	80	5	24	18	52	0,0	5	8	57	52	0,0	3	17	21	0	0,0
B.	100	10	7	53	35	0,0	6	18	42	20	0,0	4	14	11	15	0,0

Moon's mean motion for Months and Days.

JANUARY.

Days.	Mean motion ☽				Mean motion Ano.				Mean Mo. ☊		
	s	°	′	″	s	°	′	″	°	′	″
1	0	13	10	35,0	0	13	3	54,0	0	3	10,6
2	0	26	21	10,1	0	26	7	47,9	0	6	21,3
3	1	9	31	45,1	1	9	11	41,9	0	9	31,9
4	1	22	42	20,1	1	22	15	35,8	0	12	42,6
5	2	5	52	55,1	2	5	19	29,8	0	15	53,2
6	2	19	3	30,2	2	18	23	23,8	0	19	3,8
7	3	2	14	5,2	3	1	27	17,7	0	22	14,5
8	3	15	24	40,2	3	14	31	11,7	0	25	25,1
9	3	28	35	15,3	3	27	35	5,6	0	28	35,8
10	4	11	45	50,3	4	10	38	59,6	0	31	46,4
11	4	24	56	25,3	4	23	42	53,5	0	34	57,0
12	5	8	7	0,3	5	6	46	47,5	0	38	7,7
13	5	21	17	35,4	5	19	50	41,5	0	41	18,3
14	6	4	28	10,4	6	2	54	35,4	0	44	29,0
15	6	17	38	45,4	6	15	58	29,4	0	47	39,6
16	7	0	49	20,5	6	29	2	23,3	0	50	50,2
17	7	13	59	55,5	7	12	6	17,3	0	54	0,9
18	7	27	10	30,5	7	25	10	11,3	0	57	11,5
19	8	10	21	5,5	8	8	14	5,2	1	0	22,1
20	8	23	31	40,6	8	21	17	59,2	1	3	32,8
21	9	6	42	15,6	9	4	21	53,1	1	6	43,4
22	9	19	52	50,6	9	17	25	47,1	1	9	54,5
23	10	3	3	25,7	10	0	29	41,1	1	13	4,7
24	10	16	14	0,7	10	13	33	35,0	1	16	15,3
25	10	29	24	35,7	10	26	37	29,0	1	19	26,0
26	11	12	35	10,7	11	9	41	22,9	1	22	36,6
27	11	25	45	45,8	11	22	45	16,9	1	25	47,3
28	0	8	56	20,8	0	5	49	10,8	1	28	57,9
29	0	22	6	55,8	0	18	53	4,8	1	32	8,5
30	1	5	17	30,9	1	1	56	58,8	1	35	19,2
31	1	18	28	5,9	1	15	0	52,7	1	38	29,8

MOON's mean Motion for Months and Days.

FEBRUARY.

Days.	Mean motion ☽				Mo. mean Ano.				Me. Mo. ☊		
	s	°	′	″	s	°	′	″	°	′	″
1	2	1	38	40,9	1	28	4	46,7	1	41	40,4
2	2	14	49	15,9	2	11	8	40,6	1	44	51,1
3	2	27	59	51,0	2	24	12	34,6	1	48	1,7
4	3	11	10	26,0	3	7	16	28,6	1	51	12,4
5	3	24	21	1,0	3	20	20	22,5	1	54	23,0
6	4	7	31	36,1	4	3	24	16,5	1	57	33,6
7	4	20	42	11,1	4	16	28	10,4	2	0	44,3
8	5	3	52	46,1	4	29	32	4,4	2	3	54,9
9	5	17	3	21,1	5	12	35	58,3	2	7	5,5
10	6	0	13	56,2	5	25	39	52,3	2	10	16,2
11	6	13	24	31,2	6	8	43	46,3	2	13	26,8
12	6	26	35	6,2	6	21	47	40,2	2	16	37,5
13	7	9	45	41,3	7	4	51	34,2	2	19	48,1
14	7	22	56	16,3	7	17	55	28,1	2	22	58,7
15	8	6	6	51,3	8	0	59	22,1	2	26	9,4
16	8	19	17	26,3	8	14	3	16,1	2	29	20,0
17	9	2	28	1,4	8	27	7	10,0	2	32	30,7
18	9	15	38	36,4	9	10	11	4,0	2	35	41,3
19	9	28	49	11,4	9	23	14	57,9	2	38	51,9
20	10	11	59	46,5	10	6	18	51,9	2	42	2,6
21	10	25	10	21,5	10	19	22	45,9	2	45	13,2
22	11	8	20	56,5	11	2	26	39,8	2	48	23,8
23	11	21	31	31,5	11	15	30	33,8	2	51	34,5
24	0	4	42	6,6	11	28	34	27,7	2	54	45,1
25	0	17	52	41,6	0	11	38	21,7	2	57	55,8
26	1	1	3	16,6	0	24	42	15,6	3	1	6,4
27	1	14	13	51,7	1	7	46	9,6	3	4	17,0
28	1	27	24	26,7	1	20	50	3,6	3	7	27,7

⁂ In the Months January and February of a Biſſextile Year, ſubtract 1 from the Number of Days given.

MARCH.

Days.	Mean motion ☽				Mo. mean Ano.				Me. Mo. ☊		
	s	°	′	″	s	°	′	″	°	′	″
1	2	10	35	1,7	2	3	53	57,5	3	10	38,3
2	2	23	45	36,7	2	16	57	51,5	3	13	49,0
3	3	6	56	11,8	3	0	1	45,4	3	16	59,6
4	3	20	6	46,8	3	13	5	39,4	3	20	10,2
5	4	3	17	21,8	3	26	9	33,4	3	23	20,9
6	4	16	27	56,9	4	9	13	27,3	3	26	31,5
7	4	29	38	31,9	4	22	17	21,3	3	29	42,1
8	5	12	49	6,9	5	5	21	15,2	3	32	52,8
9	5	25	59	41,9	5	18	25	9,2	3	36	3,4
10	6	9	10	17,0	6	1	29	3,1	3	39	14,1
11	6	22	20	52,0	6	14	32	57,1	3	42	24,7
12	7	5	31	27,0	6	27	36	51,1	3	45	35,3
13	7	18	42	2,1	7	10	40	45,0	3	48	46,0
14	8	1	52	37,1	7	23	44	39,0	3	51	56,6
15	8	15	3	12,1	8	6	48	32,9	3	55	7,3
16	8	28	13	47,1	8	19	52	26,9	3	58	17,9
17	9	11	24	22,2	9	2	56	20,9	4	1	28,5
18	9	24	34	57,2	9	16	0	14,8	4	4	39,2
19	10	7	45	32,2	9	29	4	8,8	4	7	49,8
20	10	20	56	7,3	10	12	8	2,7	4	11	0,4
21	11	4	6	42,3	10	25	11	56,7	4	14	11,1
22	11	17	17	17,3	11	8	15	50,7	4	17	21,7
23	0	0	27	52,3	11	21	19	44,6	4	20	32,4
24	0	13	38	27,4	0	4	23	38,6	4	23	43,0
25	0	26	49	2,4	0	17	27	32,5	4	26	53,6
26	1	9	59	37,4	1	0	31	26,5	4	30	4,3
27	1	23	10	12,5	1	13	35	20,4	4	33	14,9
28	2	6	20	47,5	1	26	39	14,4	4	36	25,5
29	2	19	31	22,5	2	9	43	8,4	4	39	36,2
30	3	2	41	57,5	2	22	47	2,3	4	42	46,8
31	3	15	52	32,6	3	5	50	56,2	4	45	57,5

APRIL.

Days.	Mean motion ☽				Mo. mean Ano.				Me. mo. ☊		
	s	°	′	″	s	°	′	″	°	′	″
1	3	29	3	7,6	3	18	54	50,2	4	49	8,1
2	4	12	13	42,6	4	1	58	44,2	4	52	18,7
3	4	25	24	17,7	4	15	2	38,2	4	55	29,4
4	5	8	34	52,7	4	28	6	32,1	4	58	40,0
5	5	21	45	27,7	5	11	10	26,1	5	1	50,7
6	6	4	56	2,7	5	24	14	20,0	5	5	1,3
7	6	18	6	37,8	6	7	18	14,0	5	8	11,9
8	7	1	17	12,8	6	20	22	7,9	5	11	22,6
9	7	14	27	47,8	7	3	26	1,9	5	14	33,2
10	7	27	38	22,9	7	16	29	55,9	5	17	43,9
11	8	10	48	57,9	7	29	33	49,8	5	20	54,5
12	8	23	59	32,9	8	12	37	43,8	5	24	5,1
13	9	7	10	7,9	8	25	41	37,7	5	27	15,8
14	9	20	20	43,0	9	8	45	31,7	5	30	26,4
15	10	3	31	18,0	9	21	49	25,7	5	33	37,1
16	10	16	41	53,0	10	4	53	19,6	5	36	47,7
17	10	29	52	28,0	10	17	57	13,6	5	39	58,3
18	11	13	3	3,1	11	1	1	7,5	5	43	9,0
19	11	26	13	38,1	11	14	5	1,5	5	46	19,6
20	0	9	24	13,1	11	27	8	55,5	5	49	30,3
21	0	22	34	48,2	0	10	12	49,4	5	52	40,9
22	1	5	45	23,2	0	23	16	43,4	5	55	51,5
23	1	18	55	58,2	1	6	20	37,3	5	59	2,2
24	2	2	6	33,2	1	19	24	31,3	6	2	12,8
25	2	15	17	8,3	2	2	28	25,2	6	5	23,4
26	2	28	27	43,3	2	15	32	19,2	6	8	34,1
27	3	11	38	18,3	2	28	36	13,2	6	11	44,7
28	3	24	48	53,4	3	11	40	7,1	6	14	55,4
29	4	7	59	28,4	3	24	44	1,1	6	18	6,0
30	4	21	10	3,4	4	7	47	55,0	6	21	16,6

MAY.

Days.	Mean motion ☽				Mo. mean Ano.				Mo. Me. ☊		
	s	°	′	″	s	°	′	″	°	′	″
1	5	4	20	38,4	4	20	51	49,0	6	24	27,3
2	5	17	31	13,5	5	3	55	43,0	6	27	37,9
3	6	0	41	48,5	5	16	59	36,9	6	30	48,5
4	6	13	52	23,5	6	0	3	30,9	6	33	59,2
5	6	27	2	58,6	6	13	7	24,8	6	37	9,8
6	7	10	13	33,6	6	26	11	18,8	6	40	20,5
7	7	23	24	8,6	7	9	15	12,8	6	43	31,1
8	8	6	34	43,6	7	22	19	6,7	6	46	41,7
9	8	19	45	18,7	8	5	23	0,7	6	49	52,4
10	9	2	55	53,7	8	18	26	54,6	6	53	3,0
11	9	16	6	28,7	9	1	30	48,6	6	56	13,7
12	9	29	17	3,8	9	14	34	42,5	6	59	24,3
13	10	12	27	38,8	9	27	38	36,5	7	2	34,9
14	10	25	38	13,8	10	10	42	30,5	7	5	45,6
15	11	8	48	48,8	10	23	46	24,4	7	8	56,2
16	11	21	59	23,9	11	6	50	18,4	7	12	6,8
17	0	5	9	58,9	11	19	54	12,3	7	15	17,5
18	0	18	20	33,9	0	2	58	6,3	7	18	28,1
19	1	1	31	9,0	0	16	2	0,2	7	21	38,8
20	1	14	41	44,0	0	29	5	54,2	7	24	49,4
21	1	27	52	19,0	1	12	9	48,2	7	28	0,0
22	2	11	2	54,0	1	25	13	42,1	7	31	10,7
23	2	24	13	29,1	2	8	17	36,1	7	34	21,3
24	3	7	24	4,1	2	21	21	30,0	7	37	32,0
25	3	20	34	39,1	3	4	25	24,0	7	40	42,6
26	4	3	45	14,2	3	17	29	17,9	7	43	53,2
27	4	16	55	49,2	4	0	33	11,9	7	47	3,9
28	5	0	6	24,2	4	13	37	5,9	7	50	14,5
29	5	13	16	59,2	4	26	40	59,8	7	53	25,1
30	5	26	27	34,3	5	9	44	53,8	7	56	35,8
31	6	9	38	9,3	5	22	48	47,7	7	59	46,4

MOON's Mean Motion for Months and Days.

JUNE.

Days.	Mean motion ☽				Mo. mean Ano.				Mea. mo. ☊		
	s	°	′	″	s	°	′	″	°	′	″
1	6	22	48	44,3	6	5	52	41,7	8	2	57,1
2	7	5	59	19,4	6	18	56	35,7	8	6	7,7
3	7	19	9	54,4	7	2	0	29,6	8	9	18,3
4	8	2	20	29,4	7	15	4	23,6	8	12	29,0
5	8	15	31	4,4	7	28	8	17,5	8	15	39,6
6	8	28	41	39,5	8	11	12	11,5	8	18	50,2
7	9	11	52	14,5	8	24	16	5,4	8	22	0,9
8	9	25	2	49,5	9	7	19	59,4	8	25	11,5
9	10	8	13	24,6	9	20	23	53,4	8	28	22,2
10	10	21	23	59,6	10	3	27	47,3	8	31	32,8
11	11	4	34	34,6	10	16	31	41,3	8	34	43,4
12	11	17	45	9,6	10	29	35	35,2	8	37	54,1
13	0	0	55	44,7	11	12	39	29,2	8	41	4,7
14	0	14	6	19,7	11	25	43	23,2	8	44	15,4
15	0	27	16	54,7	0	8	47	17,1	8	47	26,0
16	1	10	27	29,8	0	21	51	11,1	8	50	36,6
17	1	23	38	4,8	1	4	55	5,0	8	53	47,3
18	2	6	48	39,8	1	17	58	59,0	8	56	57,9
19	2	19	59	14,8	2	1	2	53,0	9	0	8,5
20	3	3	9	49,9	2	14	6	46,9	9	3	19,2
21	3	16	20	24,9	2	27	10	40,9	9	6	29,8
22	3	29	30	59,9	3	10	14	34,8	9	9	40,5
23	4	12	41	35,0	3	23	18	28,8	9	12	51,1
24	4	25	52	10,0	4	6	22	22,7	9	16	1,7
25	5	9	2	45,0	4	19	26	16,7	9	19	12,4
26	5	22	13	20,0	5	2	30	10,7	9	22	23,0
24	6	5	23	55,1	5	15	34	4,6	9	25	33,7
28	6	18	34	30,1	5	28	37	58,6	9	28	44,3
29	7	1	45	5,1	6	11	41	52,5	9	31	54,9
30	7	14	55	40,2	6	24	45	46,5	9	35	5,6

JULY.

Days.	Mean motion ☽				Mo. mean Ano.				Mea. Mo. ☊		
	s	°	′	″	s	°	′	″	°	′	″
1	7	28	6	15,2	7	7	49	40,5	9	38	16,2
2	8	11	16	50,2	7	20	53	34,4	9	41	26,9
3	8	24	27	25,2	8	3	57	28,4	9	44	37,5
4	9	7	38	0,3	8	17	1	22,3	9	47	48,1
5	9	20	48	35,3	9	0	5	16,3	9	50	58,8
6	10	3	59	10,3	9	13	9	10,3	9	54	9,4
7	10	17	9	45,4	9	26	13	4,2	9	57	20,0
8	11	0	20	20,4	10	9	16	58,2	10	0	30,7
9	11	13	30	55,4	10	22	20	52,1	10	3	41,3
10	11	26	41	30,4	11	5	24	46,1	10	6	52,0
11	0	9	52	5,5	11	18	28	40,0	10	10	2,6
12	0	23	2	40,5	0	1	32	34,0	10	13	13,2
13	1	6	13	15,5	0	14	36	28,0	10	16	23,9
14	1	19	23	50,6	0	27	40	21,0	10	19	34,5
15	2	2	34	25,6	1	10	44	15,9	10	22	45,2
16	2	15	45	0,6	1	23	48	9,8	10	25	55,8
17	2	28	55	35,6	2	6	52	3,8	10	29	6,4
18	3	12	6	10,7	2	19	55	57.8	10	32	17,1
19	3	25	16	45,7	3	2	59	51,7	10	35	27,7
20	4	8	27	20,7	3	16	3	45,7	10	38	38,4
21	4	21	37	55,8	3	29	7	39,6	10	41	49,0
22	5	4	48	30,8	4	12	11	33,6	10	44	59,6
23	5	17	59	5,8	4	25	15	27,5	10	48	10,3
24	6	1	9	40,8	5	8	19	21,5	10	51	20,9
25	6	14	20	15,9	5	21	23	15,5	10	54	31,6
26	6	27	30	50,9	6	4	27	9,4	10	57	42,2
27	7	10	41	25,9	6	17	31	3,4	11	0	52,8
28	7	23	52	1,0	7	0	34	57,3	11	4	3,5
29	8	7	2	36,0	7	13	38	51,3	11	7	14,1
30	8	20	13	11,0	7	26	42	45,3	11	10	24,7
31	9	3	23	46,0	8	9	46	39,2	11	13	35,4

AUGUST.

Days.	Mean motion ☽				Mo. mean Ano.				Mea. mo. ☊		
	s	°	′	″	s	°	′	″	°	′	″
1	9	16	34	21,1	8	22	50	33,2	11	16	46,0
2	9	29	44	56,1	9	5	54	27,1	11	19	56,7
3	10	12	55	31,1	9	18	58	21,1	11	23	7,3
4	10	26	6	6,2	10	2	2	15,1	11	26	17,9
5	11	9	16	41,2	10	15	6	9,0	11	29	28,6
6	11	22	27	16,2	10	28	10	3,0	11	32	39,2
7	0	5	37	51,2	11	11	13	56,9	11	35	49,9
8	0	18	48	26,3	11	24	17	50,9	11	39	0,5
9	1	1	59	1,3	0	7	21	44,8	11	42	11,1
10	1	15	9	36,3	0	20	25	38,8	11	45	21,8
11	1	28	20	11,4	1	3	29	32,8	11	48	32,4
12	2	11	30	46,4	1	16	33	26,7	11	51	43,1
13	2	24	41	21,4	1	29	37	20,7	11	54	53,7
14	3	7	51	56,4	2	12	41	14,6	11	58	4,3
15	3	21	2	31,5	2	25	45	8,6	12	1	15,0
16	4	4	13	6,5	3	8	49	2,6	12	4	25,6
17	4	17	23	41,5	3	21	52	56,5	12	7	36,2
18	5	0	34	16,6	4	4	56	50,5	12	10	46,9
19	5	13	44	51,6	4	18	0	44,4	12	13	57,5
20	5	26	55	26,6	5	1	4	38,4	12	17	8,2
21	6	10	6	1,6	5	14	8	32,3	12	20	18,8
22	6	23	16	36,7	5	27	12	26,3	12	23	29,4
23	7	6	27	11,7	6	10	16	20,3	12	26	40,1
24	7	19	37	46,7	6	23	20	14,2	12	29	50,7
25	8	2	48	21,8	7	6	24	8,2	12	33	1,4
26	8	15	58	56,8	7	19	28	2,1	12	36	12,0
27	8	29	9	31,8	8	2	31	56,1	12	39	22,6
28	9	12	20	6,8	8	15	35	50,1	12	42	33,3
29	9	25	30	41,9	8	28	39	44,0	12	45	43,9
30	10	8	41	16,9	9	11	43	38,0	12	48	54,5
31	10	21	51	51,9	9	24	47	31.9	12	52	5,2

SEPTEMBER.

Days.	Mean motion ☽				Mo. mean Ano.				Mea. mo. ☊		
	s	°	′	″	s	°	′	″	°	′	″
1	11	5	2	27,0	10	7	51	25,9	12	55	15,8
2	11	18	13	2,0	10	20	55	19,9	12	58	26,5
3	0	1	23	37,0	11	3	59	13,8	13	1	37,1
4	0	14	34	12,0	11	17	3	7,8	13	4	47,7
5	0	27	44	47,1	0	0	7	1,7	13	7	58,4
6	1	10	55	22,1	0	13	10	55,7	13	11	9,0
7	1	24	5	57,1	0	26	14	49,6	13	14	19,7
8	2	7	16	32,2	1	9	18	43,6	13	17	30,3
9	2	20	27	7,2	1	22	22	37,6	13	20	40,9
10	3	3	37	42,2	2	5	26	31,5	13	23	51,6
11	3	16	48	17,2	2	18	30	25,5	13	27	2,2
12	3	29	58	52,3	3	1	54	19,4	13	30	12,9
13	4	13	9	27,3	3	14	38	13,4	13	33	23,5
14	4	26	20	2,3	3	27	42	7,4	13	36	34,1
15	5	9	30	37,4	4	10	46	1,3	13	39	44,8
16	5	22	41	12,4	4	23	49	55,3	13	42	55,4
17	6	5	51	47,4	5	6	53	49,2	13	46	6,0
18	6	19	2	22,4	5	19	57	43,2	13	49	16,7
19	7	2	12	57,5	6	3	1	37,2	13	52	27,3
20	7	15	23	32,5	6	16	5	31,1	13	55	38,0
21	7	28	34	7,5	6	29	9	25,1	13	58	48,6
22	8	11	44	42,6	7	12	13	19,0	14	1	59,2
23	8	24	55	17,6	7	25	17	13,0	14	5	9,9
24	9	8	5	52,6	8	8	21	6,9	14	8	20,5
25	9	21	16	27,6	8	21	25	0,9	14	11	31,1
26	10	4	27	2,7	9	4	28	54,9	14	14	41,8
27	10	17	37	37,7	9	17	32	48,8	14	17	52,4
28	11	0	48	12,7	10	0	36	42,8	14	21	3,1
29	11	13	58	47,8	10	13	40	36,7	14	24	13,7
30	11	27	9	22,8	10	26	44	30,7	14	27	24,3

MOON's Mean Motion for Months, Days and Hours.

OCTOBER.

Days.	Mean motion ☽				Mo. mean Ano.				Mea. mo. ☊		
	s	°	′	″	s	°	′	″	°	′	″
1	0	10	19	57,8	11	9	48	24,7	14	30	35,0
2	0	23	30	32,8	11	22	52	18,6	14	33	45,6
3	1	6	41	7,9	0	5	56	12,6	14	36	56,3
4	1	19	51	42,9	0	19	0	6,5	14	40	6,9
5	2	3	2	17,9	1	2	4	0,5	14	43	17,5
6	2	16	12	53,0	1	15	7	54,4	14	46	28,2
7	2	29	23	28,0	1	28	11	48,4	14	49	38,8
8	3	12	34	3,0	2	11	15	42,4	14	52	49,4
9	3	25	44	38,0	2	24	19	36,3	14	56	0,1
10	4	8	55	13,1	3	7	23	30,3	14	59	10,7
11	4	22	5	48,1	3	20	27	24,2	15	2	21,4
12	5	5	16	23,1	4	3	31	18,2	15	5	32,0
13	5	18	26	58,1	4	16	35	12,2	15	8	42,6
14	6	1	37	33,2	4	29	39	6,1	15	11	53,3
15	6	14	48	8,2	5	12	43	0,1	15	15	3,9
16	6	27	58	43,2	5	25	46	54,0	15	18	14,6
17	7	11	9	18,3	6	8	50	48,0	15	21	25,2
18	7	24	19	53,3	6	21	54	42,0	15	24	35,8
19	8	7	30	28,3	7	4	58	35,9	15	27	46,5
20	8	20	41	3,3	7	18	2	29,9	15	30	57,1
21	9	3	51	38,4	8	1	6	23,8	15	34	7,8
22	9	17	2	13,4	8	14	10	17,8	15	37	18,4
23	10	0	12	48,4	8	27	14	11,7	15	40	29,0
24	10	13	23	23,5	9	10	18	5,7	15	43	39,7
25	10	26	33	58,5	9	23	21	59,7	15	46	50,3
26	11	9	44	33,5	10	6	25	53,6	15	50	0,9
27	11	22	55	8,5	10	19	29	47,6	15	53	11,6
28	0	6	5	43,6	11	2	33	41,5	15	56	22,2
29	0	19	16	18,6	11	15	37	35,5	15	59	32,9
30	1	2	26	53,6	11	28	41	29.5	16	2	43,5
31	1	15	37	28,7	0	11	45	23,4	16	5	54,1

NOVEMBER.

Days.	Mean motion ☽				Mo. mean Ano.				Mea. Mo. ☊		
	s	°	′	″	s	°	′	″	°	′	″
1	1	28	48	3,7	0	24	49	17,4	16	9	4,8
2	2	11	58	38,7	1	7	53	11,3	16	12	15,4
3	2	25	9	13,7	1	20	57	5,3	16	15	26,1
4	3	8	19	48,8	2	4	0	59,2	16	18	36,7
5	3	21	30	23,8	2	17	4	53,2	16	21	47,3
6	4	4	40	58,8	3	0	8	47,2	16	24	58,0
7	4	17	51	33,9	3	13	12	41,1	16	28	8,6
8	5	1	2	8,9	3	26	16	35,1	16	31	19,3
9	5	14	12	43,9	4	9	20	29,0	16	34	29,9
10	5	27	23	18,9	4	22	24	23,0	16	37	40,5
11	6	10	33	54,0	5	5	28	17,0	16	40	51,2
12	6	23	44	29,0	5	18	32	10,9	16	44	1,8
13	7	6	55	4,0	6	1	36	4,9	16	47	12,4
14	7	20	5	39,1	6	14	39	58,8	16	50	23,1
15	8	3	16	14,1	6	27	43	52,8	16	53	33,7
16	8	16	26	49,1	7	10	47	46,8	16	56	44,4
17	8	29	37	24,1	7	23	51	40,7	16	59	55,0
18	9	12	47	59,2	8	6	55	34,7	17	3	5,6
19	9	25	58	34,2	8	19	59	28,6	17	6	16,3
20	10	9	9	9,2	9	3	3	22,6	17	9	26,9
21	10	22	19	44,3	9	16	7	16,5	17	12	37,6
22	11	5	30	19,3	9	29	11	10,5	17	15	48,2
23	11	18	40	54,3	10	12	15	4,5	17	18	58,8
24	0	1	51	29,3	10	25	18	58,4	17	22	9,5
25	0	15	2	4,4	11	8	22	52,4	17	25	20,1
26	0	28	12	39,4	11	21	26	46,3	17	28	30,7
27	1	11	23	14,4	0	4	30	40,3	17	31	41,4
28	1	24	33	49,5	0	17	34	34,3	17	34	52,0
29	2	7	44	24,5	1	0	38	28,2	17	38	2,7
30	2	20	54	59,5	1	13	42	22,2	17	41	13,3

DECEMBER.

Days.	Mean motion ☽				Mo. mean Ano.				Mea. mo. ☊		
	s	°	′	″	s	°	′	″	°	′	″
1	3	4	5	34,5	1	26	46	16,1	17	44	23,9
2	3	17	16	9,6	2	9	50	10,1	17	47	34,6
3	4	0	26	44,6	2	22	54	4,1	17	50	45,2
4	4	13	37	19,6	3	5	57	58,0	17	53	55,9
5	4	26	47	54,7	3	19	1	52,0	17	57	6,5
6	5	9	58	29,7	4	2	5	45,9	18	0	17,1
7	5	23	9	4,7	4	15	9	39,9	18	3	27,8
8	6	6	19	39,7	4	28	13	33,8	18	6	38,4
9	6	19	30	14,8	5	11	17	27,8	18	9	49,1
10	7	2	40	49,8	5	24	21	21,8	18	12	59,7
11	7	15	51	24,8	6	7	25	15,7	18	16	10,3
12	7	29	1	59,9	6	20	29	9,7	18	19	21,0
13	8	12	12	34,9	7	3	33	3,6	18	22	31,6
14	8	25	23	9,9	7	16	36	57,6	18	25	42,2
15	9	8	33	44,9	7	29	40	51,5	18	28	52,9
16	9	21	44	20,0	8	12	44	45,5	18	32	3,5
17	10	4	54	55,0	8	25	48	39,5	18	35	14,2
18	10	18	5	30,0	9	8	52	33,4	18	38	24,8
19	11	1	16	5,1	9	21	56	27,4	18	41	35,4
20	11	14	26	40,1	10	5	0	21,3	18	44	46,1
21	11	27	37	15,1	10	18	4	15,3	18	47	56,7
22	0	10	47	50,1	11	1	8	9,3	18	51	7,4
23	0	23	58	25,2	11	14	12	3,2	18	54	18 0
24	1	7	9	0,2	11	27	15	57,2	18	57	28 6
25	1	20	19	35,2	0	10	19	51,1	19	0	39 3
26	2	3	30	10,3	0	23	23	45,1	19	3	49 9
27	2	16	40	45,3	1	6	27	39,1	19	7	0 5
28	2	29	51	20,3	1	19	31	33,0	19	10	11,2
29	3	13	1	55,3	2	2	35	27,0	19	13	21,8
30	3	26	12	30,4	2	15	39	20,9	19	16	32,5
31	4	9	23	5,4	2	28	43	14,9	19	19	43,1

For HOURS.

Hrs.	Longitude ☽			Anomaly.			☊	
	°	′	″	°	′	″	′	″
1	0	32	56,5	0	32	39,7	0	7,9
2	1	5	52,9	1	5	19,5	0	15,9
3	1	38	49,4	1	37	59,2	0	23,8
4	2	11	45,8	2	10	39,0	0	31,8
5	2	44	42,3	2	43	18,7	0	39,7
6	3	17	38,8	3	15	58,5	0	47,7
7	3	50	35,2	3	48	38,2	0	55,6
8	4	23	31,7	4	21	18,0	1	3,6
9	4	56	28,1	4	53	57,7	1	11,5
10	5	29	24,6	5	26	37,5	1	19,4
11	6	2	21,1	5	59	17,2	1	27,4
12	6	35	17,5	6	31	57,0	1	35,3
13	7	8	14,0	7	4	36,7	1	43,3
14	7	41	10,4	7	37	16,5	1	51,2
15	8	14	6,9	8	9	56,2	1	59,2
16	8	47	3,4	8	42	36,0	2	7,1
17	9	19	59,8	9	15	15,7	2	15,0
18	9	52	56,3	9	47	55,5	2	23,0
19	10	25	52,7	10	20	35,2	2	30,9
20	10	58	49,2	10	53	15,0	2	38,9
21	11	31	45,6	11	25	54,7	2	46,8
22	12	4	42,1	11	58	34,5	2	54,8
23	12	37	38,6	12	31	14,2	3	2,7
24	13	10	35,0	13	3	54,0	3	10,6
25	13	43	31,5	13	36	33,7	3	18,6
26	14	16	27,9	14	9	13,5	3	26,5
27	14	49	24,4	14	41	53,2	3	34,5
28	15	22	20,9	15	14	33,0	3	42,4
29	15	55	17,3	15	47	12,7	3	50,4
30	16	28	13,8	16	19	52,4	3	58,3

Moon's mean motion for Minutes & Seconds.

	Lon. ☽		Anom.		☊
′	′	″	′	″	″
″	″	‴	″	‴	‴
1	0	32,9	0	32,7	0,1
2	1	5,9	1	5,3	0,3
3	1	38,8	1	38,0	0,4
4	2	11,8	2	10,6	0,5
5	2	44,7	2	43,3	0,7
6	3	17,6	3	16,0	0,8
7	3	50,6	3	48,6	0,9
8	4	23,5	4	21,3	1,1
9	4	56,5	4	54,0	1,2
10	5	29,4	5	26,6	1,3
11	6	2,4	5	59,3	1,5
12	6	35,3	6	31,9	1,6
13	7	8,2	7	4,6	1,7
14	7	41,2	7	37,3	1,9
15	8	14,1	8	9,9	2,0
16	8	47,1	8	42,6	2,1
17	9	20,0	9	15,3	2,3
18	9	52,9	9	47,9	2,4
19	10	25,9	10	20,6	2,5
20	10	58,8	10	53,2	2,6
21	11	31,8	11	25,9	2,8
22	12	4,7	11	58,6	2,9
23	12	37,6	12	31,2	3,0
24	13	10,6	13	3,9	3,2
25	13	43,5	13	36,6	3,3
26	14	16,5	14	9,2	3,4
27	14	49,4	14	41,9	3,6
28	15	22,3	15	14,5	3,7
29	15	55,3	15	47,2	3,8
30	16	28,2	16	19,9	4,0
31	17	1,2	16	52,5	4,1
32	17	34,1	17	25,2	4,2
33	18	7,1	17	57,9	4,4
34	18	40,0	18	30,5	4,5
35	19	12,9	19	3,2	4,6
36	19	45,9	19	35,8	4,8
37	20	18,8	20	8,5	4,9
38	20	51,8	20	41,2	5,0
39	21	24,7	21	13,9	5,2
40	21	57,6	21	46,5	5,3
41	22	30,6	22	19,2	5,4
42	23	3,5	22	51,8	5,6
43	23	36,5	23	24,5	5,7
44	24	9,4	23	57,1	5,8
45	24	42,3	24	29,8	6,0
46	25	15,3	25	2,5	6,1
47	25	48,2	25	35,1	6,2
48	26	21,2	26	7,8	6,4
49	26	54,1	26	40,5	6,5
50	27	27,0	27	13,1	6,6
51	28	0,0	27	45,8	6,8
52	28	32,9	28	18,5	6,9
53	29	5,9	28	51,1	7,0
54	29	38,8	29	23,8	7,1
55	30	11,8	29	56,4	7,3
56	30	44,7	30	29,1	7,4
57	31	17,6	31	1,8	7,5
58	31	50,6	31	34,4	7,7
59	32	23,5	32	7,1	7,8
60	32	56,5	32	39,8	7,9

Annual Equation of MOON's Node.

Argument. Sun's Mean Anomaly.

S	0			1			2			S
	+		Diff.	+		Diff.	+		Diff.	
°	′	″	″	′	″	″	′	″	″	°
0	0	0		4	30		7	52		30
1	0	9	9	4	38	8	7	57	5	29
2	0	19	10	4	46	8	8	1	4	28
3	0	28	9	4	54	8	8	6	5	27
4	0	38	10	5	2	8	8	11	5	26
5	0	47	9	5	10	8	8	15	4	25
6	0	56	9	5	18	8	8	19	4	24
7	1	6	10	5	26	8	8	23	4	23
8	1	15	9	5	33	7	8	27	4	22
9	1	24	9	5	41	8	8	31	4	21
10	1	34	10	5	48	7	8	34	3	20
11	1	43	9	5	55	7	8	37	3	19
12	1	52	9	6	2	7	8	41	4	18
13	2	1	9	6	10	8	8	44	3	17
14	2	10	9	6	17	7	8	47	3	16
15	2	19	9	6	23	6	8	49	2	15
16	2	28	9	6	30	7	8	52	3	14
17	2	38	10	6	37	7	8	55	3	13
18	2	47	9	6	43	6	8	57	2	12
19	2	56	9	6	50	7	8	59	2	11
20	3	4	8	6	56	6	9	1	2	10
21	3	13	9	7	2	6	9	3	2	9
22	3	22	9	7	8	6	9	4	1	8
23	3	31	9	7	14	6	9	6	2	7
24	3	39	8	7	20	6	9	7	1	6
25	3	48	9	7	26	6	9	8	1	5
26	3	57	9	7	31	5	9	9	1	4
27	4	5	8	7	37	6	9	10	1	3
28	4	13	8	7	42	5	9	11	1	2
29	4	22	9	7	47	5	9	11	0	1
30	4	30	8	7	52	5	9	12	1	0
	—			—			—			
S	11			10			9			

Annual Equation of Moon's Mean Node.

Argument. Sun's Mean Anomaly.

S	3			4			5			S
	+		Diff.	+		Diff.	+		Diff.	
°	′	″	″	′	″	″	′	″	″	°
0	9	12		8	4		4	42		30
1	9	12	0	7	59	5	4	33	9	29
2	9	12	0	7	54	5	4	25	8	28
3	9	12	0	7	49	5	4	16	9	27
4	9	11	1	7	44	5	4	7	9	26
5	9	11	0	7	38	6	3	58	9	25
6	9	10	1	7	33	5	3	49	9	24
7	9	9	1	7	27	6	3	40	9	23
8	9	8	1	7	21	6	3	31	9	22
9	9	7	1	7	15	6	3	22	9	21
10	9	6	1	7	9	6	3	13	9	20
11	9	4	2	7	3	6	3	4	9	19
12	9	2	2	6	57	6	2	54	10	18
13	9	0	2	6	50	7	2	45	9	17
14	8	58	2	6	44	6	2	36	9	16
15	8	56	2	6	37	7	2	26	10	15
16	8	54	2	6	30	7	2	17	9	14
17	8	51	3	6	23	7	2	7	10	13
18	8	49	2	6	16	7	1	57	10	12
19	8	46	3	6	9	7	1	48	9	11
20	8	43	3	6	1	8	1	38	10	10
21	8	40	3	5	54	7	1	28	10	9
22	8	36	4	5	46	8	1	19	9	8
23	8	33	3	5	39	7	1	9	10	7
24	8	29	4	5	31	8	0	59	10	6
25	8	25	4	5	23	8	0	49	10	5
26	8	21	4	5	15	8	0	39	10	4
27	8	17	4	5	7	8	0	30	9	3
28	8	13	4	4	58	9	0	20	10	2
29	8	8	5	4	50	8	0	10	10	1
30	8	4	4	4	42	8	0	0	10	0
	—			—			—			
S	8			7			6			S

Annual Equation of MOON's Mean Anomaly.

Argument. The Sun's Mean Anomaly.

S	0			1			2			3			4			5			S
	+		Diff.	+		Diff.	+		Diff.	+		Diff.	+		Diff.	+		Diff.	
°	′	″	″	′	″	″	′	″	″	′	″	″	′	″	″	′	″	″	°
0	0	0		10	37		18	33		21	42		19	1		11	5		30
1	0	22	22	10	56	19	18	45	12	21	42	0	18	50	11	10	45	20	29
2	0	44	22	11	15	19	18	56	11	21	42	0	18	38	12	10	25	20	28
3	1	6	22	11	34	19	19	6	10	21	41	1	18	26	12	10	4	21	27
4	1	29	23	11	53	19	19	17	11	21	41	0	18	14	12	9	43	21	26
5	1	51	22	12	11	18	19	27	10	21	39	2	18	1	13	9	23	20	25
6	2	13	22	12	30	19	19	37	10	21	38	1	17	48	13	9	2	21	24
7	2	35	22	12	48	18	19	46	9	21	36	2	17	35	13	8	40	22	23
8	2	57	22	13	6	18	19	55	9	21	33	3	17	21	14	8	19	21	22
9	3	19	22	13	23	17	20	4	9	21	31	2	17	7	14	7	57	22	21
10	3	40	21	13	41	18	20	13	9	21	27	4	16	53	14	7	36	21	20
11	4	2	22	13	58	17	20	21	8	21	24	3	16	38	15	7	14	22	19
12	4	24	22	14	15	17	20	28	7	21	20	4	16	23	15	6	52	22	18
13	4	46	22	14	31	16	20	36	8	21	15	5	16	8	15	6	30	22	17
14	5	7	21	14	48	17	20	43	7	21	10	5	15	53	15	6	7	23	16
15	5	29	22	15	4	16	20	49	6	21	5	5	15	37	16	5	45	22	15
16	5	50	21	15	20	16	20	55	6	21	0	5	15	20	17	5	23	22	14
17	6	11	21	15	36	16	21	1	6	20	54	6	15	4	16	5	0	23	13
18	6	33	22	15	51	15	21	6	5	20	47	7	14	47	17	4	37	23	12
19	6	54	21	16	6	15	21	11	5	20	41	6	14	30	17	4	14	23	11
20	7	15	21	16	21	15	21	16	5	20	34	7	14	13	17	3	52	22	10

Annual Equation of MOON's Mean Anomaly.

Argument. Sun's Mean Anomaly.

S	0			1			2			3			4			5			S
	+		Diff.	+		Diff.	+		Diff.	+		Diff.	+		Diff.	+		Diff.	
°	′	″	″	′	″	″	′	″	″	′	″	″	′	″	″	′	″	″	°
21	7	36	21	16	36	15	21	21	5	20	26	8	13	55	18	3	29	23	9
22	7	56	20	16	50	14	21	25	4	20	18	8	13	37	18	3	6	23	8
23	8	17	21	17	4	14	21	28	3	20	10	8	13	19	18	2	43	23	7
24	8	37	20	17	17	13	21	31	3	20	1	9	13	1	18	2	19	24	6
25	8	58	21	17	31	14	21	34	3	19	52	9	12	42	19	1	56	23	5
26	9	18	20	17	44	13	21	36	2	19	43	9	12	23	19	1	33	23	4
27	9	38	20	17	57	13	21	38	2	19	33	10	12	4	19	1	10	23	3
28	9	58	20	18	9	12	21	40	2	19	23	10	11	44	20	0	47	23	2
29	10	17	19	18	21	12	21	41	1	19	12	11	11	25	19	0	23	24	1
30	10	37	20	18	33	12	21	42	1	19	1	11	11	5	20	0	0	23	0
	—			—			—			—			—			—			
S	11			10			9			8			7			6			S

I For the MOON's Longitude.

Argument I. Sun's Mean Anomaly.

S	0			1			2			3			4			5			S
	+		Diff.	+		Diff.	+		Diff.	+		Diff.	+		Diff.	+		Diff.	
°	′	″	″	′	″	″	′	″	″	′	″	″	′	″	″	′	″	″	°
0	0	0,0	11,4	5	26,6	9,9	9	31,3	5,9	11	8,6	0,2	9	46,7	5,7	5	42,0	10,3	30
1	0	11,4	11,3	5	36,5	9,7	9	37,2	5,8	11	8,8	0,0	9	41,0	5,9	5	31,7	10,4	29
2	0	22,7	11,4	5	46,2	9,8	9	42,0	5,5	11	8,8	0,2	9	35,1	6,2	5	21,3	10,6	28
3	0	34,1	11,3	5	56,0	9,6	9	48,5	5,4	11	8,6	0,4	9	28,9	6,3	5	10,7	10,6	27
4	0	45,4	11,3	6	5,6	9,5	9	53,9	5,3	11	8,2	0,5	9	22,6	6,5	5	0,1	10,7	26
5	0	56,7	11,3	6	15,1	9,4	9	59,2	5,0	11	7,7	0,9	9	16,1	6,7	4	49,4	10,8	25
6	1	8,0	11,3	6	24,5	9,3	10	4,2	4,9	11	6,8	1,0	9	9,4	6,8	4	38,6	10,9	24
7	1	19,3	11,3	6	33,8	9,1	10	9,1	4,6	11	5,8	1,2	9	2,6	7,0	4	27,7	11,0	23
8	1	30,6	11,2	6	42,9	9,2	10	13,7	4,5	11	4,6	1,4	8	55,6	7,3	4	16,7	11,1	22
9	1	41,8	11,3	6	52,1	8,9	10	18,2	4,4	11	3,2	1,8	8	48,3	7,3	4	5,6	11,2	21
10	1	53,1	11,2	7	1,0	8,8	10	22,6	4,1	11	1,4	1,8	8	41,0	7,6	3	54,4	11,2	20
11	2	4,3	11,1	7	9,8	8,7	10	26,7	4,0	10	59,6	2,0	8	33,4	7,6	3	43,2	11,4	19
12	2	15,4	11,1	7	18,5	8,6	10	30,7	3,7	10	57,6	2,2	8	25,8	7,9	3	31,8	11,3	18
13	2	26,5	11,1	7	27,1	8,5	10	34,4	3,6	10	55,4	2,5	8	17,9	8,0	3	20,5	11,5	17
14	2	37,6	11,0	7	35,6	8,3	10	38,0	3,3	10	52,9	2,6	8	9,9	8,2	3	9,0	11,4	16
15	2	48,6	11,0	7	43,9	8,2	10	41,3	3,2	10	50,3	2,9	8	1,7	8,3	2	57,6	11,6	15
16	2	59,6	10,9	7	52,1	8,0	10	44,5	3,1	10	47,4	3,0	7	53,4	8,5	2	46,0	11,7	14
17	3	10,5	10,9	8	0,1	7,9	10	47,6	2,8	10	44,4	3,3	7	44,9	8,6	2	34,3	11,7	13
18	3	21,4	10,8	8	8,0	7,8	10	50,4	2,6	10	41,1	3,4	7	36,3	8,9	2	22,6	11,7	12
19	3	32,2	10,7	8	15,8	7,6	10	53,0	2,4	10	37,7	3,7	7	27,4	8,8	2	10,9	11,8	11
20	3	42,9	10,7	8	23,4	7,5	10	55,4	2,2	10	34,0	3,8	7	18,6	9,1	1	59,1	11,7	10
21	3	53,6	10,7	8	30,9	7,3	10	57,6	2,0	10	30,2	4,1	7	9,5	9,2	1	47,4	11,8	9
22	4	4,3	10,6	8	38,2	7,2	10	59,6	1,8	10	26,1	4,2	7	0,3	9,3	1	35,6	11,9	8
23	4	14,9	10,5	8	45,4	7,0	11	1,4	1,6	10	21,9	4,5	6	51,0	9,5	1	23,7	12,0	7
24	4	25,4	10,4	8	52,4	6,9	11	3,0	1,5	10	17,4	4,6	6	41,5	9,6	1	11,7	11,9	6
25	4	35,8	10,3	8	59,3	6,7	11	4,5	1,3	10	12,8	4,9	6	31,9	9,7	0	59,8	11,9	5
26	4	46,1	10,2	9	6,0	6,5	11	5,8	1,0	10	7,9	5,0	6	22,2	9,8	0	47,9	12,0	4
27	4	56,3	10,2	9	12,5	6,4	11	6,8	0,8	10	2,9	5,1	6	12,4	10,0	0	35,9	11,9	3
28	5	6,5	10,0	9	18,9	6,3	11	7,6	0,6	9	57,8	5,4	6	2,4	10,1	0	24,0	12,0	2
29	5	16,5	10,1	9	25,2	6,1	11	8,2	0,4	9	52,4	5,7	5	52,3	10,3	0	12,0	12,0	1
30	5	26,6		9	31,3		11	8,6		9	46,7		5	42,0		0	0,0		0
	—			—			—			—			—			—			
S	11			10			9			8			7			6			S

II. For the ☽'s Long.

Argument II.
2 ☽ à ☼ + Arg. I.

S	0	1	2
	—	—	—
S	6	7	8
	+	+	+
°	″	″	″
0	0,0	28,0	48,4
1	1,0	28,8	48,9
2	2,0	29,6	49,4
3	2,9	30,4	49,8
4	3,9	31,3	50,3
5	4,8	32,1	50,7
6	5,8	32,9	51,1
7	6,8	33,6	51,5
8	7,8	34,4	51,8
9	8,7	35,2	52,2
10	9,7	35,9	52,5
11	10,7	36,7	52,9
12	11,6	37,4	53,2
13	12,6	38,1	53,5
14	13,5	38,8	53,7
15	14,5	39,5	54,0
16	15,4	40,2	54,3
17	16,3	40,9	54,5
18	17,3	41,5	54,7
19	18,2	42,2	54,9
20	19,1	42,8	55,0
21	20,0	43,4	55,2
22	20,9	44,0	55,4
23	21,8	44,6	55,5
24	22,7	45,2	55,6
25	23,6	45,8	55,7
26	24,5	46,4	55,8
27	25,4	46,9	55,8
28	26,2	47,4	55,9
29	27,1	47,9	55,9
30	28,0	48,4	55,9
	+	+	+
S	11	10	9
	—	—	—
S	5	4	3

III. For the ☽'s Long.

Argument III.
2 ☽ à ☼ — Arg. I.

0		1		2	
—		—		—	
6		7		8	
+		+		+	
′	″	′	″	′	″
0	0,0	0	37,8	1	5,2
0	1,3	0	38,8	1	5,9
0	2,6	0	39,9	1	6,5
0	3,9	0	41,0	1	7,1
0	5,3	0	42,1	1	7 7
0	6,6	0	43,2	1	8 3
0	7,9	0	44,3	1	8,8
0	9,2	0	45,3	1	9,3
0	10,5	0	46,4	1	9,8
0	11,8	0	47,4	1	10,3
0	13,1	0	48,4	1	10,8
0	14,4	0	49,4	1	11,2
0	15,7	0	50,4	1	11,6
0	16,9	0	51,4	1	12,0
0	18,2	0	52,3	1	12,4
0	19,5	0	53,3	1	12,7
0	20,8	0	54,2	1	13,1
0	22,0	0	55,1	1	13,4
0	23,3	0	56,0	1	13,7
0	24,5	0	56,8	1	13,9
0	25,8	0	57,7	1	14,2
0	27,0	0	58,5	1	14,4
0	28,2	0	59,3	1	14,6
0	29,4	1	0,1	1	14,7
0	30,6	1	0,9	1	14,9
0	31,8	1	1,7	1	15,0
0	33,0	1	2,4	1	15,1
0	34,2	1	3,2	1	15,2
0	35,4	1	3,9	1	15,3
0	36,5	1	4,6	1	15,3
0	37,7	1	5,2	1	15,3
+		+		+	
11		10		9	
—		—		—	
5		4		3	

IV. For the ☽'s Long.

Argument IV.
2 ☽ à ☼ + ☽'s Me. Ano.

0	1	2	S
+	+	+	
6	7	8	S
—	—	—	
″	″	″	°
0,0	28,9	50,1	30
1,0	29,8	50,6	29
2,0	30,6	51,0	28
3,0	31,5	51,5	27
4,0	32,3	52,0	26
5,0	33,2	52,4	25
6,0	34,0	52,8	24
7,0	34,8	53,2	23
8,0	35,6	53,6	22
9,0	36,4	54,0	21
10,0	37,2	54,3	20
11,0	37,9	54,7	19
12,0	38,7	55,0	18
13,0	39,4	55,3	17
14,0	40,2	55,6	16
15,0	40,9	55,8	15
15,9	41,6	56,1	14
16,9	42,3	56,3	13
17,9	43,0	56,5	12
18,8	43,6	56,7	11
19,8	44,3	56,9	10
20,7	44,9	57,1	9
21,6	45,5	57,2	8
22,6	46,2	57,4	7
23,5	46,8	57,5	6
24,4	47,4	57,6	5
25,3	47,9	57,7	4
26,2	48,5	57,7	3
27,1	49,0	57,8	[illegible]
28,0	49,6	57,8	1
28,9	50 1	57,8	0
—	—	—	
11	10	9	S
+	+	+	
5	4	3	S

V. For the Moon's Longitude. Evection.

Arg. V. 2 ☽ à ☼ — ☽'s Mean Anomaly.

S	0				1				2				S
	—			Dif.	—			Dif.	—			Dif.	
°	°	′	″	″	°	′	″	″	°	′	″	″	°
0	0	0	0,0	83,0	0	39	43,8	72,0	1	9	11,1	42,1	30
1	0	1	23,0	83,1	0	40	55,8	71,2	1	9	53,2	40,9	29
2	0	2	46,1	82,9	0	42	7,1	70,5	1	10	34,1	39,6	28
3	0	4	9,0	82,9	0	43	17,6	69,8	1	11	13,7	38,3	27
4	0	5	31,9	82,8	0	44	27,4	69,1	1	11	52,0	37,1	26
5	0	6	54,7	82,7	0	45	36,5	68,2	1	12	29,1	35,8	25
6	0	8	17,4	82,5	0	46	44,7	67,4	1	13	4,9	34,4	24
7	0	9	39,9	82,4	0	47	52,1	66,5	1	13	39,3	33,1	23
8	0	11	2,3	82,2	0	48	58,6	65,7	1	14	12,4	31,8	22
9	0	12	24,5	82,0	0	50	4,3	64,7	1	14	44,2	30,4	21
10	0	12	46,5	81,7	0	51	9,0	63,9	1	15	14,6	29,1	20
11	0	15	8,2	81,4	0	52	12,9	63,0	1	15	43,7	27,8	19
12	0	16	29,6	81,2	0	53	15,9	62,1	1	16	11,5	26,3	18
13	0	17	50,8	80,8	0	54	18,0	61,0	1	16	37,8	25,0	17
14	0	19	11,6	80,6	0	55	19,0	60,1	1	17	2,8	23,6	16
15	0	20	32,2	80,1	0	56	19,1	59,1	1	17	26,4	22,1	15

V. For the Moon's Longitude. Evection.

Arg. V. 2 ☽ à ☼ — ☽'s Mean Anomaly.

S	0				1				2				S
	—			Dif.	—			Dif.	—			Dif.	
°	°	′	″	″	°	′	″	″	°	′	″	″	°
16	0	21	52,2	79,8	0	57	18,2	58,1	1	17	48,5	20,7	14
17	0	23	12,1	79,4	0	58	16,3	57,0	1	18	9,2	19,4	13
18	0	24	31,5	78,9	0	59	13,3	55,9	1	18	28,6	18,0	12
19	0	25	50,4	78,4	1	0	9,2	55,0	1	18	46,6	16,4	11
20	0	27	8,8	78,0	1	1	4,3	53,9	1	19	3,0	15,1	10
21	0	28	26,8	77,5	1	1	58,1	52,6	1	19	18,1	13,6	9
22	0	29	44,3	77,0	1	2	50,7	51,7	1	19	31,7	12,2	8
23	0	31	1,3	76,5	1	3	42,4	50,5	1	19	43,9	10,7	7
24	0	32	17,8	75,9	1	4	32,9	49,3	1	19	54,6	9,3	[illegible]
25	0	33	33,7	75,2	1	5	22,2	48,1	1	20	3,9	7,8	5
26	0	34	48,9	74,7	1	6	10,3	47,0	1	20	11,7	6,4	4
27	0	36	3,6	74,1	1	6	57,3	45,8	1	20	18,1	4,9	3
28	0	37	17,7	73,3	1	7	43,1	44,6	1	20	23,0	3,5	2
29	0	38	31,0	72,8	1	8	27,7	43,4	1	20	26,5	1,9	1
30	0	39	43,8		1	9	11,1		1	20	28,4		0
	+				+				+				
S	11				10				9				S

V. For the Moon's Longitude. Evection.

Arg. V. 2 ☽ à ☼ — ☽'s Mean Anomaly.

S	3				4				5				S
	—			Dif.	—			Dif.	—			Dif.	
°	°	′	″	″	°	′	″	″	°	′	″	″	°
0	1	20	28,4	0,5	1	10	11,9	42,2	0	40	44,6	74,0	30
1	1	20	28,9	0,9	1	9	29,7	43,4	0	39	30,6	74,7	29
2	1	20	28,0	2,5	1	8	46,3	44,8	0	38	15,9	75,5	28
3	1	20	25,5	4,0	1	8	1,5	46,0	0	37	0,4	76,1	27
4	1	20	21,5	5,4	1	7	15,5	47,3	0	35	44,3	76,8	26
5	1	20	16,1	6,9	1	6	28,2	48,5	0	34	27,5	77,5	25
6	1	20	9,2	8,3	1	5	39,7	49,8	0	33	10,0	78,1	24
7	1	20	0,9	9,8	1	4	49,9	51,0	0	31	51,9	78,8	23
8	1	19	51,1	11,3	1	3	58,9	52,2	0	30	33,1	79,3	22
9	1	19	39,8	12,8	1	3	6,7	53,3	0	29	13,8	79,8	21
10	1	19	27,0	14,2	1	[illegible]	13,4	54,6	0	27	54,0	80,4	20
11	1	19	12,8	15,6	1	1	18,8	55,7	0	26	33,6	80,9	19
12	1	18	57,2	17,2	1	0	23,1	56,8	0	25	12,7	81,4	18
13	1	18	40,0	18,5	0	59	26,3	57,9	0	23	51,3	81,8	17
14	1	18	21,5	20,1	0	58	28,4	59,1	0	22	29,5	82,3	16
15	1	18	1,4	21,4	0	57	29,3	60,1	0	21	7,2	82,6	15
16	1	17	40,0	23,0	0	56	29,2	61,2	0	19	44,6	83,0	14
17	1	17	17,0	24,3	0	55	28,0	62,3	0	18	21,6	83,4	13
18	1	16	52,7	25,8	0	54	25,7	63,2	0	16	58,2	83,8	12
19	1	16	26,9	27,1	0	53	22,5	64,3	0	15	34,4	84,0	11
20	1	15	59,8	28,6	0	52	18,2	65,3	0	14	10,4	84,3	10
21	1	15	31,2	30,0	0	51	12,9	66,1	0	12	46,1	84,5	9
22	1	15	1,2	31,2	0	50	6,8	67,2	0	11	21,6	84,7	8
23	1	14	29,9	32,8	0	48	59,6	68,1	0	9	56,9	84,9	7
24	1	13	57,1	34,2	0	47	51,5	69 0	0	8	32,0	85,1	6
25	1	13	22,9	35,5	0	46	42,5	69,9	0	7	6,9	85,2	5
26	1	12	47,4	36,9	0	45	32,6	70,8	0	5	41,7	85,3	4
27	1	12	10,5	38,2	0	44	21,8	71,5	0	4	16,4	85,4	3
28	1	11	32,3	39,5	0	43	10,3	72,5	0	2	51,0	85,5	2
29	1	10	52,8	40,9	0	41	57,8	73,2	0	1	25,5	85,5	1
30	1	10	11,9		0	40	44,6		0	0	0,0		[illegible]
	+				+				+				
S	8				7				6				

	VI. For the ☽'s Long. Argument VI. Arg. V. + Arg. I.			VII. For ☽ Lo. Argu. VII. Arg. V − Arg. I			VIII. For ☽'s Lo. Argument VIII. ☽ M. An. − Ar. I.			
S	0	1	2	0	1	2	0	1	2	S
	+	+	+	+	+	+	+	+	+	
S	6	7	8	6	7	8	6	7	8	S
	—	—	—	—	—	—	—	—	—	
°	′ ″	′ ″	′ ″	″	″	″	″	″	″	°
0	0 0,0	1 1,8	1 47,0	0,0	23,3	40,3	0,0	21,0	36,4	30
1	0 2,2	1 3,6	1 48,0	0,8	24,0	40,7	0,7	21,6	36,7	29
2	0 4,3	1 5,4	1 49,0	1,6	24,7	41,1	1,5	22,3	37,1	28
3	0 6,5	1 7,3	1 50,0	2,4	25,3	41,4	2,2	22,9	37,4	27
4	0 8,6	1 9,1	1 51,0	3,3	26,0	41,8	2,9	23,5	37,8	26
5	0 10,8	1 10,8	1 51,9	4,1	26,7	42,2	3,7	24,1	38,1	25
6	0 12,9	1 12,6	1 52,8	4,9	27,3	42,5	4,4	24,7	38,4	24
7	0 15,1	1 14,3	1 53,7	5,7	28,0	42,8	5,1	25,3	38,7	23
8	0 17,2	1 16,0	1 54,5	6,5	28,6	43,1	5,9	25,9	38,9	22
9	0 19,3	1 17,7	1 55,3	7,3	29,3	43,4	6,6	26,4	39,2	21
10	0 21,5	1 19,4	1 56,1	8,1	29,9	43,7	7,3	27,0	39,5	20
11	0 23,6	1 21,0	1 56,8	8,9	30,5	44,0	8,0	27,6	39,7	19
12	0 25,7	1 22,6	1 57,5	9,7	31,1	44,2	8,7	28,1	39,9	18
13	0 27,8	1 24,2	1 58,1	10,5	31,7	44,5	9,5	28,7	40,2	17
14	0 29,9	1 25,8	1 58,7	11,3	32,3	44,7	10,2	29,2	40,4	16
15	0 32,0	1 27,3	1 59,3	12,0	32,9	44,9	10,9	29,7	40,6	15
16	0 34,1	1 28,8	1 59,8	12,8	33,5	45,1	11,6	30,2	40,8	14
17	0 36,1	1 30,3	2 0,3	13,6	34,0	45,3	12,3	30,7	40,9	13
18	0 38,2	1 31,8	2 0,8	14,4	34,6	45,5	13,0	31,2	41,1	12
19	0 40,2	1 33,2	2 1,2	15,1	35,1	45,7	13,7	31,7	41,2	11
20	0 42,2	1 34,6	2 1,6	15,9	35,6	45,8	14,4	32,2	41,4	10
21	0 44,3	1 36,0	2 2,0	16,7	36,2	45,9	15,1	32,6	41,5	9
22	0 46,3	1 37,3	2 2,3	17,4	36,7	46,1	15,7	33,1	41,6	8
23	0 48,3	1 38,6	2 2,6	18,2	37,1	46,2	16,4	33,5	41,7	7
24	0 50,2	1 39,9	2 2,8	18,9	37,6	46,3	17,1	34,0	41,8	6
25	0 52,2	1 41,2	2 3,0	19,7	38,1	46,3	17,8	34,4	41,8	5
26	0 54,1	1 42,4	2 3,2	20,4	38,6	46,4	18,4	34,8	41,9	4
27	0 56,1	1 43,6	2 3,3	21,1	39,0	46,4	19,1	35,2	41,9	3
28	0 58,0	1 44,7	2 3,4	21,8	39,4	46,5	19,7	35,6	42,0	2
29	0 59,9	1 45,9	2 3,5	22,6	39,9	46,5	20,4	36,0	42,0	1
30	1 1,8	1 47,0	2 3,5	23,3	40,3	46,5	21,0	36.4	42,0	0
	—	—	—	—	—	—	—	—	—	
S	11	10	9	11	10	9	11	10	9	S
	+	+	+	+	+	+	+	+	+	
S	5	4	3	5	4	3	5	4	3	S

IX. For the Moon's Longitude.

Arg. IX. Mean Diſt. ☽ à ☉ — ☽'s Mean Anomaly.

S	0		1		2		
	—	Diff.	—	Diff.	∓	Diff.	
°	′ ″	″	′ ″	″	′ ″	″	°
0	0 0,0	1,6	0 38,3	0,7	0 30,0	1,2	30
1	0 1,6	1,6	0 39,0	0,6	0 28,8	1,2	29
2	0 3,2	1,6	0 39,6	0,4	0 27,6	1,3	28
3	0 4,8	1,6	0 40,0	0,5	0 26,3	1,5	27
4	0 6,4	1,6	0 40,5	0,4	0 24,8	1,4	26
5	0 8,0	1,5	0 40,9	0,4	0 23,4	1,4	25
6	0 9,5	1,6	0 41,3	0,2	0 22,0	1,6	24
7	0 11,1	1,5	0 41,5	0,2	0 20,4	1,6	23
8	0 12,6	1,5	0 41,7	0,2	0 18,8	1,6	22
9	0 14,1	1,6	0 41,9	0,0	0 17,2	1,6	21
10	0 15,7	1,5	0 41,9	0,0	0 15,6	1,8	20
11	0 17,2	1,5	0 41,9	0,0	0 13,8	1,7	19
12	0 18,7	1,4	0 41,9	0,1	0 12,1	1,7	18
13	0 20,1	1,4	0 41,8	0,2	0 10,4	1,8	17
14	0 21,5	1,3	0 41,6	0,3	0 8,6	1 8	16
15	0 22,8		0 41,3		0 6,8	,	15

IX. For the Moon's Longitude.

Arg. IX. Mean Diſt. ☽ a ☉ — ☽'s Mean Anomaly.

S	0		1		2		S
	—	Diff.	—	Diff.	∓	Diff.	
°	′ ″	″	′ ″	″	′ ″	″	°
16	0 24,1	1,3	0 41,1	0,2	0 5,0	1,8	14
17	0 25,5	1,4	0 40,7	0,4	0 3,1	1,9	13
18	0 26,7	1,2	0 40,2	0,5	0 1,2	1,9	12
19	0 27,9	1,2	0 39,7	0,5	0 0,8	2,0	11
20	0 29,1	1,2	0 39,1	0,6	0 2,8	2,0	10
21	0 30,3	1,2	0 38,5	0,6	0 4,7	1,9	9
22	0 31,4	1,1	0 37,8	0,7	0 6,7	2,0	8
23	0 32,4	1,0	0 37,1	0,7	0 8,6	1,9	7
24	0 33,5	1,1	0 36,2	0,9	0 10,7	2,1	6
25	0 34,4	0,9	0 35,3	0,9	0 12,6	1,9	5
26	0 35,2	0,8	0 34,4	0,9	0 14,6	2,0	4
27	0 36,1	0,9	0 33,4	1,0	0 16,7	2,1	3
28	0 36,9	0,8	0 32,3	1,1	0 18,7	2,0	2
29	0 37,7	0,8	0 31,2	1,1	0 20,7	2,0	1
30	0 38,3	0,6	0 30,0	1,2	0 22,7	2,0	0
	+		+		±		
S	11		10		9		S

IX. For the Moon's Longitude.

Arg. IX. Mean Diſt. ☽ a ☉ — ☽'s Mean Anomaly.

S	3		4		5		S
	+	Diff.	+	Diff.	+	Diff.	
°	′ ″	″	′ ″	″	′ ″	″	°
0	0 22,7	2,0	1 9,4	0,8	1 1,1	1,4	30
1	0 24,7	2,0	1 10,2	0,7	0 59,7	1,4	29
2	0 26,7	2,0	1 10,9	0,5	0 58,3	1,5	28
3	0 28,7	1,9	1 11,4	0,6	0 56,8	1,6	27
4	0 30,6	2,0	1 12,0	0,5	0 55,2	1,6	26
5	0 32,6	1,8	1 12,5	0,5	0 53,6	1,7	25
6	0 34,4	2,0	1 13,0	0,3	0 51,9	1,7	24
7	0 36,4	1,9	1 13,3	0,3	0 50,2	1,8	23
8	0 38,3	1,8	1 13,6	0,2	0 48,4	1,9	22
9	0 40,1	1,9	1 13,8	0,1	0 46,5	1,8	21
10	0 42,0	1,8	1 13,9	0,0	0 44,7	2,0	20
11	0 43,8	1,8	1 13,9	0,1	0 42,7	2,0	19
12	0 45,6	1,7	1 14,0	0,1	0 40,7	2,0	18
13	0 47,3	1,7	1 13,9	0,2	0 38,7	2,0	17
14	0 49,0	1,6	1 13,7	0,2	0 36,7	2,1	16
15	0 50,6	1,6	1 13,5	0,3	0 34,6	2,1	15
16	0 52,2	1,6	1 13,2	0,4	0 32,5	2,2	14
17	0 53,8	1,5	1 12,8	0,5	0 30,3	2,2	13
18	0 55,3	1,5	1 12,3	0,6	0 28,1	2,3	12
19	0 56,8	1,4	1 11,7	0,6	0 25,8	2,3	11
20	0 58,2	1,4	1 11,1	0,6	0 23,5	2,2	10
21	0 59,6	1,4	1 10,5	0,8	0 21,3	2,3	9
22	1 1,0	1,2	1 9,7	0,8	0 19,0	2,3	8
23	1 2,2	1,2	1 8,9	1,0	0 16,7	2,4	7
24	1 3,4	1,2	1 7,9	1,0	0 14,3	2,3	6
25	1 4,6	1,0	1 6,9	1,0	0 12,0	2,4	5
26	1 5,6	1,0	1 5,9	1,1	0 9,6	2,4	4
27	1 6,6	1,0	1 4,8	1,2	0 7,2	2,4	3
28	1 7,6	1,0	1 3,6	1,2	0 4,8	2,4	2
29	1 8,6	0,8	1 2,4	1,3	0 2,4	2,4	1
30	1 9,4		1 1,1		0 0,0		0
	—		—		—		
S	8		7		6		S

X. For the ☽'s Long.							XI. For ☽ Lo.			XII. For ☽ Lon.			
Argument X. M.Lo.☊—True Lon.							Argum. XI. ☽ à ☼+☼ An.			Argument XII. ☽ à ☼ — ☼ Ano.			
S	0		1		2		0	1	2	0	1	2	S
	+		+		+		—	—	—	—	—	—	
S	6		7		8		6	7	8	6	7	8	S
	—		+		+		+	+	+	+	+	+	
°	'	"	'	"	'	"	"	"	"	"	"	"	°
0	0	0,0	0	52,3	0	52,3	0,0	8,5	14,7	0,0	1,6	2,7	30
1	0	2,1	0	53,3	0	51,2	0,3	8,8	14,9	0,1	1,6	2,7	29
2	0	4,2	0	54,3	0	50,1	0,6	9,0	15,0	0,2	1,6	2,7	28
3	0	6,3	0	55,2	0	48,9	0,9	9,3	15,2	0,2	1,7	2,8	27
4	0	8,4	0	56,0	0	47,6	1,2	9,5	15,3	0,3	1,7	2,8	26
5	0	10,5	0	56,8	0	46,3	1,5	9,8	15,4	0,3	1,8	2,8	25
6	0	12,6	0	57,4	0	44,9	1,8	10,0	15,5	0,4	1,8	2,8	24
7	0	14,6	0	58,0	0	43,5	2,1	10,2	15,6	0,4	1,9	2,9	23
8	0	16,7	0	58,6	0	42,0	2,4	10,5	15,8	0,5	1,9	2,9	22
9	0	18,7	0	59,1	0	40,[illegible]	2,7	10,7	15,9	0,5	2,0	2,9	21
10	0	20,7	0	59,5	0	38,8	3,0	10,9	16,0	0,6	2,0	2,9	20
11	0	22,6	0	59,8	0	37,2	3,3	11,2	16,1	0,7	2,0	2,9	19
12	0	24,6	1	0,1	0	35,5	3,5	11,4	16,2	0,7	2,1	3,0	18
13	0	26,5	1	0,2	0	33,8	3,8	11,6	16,3	0,8	2,1	3,0	17
14	0	28,4	1	0,4	0	32,0	4,1	11,8	16,3	0,8	2,2	3,0	16
15	0	30.2	1	0,4	0	30,2	4,4	12,0	16,4	0,9	2,2	3,0	15
16	0	32,0	1	0,4	0	28,4	4,7	12,2	16,5	0,9	2,2	3,0	14
17	0	33,8	1	0,3	0	26,5	5,0	12,4	16,6	0,9	2,3	3,0	13
18	0	35,5	1	0,1	0	24,6	5,3	12,6	16,6	1,0	2,3	3,0	12
19	0	37,2	0	59,8	0	22,6	5,5	12,8	16,7	1,0	2,3	3,0	11
20	0	38,8	0	59,5	0	20,7	5,9	13,0	16,7	1,1	2,4	3,1	10
21	0	40,4	0	59,1	0	18,7	6,1	13,2	16,8	1,1	2,4	3,1	9
22	0	42,0	0	58,6	0	16,7	6,4	13,4	16,8	1,2	2,4	3·1	8
23	0	43,5	0	58,0	0	14,6	6,6	13,6	16,9	1,2	2,5	3,1	7
24	0	44,9	0	57,4	0	12,6	6,9	13,8	16,9	1,3	2,5	3,1	6
25	0	46,3	0	56,8	0	10,5	7,2	13,9	16,9	1,3	2,5	3,1	5
26	0	47,6	0	56,0	0	8,4	7,5	14,1	17,0	1,4	2,6	3,1	4
27	0	48,9	0	55,2	0	6,[illegible]	7,7	14,3	17,0	1,4	2,6	3,1	3
28	0	50,1	0	54,3	0	4,2	8,[illegible]	14,4	17,0	1,5	2,6	3,1	2
29	0	51,2	0	53,3	0	2,1	8,2	14,6	17,0	1,5	2,7	3,1	1
30	0	52,3	0	52,[illegible]	0	0,0	8,5	14,7	17,0	1,6	2,7	3,1	0
S	—		—		—		+	+	+	+	+	+	
	11		10		9		11	10	9	11	10	9	S
S	—		—		—		—	—	—	—	—	—	
	5		4		3		5	4	3	5	4	3	S

XIII. For the ☽'s Long.				XIV. For ☽'s Lon.			XV. For the ☽'s Lon.			
Argument XIII. 2☽ à ☼ + 2 ☽'s M. Ano.				Argument XIV. 4☽ à ☼ — ☽'s M.A.			Argument XV. 2☽ à ☊ — 2☽'s M. A.			
S	0	1	2	0	1	2	0	1	2	S
	—	—	—	+	+	+	—	—	—	
S	6	7	8	6	7	8	6	7	8	S
	+	+	+	—	—	—	+	+	+	
°	"	"	"	"	"	"	"	"	"	°
0	0,0	1,9	3,2	0,0	6,2	10,7	0,0	3,2	5,5	30
1	0,1	1,9	3,2	0,2	6,4	10,8	0,1	3,2	5,5	29
2	0,1	2,0	3,3	0,4	6,6	11,0	0,2	3,3	5,6	28
3	0,2	2,0	3,3	0,6	6,8	11,1	0,3	3,4	5,6	27
4	0,3	2,1	3,3	0,9	6,9	11,2	0,4	3,5	5,7	26
5	0,3	2,1	3,4	1,1	7,1	11,2	0,6	3,6	5,7	25
6	0,4	2,2	3,4	1,3	7,3	11,3	0,7	3,7	5,8	24
7	0,5	2,2	3,4	1,5	7,5	11,4	0,8	3,8	5,8	23
8	0,5	2,3	3,4	1,7	7,6	11,5	0,9	3,9	5,8	22
9	0,6	2,3	3,5	1,9	7,8	11,6	1,0	4,0	5,9	21
10	0,6	2,4	3,5	2,2	8,0	11,7	1,1	4,1	5,9	20
11	0,7	2,4	3,5	2,4	8,1	11,7	1,2	4,1	6,0	19
12	0,8	2,5	3,5	2,6	8,3	11,8	1,3	4,2	6,0	18
13	0,8	2,5	3,5	2,8	8,5	11,9	1,4	4,3	6,0	17
14	0,9	2,6	3,6	3,0	8,6	11,9	1,5	4,4	6,1	16
15	1,0	2,6	3,6	3,2	8,8	12,0	1,6	4,5	6,1	15
16	1,0	2,7	3,6	3,4	8,9	12,0	1,7	4,5	6,1	14
17	1,1	2,7	3,6	3,6	9,1	12,1	1,8	4,6	6,1	13
18	1,1	2,8	3,6	3,8	9,2	12,1	2,0	4,7	6,2	12
19	1,2	2,8	3,6	4,0	9,4	12,2	2,1	4,8	6,2	11
20	1,3	2,8	3,6	4,2	9,5	12,2	2,2	4,8	6,2	10
21	1,3	2,9	3,7	4,5	9,6	12,2	2,3	4,9	6,2	9
22	1,4	2,9	3,7	4,7	9,8	12,3	2,4	5,0	6,2	8
23	1,4	3,0	3,7	4,9	9,9	12,3	2,5	5,0	6,3	7
24	1,5	3,0	3,7	5,0	10,0	12,3	2,6	5,1	6,3	6
25	1,6	3,0	3,7	5,2	10,2	12,3	2,7	5,2	6,3	5
26	1,6	3,1	3,7	5,4	10,3	12,4	2,8	5,2	6,3	4
27	1,7	3,1	3,7	5,6	10,3	12,4	2,9	5,3	6,3	3
28	1,7	3,1	3,7	5,8	10,5	12,4	3,0	5,3	6,3	2
29	1,8	3,2	3,7	6,0	10,6	12,4	3,1	5,4	6,3	1
30	1,9	2,2	3,7	6,2	10,7	12,4	3,2	5,5	6,3	0
	+	+	+	—	—	—	+	+	+	
S	11	10	9	11	10	9	11	10	9	S
	—	—	—	+	+	+	—	—	—	
S	5	4	3	5	4	3	5	4	3	S

XVI. For the ☽'s Long.				XVII. For ☽'s Lon.			XVIII. For ☽'s Long.			
Argument XVI. 2☽ à ☉ − 2☽ à ☊ + ☽ M.A.				Argument XVII. 2☽ á ☼ — 2☽ á ☊ — ☽'s M. A.			Argument XVIII. Mean Long. ☽'s ☊			
S	0	1	2	0	1	2	0	1	2	S
	+	+	+	—	—	—	+	+	+	
S	6	7	8	6	7	8	6	7	8	S
	—	—	—	+	+	+	—	—	—	
°	"	"	"	"	"	"	"	"	"	°
0	0,0	4,2	7,2	0,0	2,7	4,6	0,0	3,9	6,7	30
1	0,2	4,3	7,3	0,1	2,7	4,6	0,1	4,0	6,7	29
2	0,3	4,4	7,3	0,2	2,8	4,7	0,3	4,1	6,8	28
3	0,4	4,5	7,4	0,3	2,9	4,7	0,4	4,2	6,[illegible]	27
4	0,6	4,7	7,5	0,4	3,0	4,8	0,5	4,3	6,9	26
5	0,7	7,8	7,5	0,5	3,1	4,8	0,7	4,4	7,0	25
6	0,9	4,9	7,6	0,6	3,1	4,9	0,8	4,5	7,0	24
7	1,0	5,0	7,7	0,7	3,2	4,9	1,0	4,6	7,1	23
8	1,2	5,1	7,7	0,7	3,3	4,9	1,1	4,7	7,1	22
9	1,3	5,2	7,8	0,8	3,3	5,0	1,2	4,8	7,2	21
10	1,4	5,3	7,8	0,9	3,4	5,0	1,3	5,0	7,2	20
11	1,6	5,5	7,9	1,0	3,5	5,0	1,5	5,1	7,3	19
12	1,7	5,6	7,9	1,1	3,6	5,0	1,6	5,2	7,3	18
13	1,9	5,7	8,0	1,2	3,6	5,1	1,7	5,3	7,4	17
14	2,0	5,8	8,0	1,3	3,7	5,1	1,9	5,4	7,4	16
15	2,2	5,9	8,0	1,4	3,8	5,1	2,0	5,4	7,4	15
16	2,3	6,0	8,1	1,5	3,8	5,2	2,1	5,5	7,5	14
17	2,4	6,1	8,1	1,6	3,9	5,2	2,2	5,6	7,5	13
18	2,6	6,2	8,1	1,6	3,9	5,2	2,4	5,7	7,5	12
19	2,7	6,3	8,2	1,7	4,0	5,2	2,5	5,8	7,5	11
20	2,8	6,4	8,2	1,8	4,1	5,2	2,6	5,9	7,6	10
21	3,0	6,5	8,2	1,9	4,1	5,2	2,8	6,0	7,6	9
22	3,1	6,6	8,2	2,0	4,2	5,3	2,9	6,1	7,6	8
23	3,3	6,6	8,2	2,1	4,2	5,3	3,0	6,1	7,6	7
24	3,4	6,7	8,3	2,2	4,3	5,3	3,1	6,2	7,7	6
25	3,5	6,8	8,3	2,2	4,3	5,3	3,3	6,3	7,7	5
26	3,6	6,9	8,3	2,3	4,4	5,3	3,4	6,4	7,7	4
27	3,8	7,0	8,3	2,4	4,5	5,3	3,5	6,5	7,7	3
28	3,9	7,0	8,3	2,5	4,5	5,3	3,6	6,5	7,7	2
29	4,0	7,1	8,3	2,6	4,5	5,3	3,7	6,6	7,7	1
30	4,2	7,2	8,3	2,7	4,6	5,3	3,9	6,7	7,7	0
	+	+	+	—	—	—	+	+	+	
S	5	4	3	5	4	3	5	4	3	S
	—	—	—	+	+	+	—	—	—	
S	11	10	9	11	10	9	11	10	9	S

XIX. For the MOON's Longitude. Equation Center

Argument XIX. Moon's Correct Anomaly.

S	0		1		2		S
	—	Diff.	—	Diff.	—	Diff.	
°	° ′ ″	′ ″	° ′ ″	′ ″	° ′ ″	′ ″	°
0	0 0 0,0	6 10,9	2 58 30,5	5 28,1	5 16 20,9	3 27,1	30
1	0 6 10,9	6 10,7	3 3 58,6	5 25,2	5 19 48,0	3 21,9	29
2	0 12 21,6	6 10,6	3 9 23,8	5 22,4	5 23 9,9	3 16,6	28
3	0 18 32,2	6 10,3	3 14 46,2	5 19,2	5 26 26,5	3 11,2	27
4	0 24 42,5	6 9,9	3 20 5,4	5 16,3	5 29 37,7	3 5,6	26
5	0 30 52,4	6 9,4	3 25 21,7	5 13,1	5 32 43,3	3 0,2	25
6	0 37 1,8	6 8,9	3 30 34,8	5 9,9	5 35 43,5	2 54,7	24
7	0 43 10,7	6 8,3	3 35 44,7	5 6,5	5 38 38,2	2 49,1	23
8	0 49 19,0	6 7,5	3 40 51,2	5 3,1	5 41 27,3	2 43,3	22
9	0 55 26,5	6 6,7	3 45 54,3	4 59,5	5 44 10,6	2 37,5	21
10	1 1 33,2	6 5,8	3 50 53,8	4 55,9	5 46 48,1	2 31,7	20
11	1 7 39,0	6 4,8	3 55 49 7	4 52,3	5 49 19,8	2 25,7	19
12	1 13 43,8	6 3,5	4 0 42,0	4 48,5	5 51 45,5	2 19,8	18
13	1 19 47,3	6 2,4	4 5 30,5	4 44,7	5 54 5,3	2 13,9	17
14	1 25 49,7	6 1,2	4 10 15,2	4 40,7	5 56 19,2	2 7,7	16
15	1 31 50,9	5 59,7	4 14 55,9	4 36,7	5 58 26,9	2 1,6	15
16	1 37 50,6	5 58,1	4 19 32,6	4 32,7	6 0 28,5	1 55,4	14
17	1 43 48,7	5 56,8	4 24 5,3	4 28,4	6 2 23,9	1 49,1	13
18	1 49 45,5	5 55,1	4 28 33,7	4 24,1	6 4 13,0	1 42,8	12
19	1 55 40,6	5 53,2	4 32 57,8	4 19,9	6 5 55,8	1 36,5	11
20	2 1 33,8	5 51,4	4 37 17,7	4 15,5	6 7 32,3	1 30,1	10
21	2 7 25,2	5 49,6	4 41 33,2	4 11,0	6 9 2,4	1 23,7	9
22	2 13 14,8	5 47,5	4 45 44,2	4 6,4	6 10 26,1	1 17,2	8
23	2 19 2,3	5 45,3	4 49 50,6	4 1,7	6 11 43,3	1 10,7	7
24	2 24 47,6	5 43,2	4 53 52,3	3 57,0	6 12 54,0	1 4,0	6
25	2 30 30,8	5 40,9	4 57 49,3	3 52,2	6 13 58,0	0 57,4	5
26	2 36 11,7	5 38,5	5 1 41,5	3 47,4	6 14 55,4	0 50,7	4
27	2 41 50,2	5 36,0	5 5 28,9	3 42,4	6 15 46,1	0 44,0	3
28	2 47 26,2	5 33,4	5 9 11,3	3 37,3	6 16 30,1	0 37,3	2
29	2 52 59,6	5 30,9	5 12 48,6	3 32,3	6 17 7,4	0 30,6	1
30	2 58 30,5		5 16 20,9		6 17 38,0		0
	+		+		+		
S	11		10		9		S

XIX. For the MOON's Longitude. Equation Center.

Argument XIX. Moon's Correct Anomaly.

S	3		4		5		S
	—	Diff.	—	Diff.	—	Diff.	
°	° ′ ″	′ ″	° ′ ″	′ ″	° ′ ″	′ ″	°
0	6 17 380,	0 23,6	5 38 46,5	3 5,9	3 20 56,1	5 58,7	30
1	6 18 1,6	0 16,9	5 35 40,6	3 12,7	3 14 57,4	6 3,0	29
2	6 18 18,5	0 10,0	5 32 27,9	3 19,4	3 8 54,4	6 7,2	28
3	6 18 28,5	0 3,1	5 29 8,5	3 26,2	3 2 47,2	6 11,1	27
4	6 18 31,6	0 3,8	5 25 42,3	3 32,7	2 56 36,1	6 14,9	26
5	6 18 27,8	0 10,8	5 22 9,6	3 39,5	2 50 21,2	6 18,8	25
6	6 18 17,0	0 17,7	5 18 30,1	3 45,9	2 44 2,4	6 22,3	24
7	6 17 59,3	0 24,8	5 14 44,2	3 52,4	2 37 40,1	6 25,9	23
8	6 17 34,5	0 31,9	5 10 51,8	3 58,8	2 31 14,2	6 29,2	22
9	6 17 2,6	0 38,9	5 6 53,0	4 5,1	2 24 45,0	6 32,4	21
10	6 16 23,7	0 45,9	5 2 47,9	4 11,3	2 18 12,6	6 35,4	20
11	6 15 37,8	0 52,8	4 58 36,6	4 17,5	2 11 37,2	6 38,3	19
12	6 14 45,0	0 59,9	4 54 19,1	4 23,8	2 4 58,9	6 41,2	18
13	6 13 45,1	1 7,2	4 49 55,3	4 29,9	1 58 17,7	6 43,7	17
14	6 12 37,9	1 14,0	4 45 25,4	4 35,7	1 51 34,0	6 46,3	16
15	6 11 23,9	1 21,3	4 40 40,7	4 41,7	1 44 47,7	6 48,6	15
16	6 10 2,6	1 28,3	4 36 8,0	4 47,5	1 37 59,1	6 50,6	14
17	6 8 34,3	1 35,4	4 31 20,5	4 53,1	1 31 8,5	6 52,7	13
18	6 6 58,9	1 42,5	4 26 27,4	4 58,8	1 24 15,8	6 54,8	12
19	6 5 16,4	1 49,5	4 21 28,6	5 4,6	1 17 21,0	6 56,4	11
20	6 3 26,9	1 56,5	4 16 24,0	5 9,9	1 10 24,6	6 57,9	10
21	6 1 30,4	2 3,7	4 11 14,1	5 15,3	1 3 26,7	6 59,4	9
22	5 59 26,7	2 10,7	4 5 58,8	5 20,5	0 56 27,3	7 0,6	8
23	5 57 16,0	2 17,7	4 0 38,3	5 25,7	0 49 26,7	7 1,8	7
24	5 54 58,3	2 24,6	3 55 12,6	5 30,6	0 42 24,9	7 2,7	6
25	5 52 33,7	2 31,6	3 49 42,0	5 35,8	0 35 22,2	7 3,5	5
26	5 50 2,1	2 38,6	3 44 6,2	5 40,4	0 28 18,7	7 4,1	4
27	5 47 23,5	2 45,4	3 38 25,8	5 45,4	0 21 14,6	7 4,6	3
28	5 44 38,1	2 52,3	3 32 40,4	5 49,8	0 14 10,0	7 4,9	2
29	5 41 45,8	2 59,3	3 26 50,6	5 54,5	0 7 5,1	7 5,1	1
30	5 38 46,5		3 20 56,1		0 0 0,0		0
			+		+		
S	8		7		6		S

XX. For the MOON's Longitude. Variation.

Argument XX. ☽'s Equated Long. — ☉'s true Long

S	0		1		2		S
	+	Diff.	+	Diff.	∓	Diff.	
°	′ ″	″	′ ″	″	′ ″	″	°
0	0 0,0	73,6	30 8,7	34,3	29 6,1	40,0	30
1	1 13,6	73,4	30 43,0	31,8	28 26,1	42,2	29
2	2 27,0	73,3	31 14,8	29,4	27 43,9	44,3	28
3	3 40,3	73,0	31 44,2	27,1	26 59,6	46,4	27
4	4 53,3	72,7	32 11,3	24,5	26 13,2	48,3	26
5	6 6,0	72,1	32 35,8	22,3	25 24,9	50,2	25
6	7 18,1	71,6	32 58,1	19,6	24 34,7	52,0	24
7	8 29,7	71,0	33 17,7	17,0	23 42,7	53,9	23
8	9 40,7	70,2	33 34,7	14,6	22 48,8	55,7	22
9	10 50,9	69,3	33 49,3	12,0	21 53,1	57,2	21
10	12 0,2	68,5	34 1,3	9,5	20 55,9	58,9	20
11	13 8,7	67,5	34 10,8	6,8	19 57,0	60,4	19
12	14 16,2	66,4	34 17,6	4,2	18 56,6	61,8	18
13	15 22,6	65,1	34 21,8	1,7	17 54,8	63,2	17
14	16 27,7	63,8	34 23,5	0,9	16 51,6	64,5	16
15	17 31,5	62,7	34 22,6	3,5	15 47,1	65,7	15
16	18 34,2	61,2	34 19,1	6,1	14 41,4	66,9	14
17	19 35,4	59,6	34 13,0	8,7	13 34,5	68,1	13
18	20 35,0	58,2	34 4,3	11,4	12 26,4	69,0	12
19	21 33,2	56,4	33 52,9	13,7	11 17,4	69,6	11
20	22 29,6	54,7	33 39,2	16,4	10 7,8	70,8	10
21	23 24,3	52,9	33 22,8	18,8	8 57,0	71,5	9
22	24 17,2	51,2	33 4,0	21,4	7 45,5	71,9	8
23	25 8,4	49,0	32 42,6	23,9	6 33,6	72,7	7
24	25 57,4	47,2	32 18,7	26,1	5 20,9	73,0	6
25	26 44,6	45,2	31 52,6	28,7	4 7,9	73,5	5
26	27 29,8	42,9	31 23,9	31,0	2 54,4	73,7	4
27	28 12,7	41,1	30 52,9	33,4	1 40,7	74,0	3
28	28 53,8	38,6	30 19,5	35,5	0 26,7	74,2	2
29	29 32,4	36,3	29 44,0	37,9	0 47,5	74,1	1
30	30 8,7		29 6,1		2 1,6		0
	—		—		∓		
S	11		10		9		S

XX. For the Moon's Longitude. Variation.

Arg. XX. ☽'s Equated Lon. — ☉'s True Lo.

S	3 —	Diff.	4 —	Diff.	5 —	Diff.	S
°	′ ″	″	′ ″	″	′ ″	″	°
0	2 1,6	74,1	32 27,7	35,3	31 54,7	39,9	30
1	3 15,7	74,0	33 3,0	32,9	31 14,8	42,2	29
2	4 29,7	73,6	33 35,9	30,6	30 32,6	44,3	28
3	5 43,3	73,5	34 6,5	28,2	29 48,3	46,7	27
4	6 56,8	73,1	34 34,7	25,9	29 1,6	48,6	26
5	8 9,9	72,6	35 0,6	23,3	28 13,0	50,8	25
6	9 22,5	71,9	35 23,9	20,9	27 22,2	52,7	24
7	10 34,4	71,3	35 44,8	18,4	26 29,5	54,7	23
8	11 45,7	70,5	36 3,2	15,8	25 34,8	56,3	22
9	12 56,2	69,8	36 19,0	13,4	24 38,5	58,3	21
10	14 6,0	68,8	36 32,4	10,7	23 40,2	60,0	20
11	15 14,8	67,8	36 43,1	8,0	22 40,2	61,6	19
12	16 22,6	66,7	36 51,1	5,5	21 38,6	63,2	18
13	17 29,3	65,7	36 56,6	2,9	20 35,4	64,9	17
14	18 35,0	64,3	36 59,5	0,3	19 30,5	66,0	16
15	19 39,3	63,1	36 59,8	2,3	18 24,5	67,4	15
16	20 42,4	61,6	36 57,5	4,9	17 17,1	68,7	14
17	21 44,0	60,2	36 52,6	7,6	16 8,4	70,0	13
18	22 44,2	58,6	36 45,0	10,2	14 58,4	70,9	12
19	23 42,8	57,1	36 34,8	12,9	13 47,5	71,9	11
20	24 39.9	55,4	36 21,9	15,4	12 35,6	72,9	10
21	25 35,3	53,5	36 6,5	18,0	11 22,7	73,8	9
22	26 28,8	51,9	35 48,5	20,4	10 8,9	74,6	8
23	27 20,7	49,8	35 28,1	23,2	8 54,3	75,0	7
24	28 10,5	48,2	35 4,9	25,5	7 39,3	75,7	6
25	28 58,7	45,9	34 39,4	28,1	6 23,6	76,2	5
26	29 44,6	44,0	34 11,3	30,5	5 7,4	76,5	4
27	30 28,6	41,9	33 40,8	33,0	3 50,9	76,8	3
28	31 10,5	39,8	33 7,8	35,4	2 34,1	77,0	2
29	31 50,3	37,4	32 32,4	37,7	1 17,1	77,1	1
30	32 27,7		31 54,7		0 0,0		0
	+ 8		+ 7		+ 6		S

XXI. For the ☽'s Lon.

Argument XXI.
2 Eq. Di. ☽ à ☊ — ☽'s C.A.

S	0 +	1 +	2 +
S	6 —	7 —	8 —
°	′ ″	′ ″	′ ″
0	0 0,0	0 42,1	1 12,9
1	0 1,5	0 43,3	1 13,6
2	0 2,9	0 44,6	1 14,3
3	0 4,4	0 45,	1 14,9
4	0 5,8	0 47.0	1 15,6
5	0 7,3	0 48,2	1 16,2
6	0 8,8	0 49,4	1 16,8
7	0 10,3	0 50,6	1 17,4
8	0 11,7	0 51,8	1 18,0
9	0 13,2	0 53,0	1 18,5
10	0 14,6	0 54,1	1 19,0
11	0 16,1	0 55,2	1 19,5
12	0 17,5	0 56,3	1 20,0
13	0 18,9	0 57,4	1 20,4
14	0 20,4	0 58,4	1 20,8
15	0 21,8	0 59,5	1 21,2
16	0 23,2	1 0,5	1 21,6
17	0 24,6	1 1,5	1 22,0
18	0 26,0	1 2,5	1 22,3
19	0 27,4	1 3,5	1 22,6
20	0 28,8	1 4,4	1 22,9
21	0 30,1	1 5,4	1 23,1
22	0 31,5	1 6,3	1 23,3
23	0 32,9	1 7,2	1 23,5
24	0 34,2	1 8,1	1 23,7
25	0 35,5	1 8,9	1 23,8
26	0 36,9	1 9,7	1 23,9
27	0 38,2	1 10,5	1 24,0
28	0 39,5	1 11,3	1 24,1
29	0 40,8	1 12,1	1 24,1
30	0 42,1	1 12,8	1 24,1
S	+ 11	— 10	— 9
S	— 5	+ 4	+ 3

XXII. For the ☽'s Long. Reduct.

Argument XXII.
Long. ☽ in Orbit. — Correct Long. ☊

0 —		1 —		2 —		S
6 —	Dif.	7 —	Dif.	8 —	Dif.	S
′ ″	″	′ ″	″	′ ″	″	°
0 0,0	14,2	5 53,1	6,9	5 53,1	7,3	30
0 14,2	14,2	6 0,0	6,4	5 45,8	7,8	29
0 28,4	14,2	6 6,4	6,0	5 38,0	8,2	28
0 42,6	14,1	6 12,4	5,6	5 29,8	8,5	27
0 56,7	14,1	6 18,0	5,1	5 21,3	9,0	26
1 10,8	14,0	6 23,1	4,7	5 12,3	9,3	25
1 24,8	13,8	6 27,8	4,1	5 3,0	9,7	24
1 38,6	13,8	6 31,9	3,7	4 53,3	10,1	23
1 52,4	13,6	6 35,6	3,2	4 43,2	10,4	22
2 6,0	13,4	6 38,8	2,7	4 32,8	10,7	21
2 19,4	13,3	6 41,5	2,2	4 22,1	11,1	20
2 32,7	13,1	6 43,7	1,8	4 11,0	11,4	19
2 45,8	12,9	6 45,5	1,2	3 59,6	11,6	18
2 58,7	12,7	8 46,7	0,7	3 48,0	11,9	17
3 11,4	12,5	6 47,4	0,3	3 36,1	12,2	16
3 23,9	12,2	6 47,7	0,3	3 23,9	12,5	15
3 36,1	11,9	6 47,4	0,7	3 11,4	12,7	14
3 48,0	11,6	6 46,7	1,2	2 58,7	12,9	13
3 59,6	11,4	6 45,5	1,8	2 45,8	13,1	12
4 11,0	11,1	6 43,7	2,2	2 32,7	13,3	11
4 22,1	10,7	6 41,5	2,7	2 19,4	13,4	10
4 32,8	10,4	6 38,8	3,2	2 6,0	13,6	9
4 43,2	10,1	6 35,6	3,7	1 52,4	13,8	8
4 53,3	9,7	6 31,9	4,1	1 38,6	13,8	7
5 3,0	9,3	6 27,8	4,7	1 24,8	14,0	6
5 12,3	9,0	6 23,1	5,1	1 10,8	14,1	5
5 21,3	8,5	6 18,0	5,6	0 56,7	14,1	4
5 29,8	8,2	6 12,4	6,0	0 42,6	14,2	3
5 38,0	7,8	6 6,4	6,4	0 28,4	14,2	2
5 45,8	7,3	6 0,0	6,9	0 14,2	14,2	1
5 53,1		5 53,1		0 0,0		0
+ 11		+ 10		+ 9		S
+ 5		+ 4		+ 3		S

Equation of the Equinoctial Points

Argument.
Mean Longitude Moon's Node.

S	0 —	1 —	2 —	S
S	6 +	7 +	8 +	S
°	″	″	″	°
0	0,0	9,0	15,6	30
1	0,3	9,3	15,8	29
2	0,6	9,5	15,9	28
3	0,9	9,8	16,0	27
4	1,2	10,0	16,2	26
5	1,5	10,3	16,3	25
6	1,9	10,6	16,4	24
7	2,2	10,8	16,6	23
8	2,5	11,1	16,7	22
9	2,8	11,3	16,8	21
10	3,1	11,6	16,9	20
11	3,4	11,	17,0	19
12	3,7	12,0	17,1	18
13	4,0	12,3	17,2	17
14	4,4	12,5	17,3	16
15	4,7	12,7	17,4	15
16	5,0	13,0	17,5	14
17	5,3	13,2	17,5	13
18	5,6	13,4	17,6	12
19	5,9	13,6	17,7	11
20	6,1	13,8	17,7	10
21	6,4	14,0	17,8	9
22	6,7	14,2	17,8	8
23	7,0	14,4	17,9	7
24	7,3	14,6	17,9	6
25	7,6	14,7	17,9	5
26	7,9	14,9	18,0	[illegible]
27	8,2	15,1	18,0	3
28	8,4	15,3	18,0	2
29	8,7	15,4	18,0	1
30	9,0	15,6	18,0	0
S	+ 11	+ 10	+ 9	S
S	— 5	— 4	— 3	S

I. For the MOON's Latitude.

Argument I. Long. ☽ in Orbit — Correct Long. ☊

S	0 +		1 +		2 +		S
S	6 —	Diff.	7 —	Diff.	8 —	Diff.	S
°	° ′ ″	′ ″	° ′ ″	′ ″	° ′ ″	′	8
0	0 0 0,0	5 23,0	2 34 17,9	4 38,6	4 27 22,6	2 39,4	30
1	0 5 23,0	5 23,0	2 38 56,5	4 35,7	4 30 2,0	2 34,6	29
2	0 10 46,0	5 22,7	2 43 32,2	4 32,8	4 32 36,6	2 29,6	28
3	0 16 8,7	5 22,5	2 48 5,0	4 29,6	4 35 6,2	2 24,5	27
4	0 21 31,2	5 22.2	2 52 34,6	4 26,4	4 37 30,7	2 19,4	26
5	0 26 53,4	5 21,6	2 57 1,0	4 23,4	4 39 50,1	2 14,3	25
6	0 32 15,0	5 20,9	3 1 24,4	4 19,9	4 42 4,4	2 9,2	24
7	0 37 35,9	5 20,4	3 5 44,3	4 16,6	4 44 13,6	2 3.9	23
8	0 42 56,3	5 19,6	3 10 0,9	4 13,0	4 46 17,5	1 58,6	22
9	0 48 15,9	5 18,7	3 14 13,9	4 9,6	4 48 16,1	1 53,4	21
10	0 53 34,6	5 17,7	3 18 23,5	4 6,0	4 50 9,5	1 48,1	20
11	0 58 52,3	5 16,6	3 22 29,5	4 2,2	4 51 57,6	1 42,8	19
12	1 4 8,9	5 15,5	3 26 31,7	3 58,5	4 53 40.4	1 37 5	11
13	1 9 24,4	5 14,2	3 30 30.2	3 54,6	4 55 17 9	1 31,9	17
14	1 14 38,6	5 12,8	3 34 24,8	3 50,8	4 56 49,8	1 26,6	16
15	1 19 51,4	5 11,3	3 38 15,6	3 46,9	4 58 16 4	1 21.2	15
16	1 25 2,7	5 9,9	3 42 2,5	3 42,7	4 59 37 6	1 15,6	14
17	1 30 12,6	5 8,3	3 45 45,2	3 38,6	5 0 53,2	1 10,1	13
18	1 35 20,9	5 6,4	3 49 23,8	3 34,4	5 2 3,3	1 4,6	12
19	1 40 27,3	5 4,7	3 52 58,2	3 30,2	5 3 7,9	0 59,0	11
20	1 45 32,0	5 2,8	3 56 28,4	3 25,8	5 4 6,9	0 53,5	10
21	1 50 34,0	5 0,7	3 59 54,2	3 21,5	5 5 0,4	0 47,9	[illegible]
22	1 55 35,9	4 58,6	4 3 15,7	3 17,0	5 5 48,3	0 42,3	8
23	2 0 34,1	4 56,4	4 6 32,7	3 12,5	5 6 30,6	0 36,6	7
24	2 5 30,5	4 54,1	4 9 45,2	3 8,1	5 7 7,2	0 31,0	6
25	2 10 24,6	4 51,8	4 12 53,3	3 3,3	5 7 38,2	0 25,5	5
26	2 15 16,4	4 49,3	4 15 56,6	2 58,7	5 8 3,7	0 19,8	4
27	2 20 5,7	4 46,7	4 18 55,3	2 53.9	5 8 23,5	0 14,2	3
28	2 24 52,4	4 44,0	4 21 49,2	2 49,1	5 8 37,7	0 8,4	2
29	2 29 36,4	4 41,5	4 24 38,3	2 44,3	5 8 46,1	0 2,8	1
30	2 34 17.9		4 27 22,6		5 8 48.9		[illegible]
S	— 11		— 10		— 9		S
S	+ 5		+ 4		+ 3		S

II. For the Moon's Latitude.

Arg. II. Do. Dist. ☽ in Orb. a ☉ — Ar. I.

S	0 +		1 +		2 +	
S	6 —	Dif.	7 —	Dif.	8 —	Dif.
°	′ ″	″	′ ″	″	′ ″	″
0	0 0,0	9,2	4 24,2	7,9	7 37,6	4,5
1	0 9,2	9,3	4 32,1	7,9	7 42,1	4,4
2	0 18,5	9,2	4 40,0	7,8	7 46,5	4,3
3	0 27,7	9,2	4 47,8	7,6	7 50,9	4,1
4	0 36,9	9,2	4 55,4	7,7	7 54,9	4,0
5	0 46,1	9,2	5 3,1	7,5	7 58,9	3,8
6	0 55,3	9,1	5 10,6	7,4	8 2,7	3,7
7	1 4,4	9,2	5 18,0	7,3	8 6,4	3,5
8	1 13,6	9,1	5 25,3	7,2	8 9,9	3,4
9	1 22,7	9,0	5 32,5	7,2	8 13,3	3,2
10	1 31,7	9,1	5 39,7	7,0	8 16,5	3,1
11	1 40,8	9,0	5 46,7	6,9	8 19,6	2,9
12	1 49,8	9,1	5 53,6	6,8	8 22,5	2,8
13	1 58,9	8,9	6 0,4	6,7	8 25,3	2,6
14	2 7,8	8,9	6 7,1	6,6	8 27,9	2,5
15	2 16,7	8,9	6 13,7	6,4	8 30,4	2,3
16	2 25,6	8,9	6 20,1	6,4	8 32,7	2,2
17	2 34,5	8,8	6 26,5	6,2	8 34,9	2,0
18	2 43,3	8,7	6 32,7	6,1	8 36,9	1,8
19	2 52,0	8,7	6 38,8	6,0	8 38,7	1,7
20	3 0,7	8,7	6 44,8	5,9	8 40,4	1,5
21	3 9,4	8,6	6 50,7	5,7	8 41,9	1,4
22	3 18,0	8,5	6 56,4	5,6	8 43,3	1,2
23	3 26,5	8,4	7 2,0	5,5	8 44,5	1,0
24	3 34,9	8,4	7 7,5	5,3	8 45,5	0,9
25	3 43,3	8,4	7 12,8	5,2	8 46,4	0,7
26	3 51,7	8,2	7 18,0	5,1	8 47,1	0,6
27	3 59,9	8,2	7 23,1	5,0	8 47,7	0,4
28	4 8,1	8,1	7 28,1	4,8	8 48,1	0,2
29	4 16,2	8,0	7 32,9	4,7	8 48,3	0,1
30	4 24,2		7 37,6		8 48,4	
	— 11		— 10		— 9	
S	+ 5		+ 4		+ 3	

For the ☽'s Lat.

Argument III.

Arg. I.—☉'s M.A.

0 +	1 +	2 +	S
6 —	7 —	8 —	S
″	″	″	°
0,0	1,6	2,7	30
0,1	1,6	2,7	29
0,2	1,6	2,7	28
0,2	1,7	2,8	27
0,3	1,7	2,8	26
0,3	1,8	2,8	25
0,4	1,8	2,8	24
0,4	1,9	2,9	23
0,5	1,9	2,9	22
0,5	2,0	2,9	21
0,6	2,0	2,9	20
0,7	2,0	2,9	19
0,7	2,1	3,0	18
0,8	2,1	3,0	17
0,8	2,2	3,0	16
0,9	2,2	3,0	15
0,9	2,2	3,0	14
0,9	2,3	3,0	13
1,0	2,3	3,0	12
1,0	2,3	3,0	11
1,1	2,4	3,1	10
1,1	2,4	3,1	9
1,2	2,4	3,1	8
1,2	2,5	3,1	7
1,3	2,5	3,1	6
1,3	2,5	3,1	5
1,4	2,6	3,1	4
1,4	2,6	3,1	3
1,5	2,6	3,1	2
1,5	2,7	3,1	1
1,6	2,7	3,1	0
— 11	— 10	— 9	S
+ 5	+ 4	+ 3	S

IV. For ☽'s Lat.

Argument IV.

Ar. I. — ☽'s M. A.

S	0 —	1 —	2 —
S	6 +	7 +	8 +
°	″	″	″
0	0,0	8,8	15,2
1	0,3	9,0	15,3
2	0,6	9,3	15,5
3	0,9	9,5	15,6
4	1,2	9,8	15,8
5	1,5	10,0	16,0
6	1,8	10,3	16,1
7	2,1	10,5	16,2
8	2,4	10,8	16,3
9	2,8	11,1	16,4
10	3,1	11,3	16,5
11	3,4	11,6	16,6
12	3,7	11,9	16,7
13	4,0	12,0	16,8
14	4,3	12,2	16,9
15	4,6	12,4	17,0
16	4,9	12,7	17,1
17	5,1	12,9	17,1

V. For ☽ Lat.

Arg. V.

A. IV— ☽ M.A.

0 —	1 —	2 —
6 +	7 +	8 +
″	″	″
0,0	12,6	21,7
0,4	12,9	22,0
0,9	13,3	22,2
1,3	13,7	22,4
1,8	14,0	22,6
2,2	14,4	22,8
2,6	14,8	22,9
3,1	15,1	23,1
3,5	15,5	23,3
3,9	15,8	23,4
4,4	16,1	23,6
4,8	16,5	23,7
5,2	16,8	23,9
5,6	17,1	24,0
6,1	17,4	24,1
6,5	17,8	24,2
6,9	18,1	24,4
7,3	18,4	24,5

VI. For ☽ La.

Arg. VI.

A.V.— ☽ M.A.

0 +	1 +	2 +
6 —	7 —	8 —
″	″	″
0,0	1,0	1,7
0,0	1,0	1,7
0,1	1,0	1,7
0,1	1,0	1,7
0,2	1,1	1,7
0,2	1,1	1,7
0,2	1,1	1,7
0,2	1,1	1,7
0,3	1,1	1,8
0,3	1,2	1,8
0,3	1,2	1,8
0,4	1,2	1,8
0,4	1,2	1,8
0,4	1,3	1,8
0,5	1,3	1,8
0,5	1,3	1,8
0,5	1,4	1,8
0,6	1,4	1,9

VII. For ☽'s Lat.

Argument VII.

Ar. II. + ☉'s M.A.

0 —	1 —	2 —	S
6 +	7 +	8 +	S
″	″	″	°
0,0	4,5	7,8	30
0,2	4,6	7,9	29
0,3	4,8	8,0	28
0,5	4,9	8,0	27
0,6	5,0	8,1	26
0,8	5,2	8,2	25
0,9	5,3	8,2	24
1,1	5,4	8,3	23
1,3	5,5	8,4	22
1,4	5,7	8,4	21
1,6	5,8	8,5	20
1,7	5,9	8,5	19
1,9	6,0	8,6	18
2,0	6,1	8,6	17
2,2	6,3	8,7	16
2,3	6,4	8,7	15
2,5	6,5	8,7	14
2,6	6,6	8,8	13

IV. For ☽'s Lat.

Argument IV.

Ar. I. — ☽'s M. A.

S	0 —	1 —	2 —
S	6 +	7 +	8 +
°	″	″	″
18	5,4	13,1	17,2
19	5,7	13,3	17,2
20	6,0	13,5	17,3
21	6,3	13,7	17,3
22	6,6	13,9	17,4
23	6,9	14,1	17,4
24	7,2	14,2	17,5
25	7,5	14,4	17,5
26	7,7	14,6	17,6
27	8,0	14,7	17,6
28	8,3	14,9	17,6
29	8,5	15,0	17,6
30	8,8	15,2	17,6
S	+ 11	+ 10	+ 9
S	— 5	— 4	— 3

V. For ☽'s Lat.

Arg. V.

A.IV.— ☽ M.A.

0 —	1 —	2 —
6 +	7 +	8 +
″	″	″
7,7	18,7	24,6
8,2	18,9	24,6
8,6	19,2	24,7
9,0	19,5	24,8
9,4	19,8	24,9
9,8	20,0	24,9
10,2	20,3	25,0
10,6	20,6	25,0
11,0	20,8	25,0
11,4	21,1	25,1
11,8	21,3	25,1
12,2	21,5	25,1
12,6	21,7	25,1
+ 11	+ 10	+ 9
— 5	— 4	— 3

VI. For ☽ La.

Arg. VI.

A.V.— ☽ M.A.

0 +	1 +	2 +
6 —	7 —	8 —
″	″	″
0,6	1,4	1,9
0,6	1,4	1,9
0,7	1,5	1,9
0,7	1,5	1,9
0,7	1,5	1,9
0,7	1,5	1,9
0,8	1,5	1,9
0,8	1,6	1,9
0,8	1,6	1,9
0,9	1,6	1,9
0,9	1,6	1,9
0,9	1,6	1,9
1,0	1,7	1,9
— 11	— 10	— 9
+ 5	+ 4	+ 3

VII. For ☽'s La.

Argument VII.

Ar. II. + ☉'s M. A.

0 —	1 —	2 —	S
6 +	7 +	8 +	S
″	″	″	°
2,7	6,7	8,8	12
2,9	6,8	8,8	11
3,1	6,9	8,9	10
3,2	7,0	8,9	9
3,4	7,1	8,9	8
3,5	7,2	8,9	7
3,7	7,3	9,0	6
3,8	7,4	9,0	5
4,0	7,5	9,0	4
4,1	7,5	9,0	3
4,2	7,6	9,0	2
4,4	7,7	9,0	1
4,5	7,8	9,0	0
+ 11	+ 10	+ 9	S
— 5	— 4	— 3	S

VIII. For ☽ Lat.

Arg. VIII.

Arg. II. — ☉ M. A.

S	0 —	1 —	—
S	6 +	7 +	8 +
°	″		″
0	0,0	1,9	3,2
1	0,1	1,9	3,2
2	0,1	2,0	3,3
3	0,2	2,0	3,3
4	0,3	2,1	3,3
5	0,3	2,1	3,4
6	0,4	2,2	3,4
7	0,5	2,2	3,4
8	0,5	2,3	3,4
9	0,6	2,3	3,5
10	0,6	2,4	3,5
11	0,7	2,4	3,5
12	0,8	2,5	3,5
13	0,8	2,5	3,5
14	0,9	2,6	3,6
15	1,0	2,6	3,6
16	1,0	2,7	3,6
17	1,1	2,7	3,6
18	1,1	2,8	3,6
19	1,2	2,8	3,6
20	1,3	2,8	3,6
21	1,3	2,9	3,7
22	1,4	2,9	3,7
23	1,4	3,0	3,7
24	1,5	3,0	3,7
25	1,6	3,0	3,7
26	1,6	3,1	3,7
27	1,7	3,1	3,7
28	1,7	3,1	3,7
29	1,8	3,2	3,7
30	1,9	3,2	3,7
S	+ 11	+ 10	+ 9
S	— 5	— 4	— 3

IX. For ☽'s Lat.

Arg. IX.

Ar. II. + ☽ M.A.

0 —	1 —	2 —
6 +	7 +	8 +
″	″	
0,0	1,1	1,9
0,0	1,1	1,9
0,1	1,2	1,9
0,1	1,2	2,0
0,1	1,2	2,0
0,2	1,3	2,0
0,2	1,3	2,0
0,3	1,3	2,0
0,3	1,4	2,0
0,4	1,4	2,0
0,4	1,4	2,1
0,4	1,4	2,1
0,5	1,5	2,1
0,5	1,5	2,1
0,5	1,5	2,1
0,6	1,6	2,1
0,6	1,6	2,1
0,6	1,6	2,2
0,7	1,6	2,2
0,7	1,7	2,2
0,8	1,7	2,2
0,8	1,7	2,2
0,8	1,7	2,2
0,9	1,8	2,2
0,9	1,8	2,2
0,9	1,8	2,2
1,0	1,8	2,2
1,0	1,9	2,2
1,0	1,9	2,2
1,1	1,9	2,2
1,1	1,9	2,2
+ 11	+ 10	+ 9
— 5	— 4	— 3

X. For ☽'s Lat.

Arg. X.

Ar. II.-- ☽ M.A.

0 +	1 +	2 +
6 —	7 —	8 —
″	″	″
0,0	8,0	13,8
0,3	8,2	13,9
0,5	8,4	14,0
0,8	8,6	14,2
1,1	8,9	14,3
1,4	9,1	14,4
1,7	9,4	14,5
1,9	9,6	14,6
2,2	9,8	14,7
2,5	10,0	14,8
2,8	10,2	14,9
3,0	10,4	15,0
3,3	10,6	15,1
2,6	10,8	15,2
3,9	11,0	15,3
4,1	11,2	15,4
4,4	11,4	15,4
4,7	11,6	15,5
4,9	11,8	15,6
5,2	12,0	15,6
5,4	12,2	15,7
5,7	12,4	15,7
6,0	12,5	15,7
6,2	12,7	15,8
6,5	12,9	15,8
6,7	13,0	15,8
7,0	13,2	15,9
7,2	13,3	15,9
7,5	13,4	15,9
7,7	13,6	15,9
8,0	13,8	15,9
— 11	— 10	— 9
+ 5	+ 4	+ 3

XI. For ☽'s Lat.

Argument XI.

Ar. X. — ☽'s M.A

0 —	1 —	2 —	S
6 +	7 +	8 +	S
″	″	″	°
0,0	2,6	4,5	30
0,1	2,7	4,5	29
0,2	2,7	4,6	28
0,3	2,8	4,6	27
0,4	2,9	4,7	26
0,5	3,0	4,7	25
0,6	3,0	4,7	24
0,6	3,1	4,8	23
0,7	3,2	4,8	22
0,8	3,3	4,8	21
0,9	3,3	4,9	20
1,0	3,4	4,9	19
1,1	3,5	4,9	18
1,2	3,6	5,0	17
1,3	3,6	5,0	16
1,4	3,7	5,0	15
1,4	3,7	5,0	14
1,5	3,8	5,1	13
1,6	3,9	5,1	12
1,7	3,9	5,1	11
1,8	4,0	5,1	10
1,9	4,0	5,1	9
2,0	4,1	5,1	8
2,0	4,2	5,2	7
2,1	4,2	5,2	6
2,2	4,3	5,2	5
2,3	4,3	5,2	4
2,4	4,4	5,2	3
2,4	4,4	5,2	2
2,5	4,5	5,2	1
2,6	4,5	5,2	0
+ 11	+ 10	+ 9	S
— 5	— 4	— 3	S

I. For the Equatorial Parallax of the Moon.

Argument I.
Argument of Longitude I.
☉'s Mean Anomaly.

S	0	1	2	S
	+	+	+	
S	6	7	8	S
	—	—	—	
°	″	″	″	°
0	0,3	0,2	0,2	30
5	0,3	0,2	0,1	25
10	0,3	0,2	0,1	20
15	0,3	0,2	0,1	15
20	0,3	0,2	0,1	10
25	0,3	0,2	0,0	5
30	0,3	0,2	,0	0
	+	+	+	
S	11	10	9	S
	—	—	—	
S	5	4	3	S

II. For the Equatorial Parallax of the Moon.

Argument II.
Argument of Longitude II.
2☽ à ☉ + ☽'s Mean Anomaly.

S	0	1	2	S
	—	—	—	
S	6	7	8	S
	+	+	+	
°	″	″	″	°
0	0,7	0,6	0,4	30
5	0,7	0,6	0,3	25
10	0,7	0,5	0,3	20
15	0,7	0,5	0,2	15
20	0,7	0,5	0,2	10
25	0,6	0,4	0,1	5
30	0,6	0,4	0,0	0
	—	—	—	
S	11	10	9	S
	+	+	+	
S	5	4	3	S

III. For the Equatorial Parallax of the Moon.

Argument III.
Argument of Longitude III.
2☽ á ☉ — ☽'s M. Anomaly.

S	0	1	2	S
	—	—	—	
S	6	7	8	S
	+	+	+	
°	″	″	″	″
0	0,8	0,7	0,4	30
5	0,8	0,7	0,3	25
10	0,8	0,6	0,3	20
15	0,8	0,6	0,2	15
20	0,8	0,5	0,2	10
25	0,7	0,5	0,1	5
30	0,7	0,4	0,0	0
	—	—	—	S
S	11	10	9	
	+	+	+	
S	5	4	3	S

IV. For the Equatorial Parallax of the Moon.

Argument IV.
Argument of Longitude IV.
2☽ à ☉ + ☽'s Mean Anomaly.

S	0	1	2	S
	+	+	+	
S	6	7	8	S
	—	—	—	
°	″	″	″	°
0	0,1	0,1	0,0	30
5	0,1	0,1	0,0	25
10	0,1	0,1	0,0	20
15	0,1	0,1	0,0	15
20	0,1	0,1	0,0	10
25	0,1	0,0	0,0	5
30	0,1	0,0	0,0	0
S	+	+	+	
	11	10	9	S
S	—	—	—	
	5	4	3	S

V. For the Equatorial Parallax of the Moon.

Argument V.
Argument of Longitude V.
2☽ à ☉ — ☽'s Mean Anomaly.

S	0	1	2	3	4	5	S
	—	—	—	+	+	+	
°	″	″	″	″	″	″	°
0	37,0	32,1	18,8	0,3	18,5	32,5	30
1	37,0	31,8	18,2	0,3	19,1	32,8	29
2	37,0	31,4	17,7	1,0	19,6	33,1	28
3	37,0	31,1	17,1	1,6	20,2	33,4	17
4	36,9	30,7	16,6	2,3	20,7	33,7	26
5	36,9	30,4	16,0	2,9	21,3	34,0	25
6	36,8	30,0	15,4	3,6	21,8	34,3	24
7	36,7	29,7	15,8	4,2	22,4	34,5	23
8	36,6	29,3	14,2	4,9	22,9	34,8	22
9	36,5	28,9	13,6	5,5	23,4	35,0	21
10	36,4	28,5	13,0	6,2	23,9	35,3	20
11	36,3	28,1	12,4	6,8	24,4	35,5	19
12	36,2	27,7	11,8	7,5	24,9	35,7	18
13	36,0	27,3	11,2	8,1	25,4	35,9	17
14	35,9	26,9	10,6	8,8	25,9	36,1	16
15	35,7	26,4	10,0	9,4	26,4	36,3	15

V. For the Equatorial Parallax of the Moon.

Argument V.
Argument of Longitude V.
2☽ à ☉ — ☽'s Mean Anomaly.

S	0	1	2	3	4	5	S
	—	—	—	+	+	+	
°	″	″	″	″	″	″	°
16	35,6	26,0	9,4	10,0	26,9	36,4	14
17	35,4	25,5	8,7	10,7	27,3	36,6	13
18	35,2	25,1	8,1	11,3	27,8	36,7	12
19	35,0	24,6	7,4	11,9	28,3	36,9	11
20	34,8	24,1	6,8	12,6	28,7	37,0	10
21	34,6	23,6	6,1	13,2	29,1	37,1	9
22	34,4	23,1	5,5	13,8	29,5	37,2	8
23	34,1	22,5	4,8	14,4	29,9	37,3	7
24	33,9	22,0	4,2	15,0	30,3	37,4	6
25	33,6	21,5	3,5	15,6	30,7	37,5	5
26	33,3	21,0	2,9	16,2	31,1	37,5	4
27	33,0	20,4	2,2	16,8	31,4	37,6	3
28	32,7	19,9	1,6	17,4	31,8	37,6	2
29	32,4	19,3	0,9	18,0	32,1	37,6	1
30	32,1	18,8	0,3	18,5	32,5	37,6	0
	—	—	—	+	+	+	
S	11	10	9	8	7	6	S

VI. For Equato. par. ☽

Argument VI.
Argument of Long. VI.
Arg. V. + Arg. I.

S	0	1	2	S
	+	+	+	
S	6	7	8	S
	—	—	—	
°	″	″	″	°
0	1,0	0,9	0,5	30
5	1,0	0,8	0,4	25
10	1,0	0,8	0,3	20
15	1,0	0,7	0,3	15
20	0,9	0,6	0,2	10
25	0,9	0,6	0,1	5
30	0,9	0,5	0,0	0
	+	+	+	
S	11	10	9	S
	—	—	—	
S	5	4	3	S

VII. For Equat. paral ☽

Argument VII.
Argument of Long. VII.
Arg. V. — Arg. I.

S	0	1	2	S
	+	+	+	
S	6	7	8	S
	—	—	—	
°	″	″	″	°
0	0,6	0,5	0,3	30
5	0,6	0,5	0,3	25
10	0,6	0,4	0,2	20
15	0,6	0,4	0,2	15
20	0,6	0,4	0,1	10
25	0,5	0,3	0,1	5
30	0,5	0,2	0,0	0
	+	+	+	
S	11	10	9	S
	—	—	—	
S	5	4	3	S

VIII. For Equa. paral. ☽

Argument VIII.
Argument of Lon. VIII.
☽'s M. An. — ☉'s M. A

S	0	1	2	S
	+	+	+	
S	6	7	8	S
	—	—	—	
°	″	″	″	°
0	0,2	0,2	0,1	30
5	0,2	0,2	0,1	25
10	0,2	0,2	0,1	20
15	0,2	0,1	0,1	15
20	0,2	0,1	0,0	10
25	0,2	0,1	0,0	5
30	0,2	0,1	0,0	0
	+	+	+	
S	11	10	9	S
	—	—	—	
S	5	4	3	S

IX. For the Equatorial Parallax of the Moon.

Argument IX.
Argument of Longitude IX.
M. Diſt. ☽ à ☉ — ☽'s M. An.

S	0	1	2	3	4	5	S
	+	±	—	—	∓	+	
°	″	″	″	″	″	″	°
0	0,4	0,2	0,2	0,4	0,2	0,2	30
5	0,4	0,1	0,2	0,4	0,1	0,2	25
10	0,4	0,1	0,3	0,4	0,1	0,3	20
15	0,3	0,0	0,3	0,3	0,0	0,3	15
20	0,3	0,1	0,4	0,3	0,1	0,4	10
25	0,2	0,1	0,4	0,2	0,1	0,4	5
30	0,2	0,2	0,4	0,2	0,2	0,4	0
	+	+	—	—	∓	+	
S	11	10	9	8	7	6	S

X. For the Equatorial Parallax of the Moon.

Argument X.
Argument of Longitude X.
M. Long. ☊ — True Long. ☉

S	0	1	2	3	4	5	S
	+	±	—	—	∓	+	
°	″	″	″	″	″	″	°
0	2,2	1,2	0,9	2,0	1,1	0,8	30
5	2,1	0,9	1,2	2,0	0,8	1,1	25
10	2,0	0,5	1,4	1,9	0,5	1,3	20
15	1,9	0,1	1,6	1,8	0,1	1,5	15
20	1,7	0,2	1,8	1,6	0,2	1,6	10
25	1,5	0,6	1,9	1,4	0,5	1,7	5
30	1,2	0,9	2,0	1,1	0,8	1,8	0
	+	±	—	—	∓	+	
S	11	10	9	8	7	6	S

XI. For the Equatorial Parallax of the Moon.

Argument XI.
Argument of Longitude XI.
☽'s Correct Anomaly.

S	0		1		2		3		4		5	
	+	Dif.	+	Dif.	+	Dif.	+	Dif.	+	Dif.	+	Dif.
°	′ ″	″	′ ″	″	′ ″	″	′ ″	″	′ ″	″	′ ″	″
0	54 13,0	0,0	54 33,5	1,4	55 32,5	2,6	57 1,0	3,3	58 39,5	3,1	59 58,6	1,9
1	44 13,0	0,1	54 34,9	1,4	55 35,1	2,6	57 4,3	3,3	58 42,6	3,1	60 0,5	1,8
2	54 13,1	0,1	54 36,3	1,5	55 37,7	2,6	57 7,6	3,3	58 45,7	3,1	60 2,3	1,8
3	54 13,2	0,2	54 37,8	1,4	55 40,3	2,6	57 10,9	3,3	58 48,8	3,1	60 4,1	1,8
4	54 13,4	0,2	54 39,2	1,5	55 42,9	2,7	57 14,2	3,3	58 51,9	3,0	60 5,9	1,7
5	54 13,6	0,3	54 40,7	1,6	55 45,6	2,7	57 17,5	3,4	58 54,9	3,0	60 7,6	1,6
6	54 13,9	0,3	54 42,3	1,6	55 48,3	2,7	57 20,9	3,3	58 57,9	3,0	60 9,2	1,6
7	54 14,2	0,4	54 43,9	1,7	55 51,0	2,8	57 24,2	3,3	59 0,9	3,0	60 10,8	1,5
8	54 14,6	0,4	54 45,6	1,7	55 53,8	2,8	57 27,5	3,3	59 3,9	2,9	60 12,3	1,5
9	54 15,0	0,4	54 47,3	1,8	55 56,6	2,8	57 30,8	3,3	59 6,8	2,9	60 13,8	1,4
10	54 15,4	0,5	54 49,1	1,8	55 59,4	2,8	57 34,1	3,4	59 9,7	2,9	60 15,2	1,3
11	54 15,9	0,6	54 50,9	1,8	56 2,2	2,9	57 37,5	3,3	59 12,6	2,8	60 16,5	1,3
12	54 16,5	0,5	54 52,7	1,8	56 5,1	2,9	57 40,8	3,3	59 15,4	2,8	60 17,8	1,2
13	54 17,0	0,6	54 54,5	1,9	56 8,0	2,9	57 44,1	3,3	59 18,2	2,7	60 19,0	1,1
14	54 17,6	0,6	54 56,4	1,9	56 10,9	3,0	57 47,4	3,3	59 20,9	2,7	60 21,1	1,1
15	54 18,2	0,7	54 58,3	2,0	56 13,9	3,0	57 50,7	3,3	59 23,6	2,6	60 21,2	1,0
16	54 18,9	0,7	55 0,3	2,1	56 16,9	3,0	57 54,0	3,3	59 26,2	2,6	60 22,2	0,9
17	54 19,6	0,8	55 2,4	2,1	56 19,9	3,1	57 57,3	3,3	59 28,8	2,6	60 23,1	0,9
18	54 20,4	0,8	55 4,5	2,2	56 23,0	3,1	58 0,6	3,3	59 31,4	2,5	60 24,0	0,8
19	54 21,2	0,9	55 6,7	2,2	56 26,1	3,1	58 3,9	3,3	59 33,9	2,5	60 24,8	0,7
20	54 22,1	0,9	55 8,9	2,2	56 29,2	3,1	58 7,2	3,3	59 36,4	2,4	60 25,5	0,6
21	54 23,0	1,0	55 11,1	2,3	56 32,3	3,1	58 10,5	3,3	59 38,8	2,4	60 26,1	0,6
22	54 24,0	1,0	55 13,4	2,3	56 35,4	3,1	58 13,8	3,2	59 41,2	2,3	60 26,7	0,5
23	54 25,0	1,1	55 15,7	2,3	56 38,5	3,2	58 17,0	3,3	59 43,5	2,3	60 27,2	0,5
24	54 26,1	1,1	55 18,0	2,3	56 41,7	3,2	58 20,3	3,3	59 45,8	2,3	60 27,7	0,4
25	54 27,2	1,2	55 20,3	2,4	56 44,9	3,2	58 23,6	3,2	59 48,1	2,2	60 28,1	0,3
26	54 28,4	1,2	55 22,7	2,4	56 48,1	3,2	58 26,8	3,2	59 50,3	2,1	60 28,4	0,3
27	54 29,6	1,3	55 25,1	2,4	56 51,[illegible]	3,2	58 30,0	3,2	59 52,4	2,1	60 28,7	0,2
28	54 30,9	1,3	55 27,5	2,5	56 54,[illegible]	3,2	58 33,2	3,2	59 54,5	2,1	60 28,9	0,1
29	54 32,2	1,3	55 30,0	2,5	56 57,[illegible]	3,3	53 36,4	3,1	59 56,6	2,0	60 29,0	0,0
30	54 33,5		55 32,5		57 1,0		58 39,5		59 58,6		60 29,0	
	+		+		+		+		+		+	
S	11		10		9		8		7		6	

XII. For Equat. Par. of the ☽

Argument XII.
Argument of Longitude XII.
☽'s Eq. Long.—☉'s Tr. Lon.

	0	1	2	3	4	5	S
	+	±	−	−	∓	+	
°	″	″	″	″	″	″	°
0	25,2	12,0	13,6	25,8	12,6	13,8	30
1	25,2	11,2	14,3	25,8	11,8	14,6	29
2	25,1	10,4	15,1	25,7	11,0	15,4	28
3	25,0	9,6	15,8	25,6	10,2	16,2	27
4	24,9	8,8	16,5	25,5	9,4	16,9	26
5	24,8	7,9	17,2	25,3	8,5	17,6	25
6	24,6	7,1	17,9	25,1	7,7	18,3	24
7	24,4	6,2	18,5	24,9	6,8	19,0	23
8	24,2	5,3	19,1	24,7	5,9	19,6	22
9	23,9	4,4	19,7	24,4	5,0	20,2	21
10	23,6	3,5	20,3	24,1	4,1	20,8	20
11	23,3	2,7	20,8	23,8	3,2	21,4	19
12	22,9	1,8	21,3	23,4	2,3	22,0	18
13	22,5	0,9	21,8	23,0	1,4	22,6	17
14	22,1	0,0	22,3	22,6	0,5	23,1	16
15	21,7	0,9	22,7	22,1	0,5	23,6	15
16	21,2	1,7	23,1	21,6	1,4	24,0	14
17	20,7	2,6	23,5	21,1	2,4	24,4	13
18	20,2	3,5	23,9	20,6	3,3	24,8	12
19	19,6	4,4	24,2	20,1	4,2	25,2	11
20	19,0	5,3	24,5	19,5	5,1	25,5	10
21	18,4	6,1	24,8	18,9	6,0	25,8	9
22	17,8	7,0	25,0	18,3	6,9	26,1	8
23	17,2	7,8	25,2	17,6	7,8	26,4	7
24	16,5	8,7	25,4	16,9	8,7	26,6	6
25	15,8	9,6	25,5	16,2	9,6	26,8	5
26	15,1	10,4	25,6	15,5	10,5	26,9	4
27	14,4	11,2	25,7	14,8	11,3	27,0	3
28	13,6	12,0	25,7	14,1	12,2	27,1	2
29	12,8	12,8	25,8	13,4	13,0	27,2	1
30	12,0	13,6	25,8	12,6	13,8	27,2	0
	+	±	−	−	∓	+	
	11	10	9		7	6	S

XIII. For the Equatorial Parallax of the Moon.

Argument XIII.
Argument of Longitude XIII
D. Eq. dist. ☽ à ☊— ☽ Cor. A.

S	0	1	2	S
	+	+	+	
S	6	7	8	S
	−	−	−	
°	″	″	″	°
0	0,8	0,7	0,4	30
5	0,8	0,7	0,3	25
10	0,8	0,7	0,3	20
15	0,8	0,6	0,2	15
20	0,8	0,6	0,2	10
25	0,7	0,5	0,1	5
30	0,7	0,4	0,0	0
	+	+	+	S
S	11	10	9	
	−	−	−	
S	5	4	3	S

For finding the Horizontal Parallax by the Equatorial Parallax.

Alſo for the Reduction of the Elevation of the Pole.
Argument.
Elev. of the Pole in la & below Eq. Par.

Elev. Pole.	Reduction of Paral. 54′	57′	60′	Red. of Ele. of the Pole.	
	−	−	−	−	
°	″	″	″	′	″
0	0,0	0,0	0,0	0	0
6	0,2	0,2	0,2	3	6
12	0,6	0,7	0,7	6	4
18	1,4	1,4	1,5	8	57
24	2,3	2,5	2,6	11	6
30	3,5	3,7	3,9	12	56
36	4,9	5,1	5,4	14	12
42	6,3	6,7	7,0	14	51
48	7,7	8,2	8,6	14	51
54	9,2	9,7	10,2	14	12
60	10,5	11,1	11,7	12	56
66	11,7	12,4	13,0	11	6
72	12,7	13,4	14,1	8	57
78	13,4	14,2	14,9	6	4
84	13,9	14,6	15,4	3	6
90	14,1	14,8	15,6	0	0

For finding the Diameter of the Moon by the Equa. Paral.

Arg. Equa Paral. ☽

Eq. Par ′	″	Dia. ☽ ′	″	Eq. Par ′	″	Dia. ☽ ′	″
54	0	29	25,8	58	0	31	36,6
54	10	29	31,2	58	10	31	42,0
54	20	29	36,7	58	20	31	47,5
54	30	29	42,1	58	30	31	52,9
54	40	29	47,6	58	40	31	58,4
54	50	29	53,0	58	50	32	3,8
55	0	29	58,5	59	0	32	9,3
55	10	30	3,9	59	10	32	14,7
55	20	30	9,4	59	20	32	20,2
55	30	30	14,8	39	30	32	25,6
55	40	30	20,3	59	40	32	31,1
55	50	30	25,7	59	50	32	36,5
56	0	30	31,2	60	0	32	42,0
56	10	30	36,6	60	10	32	47,4
56	20	30	42,1	60	20	32	52,9
56	30	30	47,5	60	30	32	58,3
56	40	30	53,0	60	40	33	3,8
56	50	30	58,4	60	50	33	9,2
57	0	31	3,9	61	0	33	14,7
57	10	31	9,3	61	10	33	20,1
57	20	31	14,8	61	20	33	25,6
57	30	31	20,2	61	30	33	31,0
57	40	31	25,7	61	40	33	36,5
57	50	31	31,1	61	50	33	41,9
58	0	31	36,6	62	0	33	47,3

I. For the Horary Motion of the Moon 's Long.

Argument I.
Argument of Longitude I.

S	0	1	2	S
	+	+	+	
S	6	7	8	S
	—	—	—	
°	″	″		°
0	0,5	0,4	0,2	30
5	0,5	0,4	0,2	25
10	0,5	0,4	0,2	20
15	0,5	0,3	0,1	15
20	0,4	0,3	0,1	10
25	0,4	0,3	0,0	5
30	0,4	0,2	0,0	0
	+	+	+	
S	11	10	9	S
	—	—	—	
S	5	4	3	S

II. For the Horary Motion of the Moon's Long.

Argument II.
Argument of Longitude II.

S	0	1	2	S
	—	—	—	
S	6	7	8	S
	+	+	+	
°	″	″	″	°
0	1,0	0,9	0,5	30
5	1,0	0,8	0,4	25
10	1,0	0,8	0,3	20
15	1,0	0,7	0,3	15
20	0,9	0,6	0,2	10
25	0,9	0,6	0,1	5
30	0,9	0,5	0,0	0
	—	—	—	
S	11	10	9	S
	+	+	+	
S	5	4	3	S

III. For the Horary Motion of the Moon's Long.

Argument III.
Argument of Longitude III.

S	0	1	2	S
	—	—	—	
S	6	7	8	S
	+	+	+	
°	″	″	″	°
0	1,2	1,0	0,6	30
5	1,2	1,0	0,5	25
10	1,2	0,9	0,4	20
15	1,2	0,9	0,3	15
20	1,1	0,8	0,2	10
25	1,1	0,7	0,1	5
30	1,0	0,6	0,0	0
	—	—	—	S
S	11	10	9	
	+	+	+	
S	5	4	3	S

IV. For the Horary Motion of the Moon's Long.

Argument IV.
Argument of Longitude IV.

S	0	1	2	S
	—	—	—	
S	6	7	8	S
	+	+	+	
°	″	″	″	°
0	0,9	0,8	0,4	30
5	0,9	0,7	0,4	25
10	0,9	0,7	0,3	20
15	0,9	0,6	0,2	15
20	0,8	0,6	0,1	10
25	0,8	0,5	0,1	5
30	0,8	0,4	0,0	0
S	—	—	—	
	11	10	9	S
S	+	+	+	
	5	4	3	S

V. For the Horary Motion of the Moon's Longitude.

Argument V.
Argument of Longitude V.

S	0	1	2	3	4	5	
	—	—	—	+	+	+	
°	″	″	″	″	″	″	°
0	41,4	36,1	21,3	0,6	20,7	36,7	[illegible]
1	41,4	35,7	20,7	0,1	21,4	37,1	2
2	41,4	35,3	20,1	0,9	22,0	37,4	
3	41,3	34,9	19,4	1,6	22,7	37,8	
4	41,3	34,5	18,8	2,4	23,3	38,2	
5	41,2	34,1	18,1	3,1	23,9	38,5	
6	41,2	33,7	17,5	3,8	24,5	38,8	24
7	41,1	33,3	16,8	4,6	25,1	39,1	2
8	41,0	32,9	16,1	5,3	25,7	39,4	2
9	40,9	32,5	15,5	6,0	26,3	39,7	21
10	40,8	32,0	14,9	6,7	26,9	39,9	20
11	40,6	31,6	14,2	7,5	27,5	40,2	19
12	40,5	31,1	13,5	8,2	28,0	40,4	18
13	40,4	30,7	12,8	8,9	28,6	40,7	17
14	40,2	30,2	12,1	9,7	29,1	40,9	16
15	40,0	29,7	11,4	10,4	29,7	41,1	15

V. For the Horary Motion of the Moon 's Longitude.

Argument V.
Argument of Longitude V.

S	0	1	2	3	4	5	S
	—	—	—	+	+	+	
°	″	″	″	″	″	″	°
16	39,8	29,2	10,7	11,2	30,3	41,3	14
17	39,6	28,7	10,0	11,9	30,8	41,4	13
18	39,4	28,2	9,3	12,6	31,4	41,6	12
19	39,2	27,6	8,6	13,3	31,9	41,8	11
20	39,0	27,1	7,9	13,9	32,4	42,0	10
21	38,8	26,5	7,2	14,6	32,8	42,1	9
22	38,5	26,0	6,4	15,3	33,3	42,2	8
23	38,3	25,4	5,7	16,0	33,7	42,3	7
24	38,0	24,9	4,9	16,7	34,2	42,3	6
25	37,7	24,3	4,2	17,4	34,6	42,4	5
26	37,4	23,7	3,5	18,0	35,1	42,4	4
27	37,1	23,1	2,7	18,7	35,5	42,5	3
28	36,8	22,5	2,0	19,4	35,9	42,5	2
29	36,5	21,9	1,3	20,1	36,3	42,6	1
30	36,1	21,3	0,6	20,7	36,7	42,6	0
	—	—	—	+	+	+	
S	11	10	9	8	7	6	S

VI. For Hor. Mot. ☽ Lo.

Argument VI.
Argument of Long. VI.

S	0	1	2	S
	+	+	+	
S	6	7	8	S
	—	—	—	
°	″	″	″	°
0	1,1	0,9	0,5	30
5	1,1	0,9	[illegible]	25
10	1,1	[illegible]	0,4	20
15	1,0	0,8	0,3	15
20	1,0	0,7	0,2	10
25	1,0	0,6	0,1	5
30	0,9	0,5	0,0	0
	+	+	+	
S	11	10	9	S
	—	—	—	
S	5	4	3	S

VII. For Hor Mot. ☽ Lo.

Argument VII.
Argument of Long. VII.

S	0	1	2	S
	+	+	+	
S	6	7	8	S
	—	—	—	
°	″	″	″	
0	0,4	0,3	0,2	30
5	0,4	0,3	0,2	25
10	0,4	0,3	0,1	20
15	0,4	0,3	0,1	15
20	0,4	0,3	0,1	10
25	0,4	0,2	0,0	5
30	0,3	0,2	0,0	0
	+	+	+	
S	11	10	9	S
	—	—	—	
S	5	4	3	S

VIII. For Hor. Mot ☽ Lo.

Argument VIII.
Argument of Lon. VIII.

S	0	1	2	S
	+	+	+	
S	6	7	8	S
	—	—	—	
	″	″	″	°
0	0,3	0,3	0,1	30
5	0,3	0,2	0,1	25
10	0,3	0,2	0,1	20
15	0,3	0,2	0,1	15
20	0,3	0,2	0,1	10
25	0,3	0,2	0,0	5
30	0,3	0,1	0,0	0
	+	+	+	
S	11	10	9	S
	—	—	—	
S	5	4	3	S

IX. For Horary Motion ☽'s Long.

Argument IX.
Argument of Longitude IX.

S	0	1	2	S
	—	—	—	
S	6	7	8	S
	+	+	+	
°	″	″	″	°
0	0,1	0,1	0,0	30
5	0,1	0,1	0,0	25
10	0,1	0,1	0,0	20
15	0,1	0,1	0,0	15
20	0,1	0,1	0,0	10
25	0,1	0,0	0,0	5
30	0,1	0,0	0,0	0
S	—	—	—	
	11	10	9	S
	+	+	+	
S	5	4	3	S

X. For the Horary Motion of the Moon 's Long.

Argument X.
Argument of Longitude X.

S	0	1	[illegible]	3		5	S
	+	+	—	—	+	+	
°	″	″	″	″	″	″	°
	3,1	1,8	0,9	[illegible]	[illegible]	0,6	[illegible]
	3,0	1,4	[illegible]	2,4	1,2	[illegible]	25
	[illegible]	0,9	1,5	2,4	0,8	1,2	20
	2,7	0,5	1,9	2,2	0,4	1,5	15
	2,4	0,0	2,1	2,1	0,1	1,6	10
25	2,1	0,4	2,3	1,8	0,3	1,7	5
30	1,8	0,9	2,4	1,5	0,6	1,7	[illegible]
	+	+	—	—	+	+	
S	11	10	9	8	7	6	S

XI. For the horary Motion of the Moon's Long.

Arg. XI. Argument of Longitude XI.

S	0	1	2	3	4	5
	+	+	+	+	+	+
°	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″
0	29 34,8	29 57,4	31 2,3	32 41,6	34 35,7	36 10,3
1	29 34,8	29 58,9	31 5,1	32 45,3	34 39,4	36 12,6
2	29 34,8	30 0,5	31 8,0	32 49,1	34 42,9	36 14,8
3	29 35,0	30 2,1	31 10,8	32 52,8	34 46,5	36 17,0
4	29 35,2	30 3,7	31 13,8	32 56,6	34 50,2	36 19,2
5	29 35,4	30 5,3	31 16,8	33 0,3	34 53,7	36 21,2
6	29 35,7	30 7,1	31 19,9	33 4,1	34 57,3	36 23,2
7	29 36,1	30 8,9	31 23,0	33 7,9	35 0,8	36 25,2
8	29 36,5	30 10,8	31 26,1	33 11,7	35 4,3	36 27,0
9	29 36,9	30 12,7	31 29,2	33 15,5	35 7,8	36 28,8
10	29 37,4	30 14,6	31 32,3	33 19,3	35 11,3	36 30,5
11	29 37,9	30 16,5	31 35,5	33 23,1	35 14,7	36 32,2
12	29 38,5	30 18,5	31 38,7	33 26,9	35 18,0	36 33,7
13	29 39,0	30 20,6	31 42,0	33 30,8	35 21,3	36 35,2
14	29 39,7	30 22,7	31 45,2	33 34,7	35 24,6	36 36,6
15	29 40,5	30 24,8	31 48,6	33 38,6	35 28,0	36 38,0
16	29 41,3	30 27,1	31 52,5	33 42,5	35 31,0	36 39,2
17	29 42,1	30 29,4	31 55,4	33 46,3	35 34.1	36 40,4
18	29 43,0	30 31,7	31 58,8	33 50,0	35 37,2	36 41,3
19	29 43,9	30 34,0	32 2,2	33 53,9	35 40,3	36 42,3
20	29 44,9	30 36,3	32 5,7	33 57,7	35 43,3	36 43,3
21	29 45,9	30 38,7	32 9,2	34 1,5	35 46,3	36 44,1
22	29 47,0	30 41,2	32 12,7	34 5,4	35 49,1	36 44,8
23	29 48,1	30 43,7	32 16,2	34 9,2	35 52,0	36 45,4
24	29 49,3	30 46,3	32 19,7	34 13,1	35 54,8	36 46,0
25	29 50,5	30 48,9	32 23,3	34 16,9	35 57,5	36 46,5
26	29 51,7	30 51,5	32 26,9	34 20,6	36 0,2	36 46,9
27	29 53,1	30 54,2	32 30,6	34 24,4	36 2,8	36 47,2
28	29 54,5	30 56,9	32 34,2	34 28,1	36 5,3	36 47,4
29	29 55,9	30 59,6	32 37,9	34 31,9	36 7,8	36 47,6
30	29 57,4	31 2,3	32 41,6	34 35,7	36 10,3	36 47,6
	+	+	+	+	+	+
S	11	10	9	8	7	6

XII. For the horary Motion of the Moon's Long.

Arg. XII. Argument of Longitude XII.

0	1	2	3	4	5	S
+	±	—	—	∓	+	
″	″	″	″	″	″	°
39,6	19,0	20,8	39,8	19,8	20,8	30
39,6	17,8	22,0	39,8	18,6	22,0	29
39,5	16,5	23,1	39,7	17,3	23,2	28
39,4	15,2	24,2	39,6	16,1	24,4	27
39,2	13,9	25,3	39,4	14,8	25,6	26
39,0	12,6	26,3	39,1	13,5	26,7	25
38,7	11,3	27,3	38,8	12,1	27,8	24
38,3	9,9	28,3	38,5	10,8	28,8	23
38,0	8,6	29,3	38,2	9,5	29,9	22
37,6	7,2	30,2	37,8	8,1	30,8	21
37,1	5,8	31,1	37,3	6,7	31,8	20
36,6	4,4	31,9	36,8	5,3	32,7	19
36,0	3,1	32,7	36,2	3,9	33,6	18
35,4	1,7	33,5	35,7	2,5	34,4	17
34,7	0,3	34,2	35,0	1,1	35,2	16
34,0	1,1	34,8	34,3	0,3	36,0	15
33,3	2,5	35,5	33,6	1,7	36,7	14
32,5	3,9	36,1	32,9	3,1	37,4	13
31,7	5,3	36,7	32,1	4,5	38,0	12
30,8	6,6	37,2	31,2	5,9	38,5	11
29,9	8,0	37,6	30,4	7,4	39,0	10
29,0	9,3	38,1	29,5	8,8	39,5	9
28,0	10,7	38,4	28,5	10,2	40,0	8
27,0	12,0	38,8	27,6	11,5	40,3	7
26,0	13,3	39,1	26,5	12,9	40,7	6
24,9	14,6	39,3	25,5	14,3	41,0	5
23,8	15,9	39,5	24,4	15,6	41,2	4
22,6	17,2	39,7	23,3	16,9	41,4	3
21,4	18,4	39,7	22,1	18,2	41,5	2
20,2	19,6	39,8	21,0	19,5	41,6	1
19,0	20,8	39,8	19,8	20,8	41,6	0
+	±	—	—	∓	+	
11	10	9	8	7	6	S

XIII. For the horary motion of ☽'s Long.

Arg. XIII.
Arg. of Long. XIII.

S	0	1	2	S
	+	+	+	
S	6	7	8	S
	—	—	—	
°	″	″	″	°
0	0,8	0,7	0,4	30
5	0,8	0,7	0,3	25
10	0,8	0,6	0,3	20
15	0,8	0,6	0,2	15
20	0,8	0,5	0,2	10
25	0,7	0,5	0,1	5
30	0,7	0,4	0,0	0
	+	+	+	
S	11	10	9	S
	—	—	—	
S	5	4	3	S

For the horary Motion of the Moon's Longitude.

Arg. XIV. Argument of Longitude XIV.

S	0	1	2	S
	+	∓	+	
S	6	7	8	S
	—	∓	+	
°	″	″	″	°
0	7,7	3,8	3,8	30
1	7,7	3,6	4,1	29
3	7,7	3,4	4,3	28
5	7,7	3,1	4,5	27
4	7,6	2,9	4,7	26
5	7,6	2,6	4,9	25
6	7,5	2,4	5,1	24
7	7,4	2,1	5,3	23
8	7,4	1,9	5,5	22
9	7,3	1,6	5,7	21
10	7,2	1,3	5,9	20
11	7,1	1,1	6,1	19
12	7,0	0,8	6,2	18
13	6,9	0,5	6,4	17
14	6,8	0,3	6,5	16
15	6,7	0,0	6,7	15
16	6,5	0,3	6,8	14
17	6,4	0,5	6,9	13
18	6,2	0,8	7,0	12

S	0	1	2	S
	—	∓	+	
S	6	7	8	S
	—	∓	+	
°	″	″	″	°
19	6,1	1,1	7,1	11
20	5,9	1,3	7,2	10
21	5,7	1,6	7,3	9
22	5,5	1,9	7,4	8
23	5,3	2,1	7,5	7
24	5,1	2,4	7,5	6
25	4,9	2,6	7,6	5
26	4,7	2,9	7,6	4
27	4,5	3,1	7,7	3
28	4,3	3,4	7,7	2
29	4,1	3,6	7,7	1
30	3,8	3,8	7,7	0
	—	∓	+	
S	11	10	9	S
	—	∓	+	
S	5	4	3	S

The numbers taken from this Table ſhould be added or ſubtracted in the mean ratio of the Moon's horary motion, which is 32′ 56″, to the Moon's hourly motion juſt found, when it appeareth that operation is uſeful.

For the Horary Motion of the Moon's Latitude.

Argument. I.
Argument of Latitude I.

S	0 +	1 +	2 +	S
S	6 —	7 —	8 —	S
°	′ ″	′ ″	′ ″	°
0	2 58,2	2 34,3	1 29,1	30
1	2 58,2	2 32,7	1 26,4	29
2	2 58,1	2 31,	1 23,7	28
3	2 57,9	2 29,4	1 20,9	27
4	2 57,7	2 27,7	1 18,1	26
5	2 57,5	2 26,0	1 15,3	25
6	2 57,2	2 24,2	1 12,5	24
7	2 56,9	2 22,3	1 9,6	23
8	2 56,5	2 20,4	1 6,7	22
9	2 56,0	2 18,5	1 3,9	21
10	2 55,5	2 16,5	1 1,0	20
11	2 54,9	2 14,5	0 58,0	19
12	2 54,3	2 12,4	0 55,1	18
13	2 53,6	2 10,3	0 52,1	17
14	2 52,9	2 8,2	0 49,1	16
15	2 52,1	2 6,0	0 46,1	15
16	2 51,3	2 3,8	0 43,1	14
17	2 50,4	2 1,5	0 40,1	13
18	2 49,5	1 59,2	0 37,0	12
19	2 48,5	1 56,9	0 34,0	11
20	2 47,4	1 54,5	0 30,9	10
21	2 46,4	1 52,1	0 27,9	9
22	2 45,2	1 49,7	0 24,8	8
23	2 44,0	1 47,2	0 21,7	7
24	2 42,8	1 44,7	0 18,6	6
25	2 41,5	1 42,2	0 15,5	5
26	2 40,2	1 39,6	0 12,4	4
27	2 38,8	1 37,0	0 9,3	3
28	2 37,3	1 34,4	0 6,2	2
29	2 35,9	1 31,8	0 3,1	1
30	2 34,3	1 29,1	0 0,0	0
S	+ 11	+ 10	+ 0	S
S	— 5	— 4	— 3	S

Argument II.
Argument of Latitude II.

S	0 +	1 +	2 +	S
S	6 —	7 —	8 —	S
°	″	″	″	°
0	4,3	3,7	2,1	30
1	4,3	3,7	2,1	29
2	4,3	3,6	2,0	28
3	4,3	3,6	1,9	27
4	4,3	3,5	1,9	26
5	4,3	3,5	1,8	25
6	4,3	3,4	1,7	24
7	4,3	3,4	1,7	23
8	4,3	3,4	1,6	22
9	4,2	3,3	1,5	21
10	4,2	3,3	1,5	20
11	4,2	3,2	1,4	19
12	4,2	3,2	1,3	18
13	4,2	3,1	1,2	17
14	4,1	3,1	1,2	16
15	4,1	3,0	1,1	15
16	4,1	3,0	1,0	14
17	4,1	2,9	1,0	13
18	4,1	2,9	0,9	12
19	4,1	2,8	0,8	11
20	4,0	2,7	0,7	10
21	4,0	2,7	0,7	9
22	4,0	2,6	0,6	8
23	4,0	2,6	0,5	7
24	3,9	2,5	0,5	6
25	3,9	2,4	0,4	5
26	3,8	2,4	0,3	4
27	3,8	2,3	0,2	3
28	3,8	2,3	0,1	2
29	3,8	2,2	0,1	1
30	3,7	2,1	0,0	0
S	+ 11	+ 10	+ 9	S
S	— 5	— 4	— 3	S

The quantity and difference of theſe Equations, as the ſign ſignifies, is increaſed or diminiſhed in proportion to the mean horary motion of the Moon, which is 32′. 56″, to the horary motion of the Moon in her proper orbit.

Eclipſes of Jupiter's Satellites.

SECT. XI. *The method of finding the Longitude by the Eclipſes of Jupiter's Satellites; the amazing Velocity of Light demonſtrated by theſe Eclipſes; and of Cometary Eclipſes.*

482 Frequency of theſe eclipſes.

IN the former ſection, having explained at great length how eclipſes of the ſun and moon happen at certain times, it muſt be evident, that ſimilar eclipſes will be obſerved by the inhabitants of Jupiter and Saturn, which are attended by ſo many moons. Theſe eclipſes indeed very frequently happen to the ſatellites of Jupiter; and as they are of the greateſt ſervice in determining the longitude of places on this earth, aſtronomers have been at great pains to calculate tables for the eclipſes of theſe ſatellites by their primary, for the ſatellites themſelves have never been obſerved to eclipſe one another. The conſtruction of ſuch tables is indeed much eaſier for theſe ſatellites than of any other celeſtial bodies, as their motions are much more regular.

The Engliſh tables are calculated for the meridian of Greenwich, and by theſe it is very eaſy to find how many degrees of longitude any place is diſtant either eaſt or weſt from Greenwich; for, let an obſerver, who has theſe tables, with a good teleſcope and a well-regulated clock at any other place of the earth, obſerve the beginning or ending of an eclipſe of one of Jupiter's ſatellites, and note the preciſe moment of time that he ſaw the ſatellite either immerge into, or emerge out of the ſhadow, and compare that time with the time ſhown by the tables for Greenwich; then 15 degrees difference of longitude being allowed for every hour's difference of time, will give the longitude of that place from Greenwich; and if there be any odd minutes of time, for every minute a quarter of a degree, eaſt or weſt, muſt be allowed, as the time of obſervation is later or earlier than the time ſhown by the tables. Such eclipſes are very convenient for this purpoſe at land, becauſe they happen almoſt every day; but are of no uſe at ſea, becauſe the rollings of the ſhip hinders all nice teleſcopical obſervations.

Fig. 177.

To explain this by a figure, let J be Jupiter, K, L, M, N his four ſatellites in their reſpective orbits, 1, 2, 3, 4; and let the earth be at F (ſuppoſe in November, although that month is no otherwiſe material than to find the earth readily in this ſcheme, where it is ſhown in eight different parts of the orbit). Let Q be a place on the meridian of Greenwich, and R a place on ſome other meridian eaſtward from Greenwich. Let a perſon at R obſerve the inſtantaneous vaniſhing of the firſt ſatellite K into Jupiter's ſhadow, ſuppoſe at three o'clock in the morning; but by the tables he finds the immerſion of that ſatellite to be at midnight at Greenwich; he then can immediately determine, that as there are three hours difference of time between Q and K, and that R is three hours forwarder in reckoning than Q, it muſt be 45 degrees of eaſt longitude from the meridian of Q. Were this method as practicable at ſea as at land, any ſailor might almoſt as eaſily, and with equal certainty, find the longitude as the latitude.

483 When the immerſions or emerſions are to be obſerved.

Whilſt the earth is going from C to F in its orbit, only the immerſions of Jupiter's ſatellites into his ſhadow are generally ſeen; and their emerſions out of it while the earth goes from G to B. Indeed, both theſe appearances may be ſeen of the ſecond, third, and fourth ſatellite when eclipſed, whilſt the earth is between D and E, or between G and A; but never of the firſt ſatellite, on account of the ſmallneſs of its orbit and the bulk of Jupiter, except only when Jupiter is directly oppoſite to the ſun, that is, when the earth is at G; and even then, ſtrictly ſpeaking, we cannot ſee either the immerſions or emerſions of any of his ſatellites, becauſe his body being directly between us and his conical ſhadow, his ſatellites are hid by his body a few moments before they touch his ſhadow; and are quite emerged from thence before we can ſee them, as it were juſt dropping from him. And when the earth is at C, the ſun, being between it and Jupiter, hides both him and his moons from us.

Eclipſes of Jupiter's Satellites.

In this diagram, the orbits of Jupiter's moons are drawn in true proportion to his diameter; but in proportion to the earth's orbit, they are drawn vaſtly too large.

In whatever month of the year Jupiter is in conjunction with the ſun, or in oppoſition to him, in the next year it will be a month later at leaſt. For whilſt the earth goes once round the ſun, Jupiter deſcribes a twelfth part of his orbit. And therefore, when the earth has finiſhed its annual period, from being in a line with the ſun and Jupiter, it muſt go as much forwarder as Jupiter has moved in that time, to overtake him again; juſt like the minute-hand of a watch, which muſt, from any conjunction with the hour-hand, go once round the dial-plate and ſomewhat above a twelfth part more, to overtake the hour-hand again.

484 Velocity of light.

It is found by obſervation, that when the earth is between the ſun and Jupiter, as at G, his ſatellites are eclipſed about 8 minutes ſooner than they ſhould be according to the tables; and when the earth is at B or C, theſe eclipſes happen about 8 minutes later than the tables predict them. Hence it is undeniably certain, that the motion of light is not inſtantaneous, ſince it takes about 16½ minutes of time to go through a ſpace equal to the diameter of the earth's orbit, which is 180,000,000 of miles in length; and conſequently the particles of light fly almoſt 200,000 miles every ſecond of time, which is above a milion of times ſwifter than the motion of a cannon bullet. And as light is 16½ minutes in travelling acroſs the earth's orbit, it muſt be 8¼ minutes in coming from the ſun to us: therefore if the ſun were annihilated, we ſhould ſee him for 8¼ minutes after; and if he were again created, he would be 8¼ minutes old before we could ſee him.

Fig. 178.

To illuſtrate this progreſſive motion of light, let A and B be the earth in two different parts of its orbit, whoſe diſtance from each other is 95,000,000 of miles, equal to the earth's diſtance from the ſun S. It is plain, that if the motion of light were inſtantaneous, the ſatellite 1 would appear to enter into Jupiter's ſhadow FF at the ſame moment of time to a ſpectator in A, as to another in B. But by many years obſervations it has been found, that the immerſion of the ſatellite into the ſhadow is ſeen 8¼ minutes ſooner when the earth is at B than when it is at A. And ſo, as Mr Romeur firſt diſcovered, the motion of light is thereby proved to be progreſſive, and not inſtanta-

Eclipſes of Jupiter's Satellites.

neous, as was formerly believed. It is eaſy to compute in what time the earth moves from A to B; for the chord of 60 degrees of any circle is equal to the ſemidiameter of that circle: and as the earth goes through all the 360 degrees of its orbit in a year, it goes through 60 of thoſe degrees in about 61 days. Therefore, if on any given day, ſuppoſe the firſt of June, the earth is at A, on the firſt of Auguſt it will be at B; the chord, or ſtraight line AB, being equal to DS the radius of the earth's orbit, the ſame with AS its diſtance from the ſun.

As the earth moves from D to C, thro' the ſide AB of its orbit, it is conſtantly meeting the light of Jupiter's ſatellites ſooner, which occaſions an apparent acceleration of their eclipſes; and as it moves through the other half H of its orbit, from C to D, it is receding from their light, which occaſions an apparent retardation of their eclipſes, becauſe their light is then longer before it overtakes the earth.

485 Acceleration of theſe eclipſes not owing to any inequality in the motions of the ſatellites.

That theſe accelerations of the immerſions of Jupiter's ſatellites into his ſhadow, as the earth approaches towards Jupiter, and the retardations of their emerſions out of his ſhadow, as the earth is going from him, are not occaſioned by any inequality ariſing from the motions of the ſatellites in eccentric orbits, is plain, becauſe it affects them all alike, in whatever parts of their orbits they are eclipſed. Beſides, they go often round their orbits every year, and their motions are no way commenſurate to the earth's. Therefore, a phenomenon not to be accounted for from the real motions of the ſatellites, but ſo eaſily deducible from the earth's motion, and ſo anſwerable thereto, muſt be allowed to reſult from it. This affords one very good proof of the earth's annual motion.

486 Eclipſes by comets.

From what we have ſaid in general concerning eclipſes, it is plain that ſecondary planets are not the only bodies that may occaſion them. The primary planets would eclipſe one another, were it not for their great diſtances; but as the comets are not ſubject to the ſame laws with the planets, it is poſſible they may ſometimes approach ſo near to the primary planets, as to cauſe an eclipſe of the ſun to thoſe planets; and as the body of a comet bears a much larger proportion to the bulk of a primary planet than any ſecondary, it is plain that a cometary eclipſe would both be of much longer continuance, and attended with much greater darkneſs, than that occaſioned by a ſecondary planet. This behoved to be the caſe at any rate: but if we ſuppoſe the primary planet and comet to be moving both the ſame way, the duration of ſuch an eclipſe would be prodigiouſly lengthened; and thus, inſtead of four minutes, the ſun might be totally darkened to the inhabitants of certain places for as many hours. Hence we may account for that prodigious darkneſs which we ſometimes read of in hiſtory at times when no eclipſe of the ſun by the moon could poſſibly happen. It is remarkable, however, that no comet hath ever been obſerved paſſing over the diſk of the ſun like a ſpot, as Venus and Mercury are; yet this muſt certainly happen, when the comet is in its perihelion, and the earth on the ſame ſide of its annual orbit. Such a phenomenon well deſerves the watchful attention of aſtronomers, as it would be a greater confirmation of the planetary nature of comets than any thing hitherto obſerved.

Aſtronomical Machinery.

Sect. XII. *A Deſcription of the Aſtronomical Machinery ſerving to explain and illuſtrate the foregoing part of this Treatiſe.*

487 The machine repreſented by fig. 207. is the Grand Orrery, firſt made in this kingdom by Mr Rowley for King George I. The frame of it, which contains the wheel-work, &c. and regulates the whole machine, is made of ebony, and about four feet in diameter; the outſide thereof is adorned with 12 pilaſtres. Between theſe the 12 ſigns of the zodiac are neatly painted with gilded frames. Above the frame is a broad ring ſupported with 12 pillars. This ring repreſents the plane of the ecliptic; upon which are two circles of degrees, and between theſe the names and characters of the 12 ſigns. Near the outſide is a circle of months and days, exactly correſponding to the ſun's place at noon each day throughout the year. Above the ecliptic ſtand ſome of the principal circles of the ſphere, agreeable to their reſpective ſituations in the heavens: viz. N° 10. are the two colures, divided into degrees and half degrees; N° 11. is one-half of the equinoctial circle, making an angle of 23½ degrees. The tropic of cancer and the arctic circle are each fixed parallel at their proper diſtance from the equinoctial. On the northern half of the ecliptic is a braſs ſemicircle, moveable upon two points fixed in ♈ and ♎. This ſemicircle ſerves as a moveable horizon to be put to any degree of latitude upon the north part of the meridian, and the whole machine may be ſet to any latitude without diſturbing any of the internal motions, by two ſtrong hinges (N° 13.) fixed to the bottom-frame upon which the inſtrument moves, and a ſtrong braſs arch, having holes at every degree, through which a ſtrong pin is put at every elevation. This arch and the two hinges ſupport the whole machine when it is lifted up according to any latitude; and the arch at other times lies conveniently under the bottom-frame. When the machine is ſet to any latitude (which is eaſily done by two men, each taking hold of two handles conveniently fixed for the purpoſe), ſet the moveable horizon to the ſame degree upon the meridian, and hence you may form an idea of the reſpective altitude or depreſſion of the planets both primary and ſecondary. The ſun (N° 1.) ſtands in the middle of the whole ſyſtem upon a wire, making an angle with the ecliptic of about 82 degrees. Next the ſun is a ſmall ball (2.), repreſenting Mercury. Next to Mercury is Venus (3.), repreſented by a larger ball. The earth is repreſented (N° 4.) by an ivory ball, having ſome circles and a map ſketched upon it. The wire which ſupports the earth makes an angle with the ecliptic of 66½ degrees, the inclination of the earth's axis to the ecliptic. Near the bottom of the earth's axis is a dial-plate (N° 9.), having an index pointing to the hours of the day as the earth turns round its axis. Round the earth is a ring ſupported by two ſmall pillars, repreſenting the orbit of the moon; and the diviſions upon it anſwer to the moon's latitude. The motion of this ring repreſents the motion of the moon's orbit according to that of the nodes. Within this ring is the moon (N° 5.), having a black cap or caſe, by which its motion repreſents the phaſes of the moon according to her age. Without the orbits of the

Aſtronomical Machinery.

the earth and moon is Mars (N° 6.) The next in order to Mars is Jupiter and his four moons (N° 7.) Each of theſe moons is ſupported by a wire fixed in a ſocket which turns about the pillar ſupporting Jupiter. Theſe ſatellites may be turned by the hand to any poſition, and yet when the machine is put into motion they will all move in their proper times. The outermoſt of all is Saturn, his five moons, and his ring (N° 8.). Theſe moons are ſupported and contrived ſimilar to thoſe of Jupiter. The machine is put into motion by turning a ſmall winch (N° 14,); and the whole ſyſtem is alſo moved by this winch, and by pulling out and puſhing in a ſmall cylindrical pin above the handle. When it is puſhed in, all the planets, both primary and ſecondary, will move according to their reſpective periods by turning the handle. When it is drawn out, the motions of the ſatellites of Jupiter and Saturn will be ſtopped while all the reſt move without interruption. There is alſo a braſs lamp having two convex glaſſes to be put in room of the ſun; and alſo a ſmaller earth and moon, made ſomewhat in proportion to their diſtance from each other, which may be put on at pleaſure. The lamp turns round at the ſame time with the earth, and the glaſſes of it caſt a ſtrong light upon her. And when the ſmaller earth and moon are placed on, it will be eaſy to ſhow when either of them will be eclipſed. When this machine is intended to be uſed, the planets muſt be duly placed by means of an ephemeris hereafter deſcribed; and you may place a ſmall black patch or bit of wafer upon the middle of the ſun. Right againſt the firſt degree of ♈, you may alſo place patches upon Venus, Mars, and Jupiter, right againſt ſome noted point in the ecliptic. Put in the handle, and puſh in the pin which is above it. One turn of this handle anſwers to a revolution of the ball which repreſents the earth about its axis; and conſequently to 24 hours of time, as ſhown by the hour-index (9.), which is marked and placed at the foot of the wire on which the ball of the earth is fixed. Again, when the index has moved the ſpace of ten hours, Jupiter makes one revolution round its axis, and ſo of the reſt. By theſe means the revolutions of the planets, and their motions round their own axes, will be repreſented to the eye. By obſerving the motions of the ſpots upon the ſurface of the ſun and of the planets in the heavens, their diurnal motion was firſt diſcovered, after the ſame manner as we in this machine obſerve the motions of their repreſentatives by that of the marks placed upon them.

488 The Orrery (fig. 208.) is a machine contrived by the late ingenious Mr James Ferguſon. It ſhows the motions of the ſun, Mercury, Venus, earth, and moon; and occaſionally the ſuperior planets, Mars, Jupiter, and Saturn, may be put on. Jupiter's four ſatellites are moved round him in their proper times by a ſmall winch; and Saturn has his five ſatellites, and his ring which keeps its parallelism round the ſun; and by a lamp put in the ſun's place, the ring ſhows all its various phaſes already deſcribed.

In the centre, N° 1. repreſents the ſun, ſupported by its axis, inclining almoſt 8 degrees from the axis of the ecliptic, and turning round in $25\frac{1}{4}$ days on its axis, of which the north pole inclines toward the eighth degree of Piſces in the great ecliptic (N° 11.), whereon the months and days are engraven over the ſigns and degrees in which the ſun appears, as ſeen from the earth, on the different days of the year.

Aſtronomical Machinery.

The neareſt planet (N° 2.) to the ſun is Mercury, which goes round him in 87 days 23 hours, or $87\frac{23}{24}$ diurnal rotations of the earth; but has no motion round its axis in the machine, becauſe the time of its diurnal motion in the heavens is not known to us.

The next planet in order is Venus (N° 3.), which performs her annual courſe in 224 days 17 hours, and turns round her axis in 24 days 8 hours, or in $24\frac{1}{3}$ diurnal rotations of the earth. Her axis inclines 75 degrees from the axis of the ecliptic, and her north pole inclines towards the 20th degree of Aquarius, according to the obſervations of Bianchini. She ſhows all the phenomena deſcribed in Sect. ii.

Next, without the orbit of Venus, is the earth (N° 4.), which turns round its axis, to any fixed point at a great diſtance, in 23 hours 56 minutes 4 ſeconds of mean ſolar time; but from the ſun to the ſun again, in 24 hours of the ſame time. N° 6. is a ſidereal dial-plate under the earth, and N° 7. a ſolar dial-plate on the cover of the machine. The index of the former ſhows ſidereal, and of the latter, ſolar time; and hence the former index gains one entire revolution on the latter every year, as 365 ſolar or natural days contain 366 ſidereal days, or apparent revolutions of the ſtars. In the time that the earth makes $365\frac{1}{4}$ diurnal rotations on its axis, it goes once round the ſun in the plane of the ecliptic; and always keeps oppoſite to a moving index (N° 10.) which ſhows the ſun's daily change of place, and alſo the days of the months.

The earth is half covered with a black cap, for dividing the apparently enlightened half next the ſun from the other half, which, when turned away from him, is in the dark. The edge of the cap repreſents the circle bounding light and darkneſs, and ſhows at what time the ſun riſes and ſets to all places throughout the year. The earth's axis inclines $23\frac{1}{2}$ degrees from the axis of the ecliptic: the north pole inclines toward the beginning of Cancer, and keeps its paralleliſm throughout its annual courſe; ſo that in ſummer the northern parts of the earth incline towards the ſun, and in winter from him: by which means, the different length of days and nights, and the cauſe of the various ſeaſons, are demonſtrated to ſight.

There is a broad horizon, to the upper ſide of which is fixed a meridian ſemicircle in the north and ſouth points, graduated on both ſides from the horizon to 90° in the zenith or vertical point. The edge of the horizon is graduated from the eaſt and weſt to the ſouth and north points, and within theſe diviſions are the points of the compaſs. From the lower ſide of this thin horizontal plate ſtand out four ſmall wires, to which is fixed a twilight-circle 18 degrees from the graduated ſide of the horizon all round. This horizon may be put upon the earth (when the cap is taken away), and rectified to the latitude of any place; and then by a ſmall wire called the *ſolar ray*, which may be put on ſo as to proceed directly from the ſun's centre towards the earth's, but to come no farther than almoſt to touch the horizon. The beginnnig of twilight, time of ſun-riſing, with his amplitude, meridian altitude, time of ſetting, amplitude then, and end of twilight, are ſhown for every day of the year, at that place to which the horizon is rectified.

Aſtronomical Machinery.

The moon (N° 5.) goes round the earth, from between it and any fixed point at a great diſtance, in 27 days 7 hours 43 minutes, or through all the ſigns and degrees of her orbit, which is called her *periodical revolution*; but ſhe goes round from the ſun to the ſun again, or from change to change, in 29 days 12 hours 35 minutes, which is her *ſynodical revolution*; and in that time ſhe exhibits all the phaſes already deſcribed.

When the abovementioned horizon is rectified to the latitude of any given place, the times of the moon's riſing and ſetting, together with her amplitude, are ſhown to that place as well as the ſun's; and all the various phenomena of the harveſt-moon are made obvious to ſight.

The moon's orbit (N° 9.) is inclined to the ecliptic (N° 11.), one-half being above and the other below it. The nodes, or points at ☊ and ☋, lie in the plane of the ecliptic, as before deſcribed, and ſhift backward through all its ſines and degrees in $18\frac{2}{3}$ years. The degrees of the moon's latitude to the higheſt at NL (north latitude) and loweſt at SL (ſouth latitude), are engraven both ways from her nodes at ☊ and ☋, and as the moon riſes and falls in her orbit according to its inclination, her latitude and diſtance from her nodes are ſhown for every day, having firſt rectified her orbit ſo as to ſet the nodes to their proper places in the ecliptic; and then as they come about at different and almoſt oppoſite times of the year, and then point towards the ſun, all the eclipſes may be ſhown for hundreds of years (without any new rectification), by turning the machinery backward for time paſt, or forward for time to come. At 17 degrees diſtance from each node, on both ſides, is ingraved a ſmall ſun; and at 12 degrees diſtance, a ſmall moon, which ſhow the limits of ſolar and lunar eclipſes; and when, at any change, the moon falls between either of theſe ſuns and the node, the ſun will be eclipſed on the day pointed to by the annual-index (N° 10.); and as the moon has then north or ſouth latitude, one may eaſily judge whether that eclipſe will be viſible in the northern or ſouthern hemiſphere: eſpecially as the earth's axis inclines toward the ſun or from him at that time. And when at any full the moon falls between either of the little moon's and node, ſhe will be eclipſed, and the annual-index ſhows the day of that eclipſe. There is a circle of 29½ equal parts (N° 8.) on the cover of the machine, on which an index ſhows the days of the moon's age.

There are two ſemicircles (fig. 216.) fixed to an elliptical ring, which being put like a cap upon the earth, and the forked part F upon the moon, ſhows the tides as the earth turns round within them, and they are led round it by the moon. When the different places come to the ſemicircle A*a*E*b*B, they have tides of flood; and when they come to the ſemicircle CED, they have tides of ebb; the index on the hour-circle (fig. 208.) ſhowing the times of theſe phenomena.

There is a jointed wire, of which one end being put into a hole in the upright ſtem that holds the earth's cap, and the wire laid into a ſmall forked piece which may be occaſionally put upon Venus or Mercury, ſhows the direct and retrograde motions of theſe two planets, with their ſtationary times and places, as ſeen from the earth.

Aſtronomical Machinery.

The whole machinery is turned by a winch or handle (N° 12.); and is ſo eaſily moved, that a clock might turn it without any danger of ſtopping.

To give a plate of the wheel-work of this machine would anſwer no purpoſe, becauſe many of the wheels lie ſo behind others as to hide them from ſight in any view whatever.

489 The PLANETARIUM (fig. 209.) is an inſtrument contrived by Mr William Jones of Holburn, London, mathematical inſtrument maker, who has paid conſiderable attention to thoſe ſort of machines, in order to reduce them to their greateſt degree of ſimplicity and perfection. It repreſents, in a general manner, by various parts of its machinery, all the motions and phenomena of the planetary ſyſtem. This machine conſiſts of, the Sun (in the centre), with the planets, Mercury, Venus, the Earth and Moon, Mars, Jupiter and his four moons, Saturn and his five moons; and to it is occaſionally applied an extra long arm for the Georgian planet and his two moons. To the earth and moon is applied a frame CD, containing only four wheels and two pinions, which ſerve to preſerve the earth's axis in its proper paralleliſm in its motion round the ſun, and to give the moon her due revolution about the earth at the ſame time. Theſe wheels are connected with the wheel-work in the round box below, and the whole is ſet in motion by the winch H. The arm M that carries round the moon, points out on the plate C her age and phaſes for any ſituation in her orbit, and which accordingly are engraved thereon. In the ſame manner the arm points out her place in the ecliptic B, in ſigns and degrees, called her geocentric place; that is, as ſeen from the earth. The moon's orbit is repreſented by the flat rim A; the two joints of which, and upon which it turns, denoting her nodes. This orbit is made to incline to any deſired angle. The earth of this inſtrument is uſually made of a three inch or $1\frac{1}{4}$ globe, papered, &c. for the purpoſe; and by means of the terminating wire that goes over it, points out the changes of the ſeaſons, and the different lengths of days and nights more conſpicuouſly. This machine is alſo made to repreſent the Ptolemaic Syſtem, or ſuch as is vulgarly received; which places the earth in the centre, and the planets and ſun revolving about it. (It is done by an auxiliary ſmall ſun and an earth, which change their places in the inſtrument.) At the ſame time, it affords a moſt manifeſt confutation of it: for it is plainly obſerved by this conſtruction, (1.) That the planets Mercury and Venus being both within the orbit of the ſun, cannot at any time be ſeen to go behind it; whereas in nature we obſerve them as often to go behind as before the ſun in the heavens. (2.) It ſhows, that as the planets move in circular orbits about the central earth, they ought at all times to be of the ſame apparent magnitude; whereas, on the contrary, we obſerve their apparent magnitude in the heavens to be very variable, and ſo far different, that, for inſtance, Mars will ſometimes appear as big as Jupiter nearly, and at other times you will ſcarcely know him from a fixed ſtar. (3.) It ſhows that any of the planets might be ſeen at all diſtances from the ſun in the heavens; or, in other words, that when the ſun is ſetting, Mercury or Venus may be ſeen not only in the ſouth but even in the eaſt; which circumſtances were never yet obſerved. (4.)

ASTRONOMY Plate LXXXVII

Fig. 207 The GRAND ORRERY by Rowley

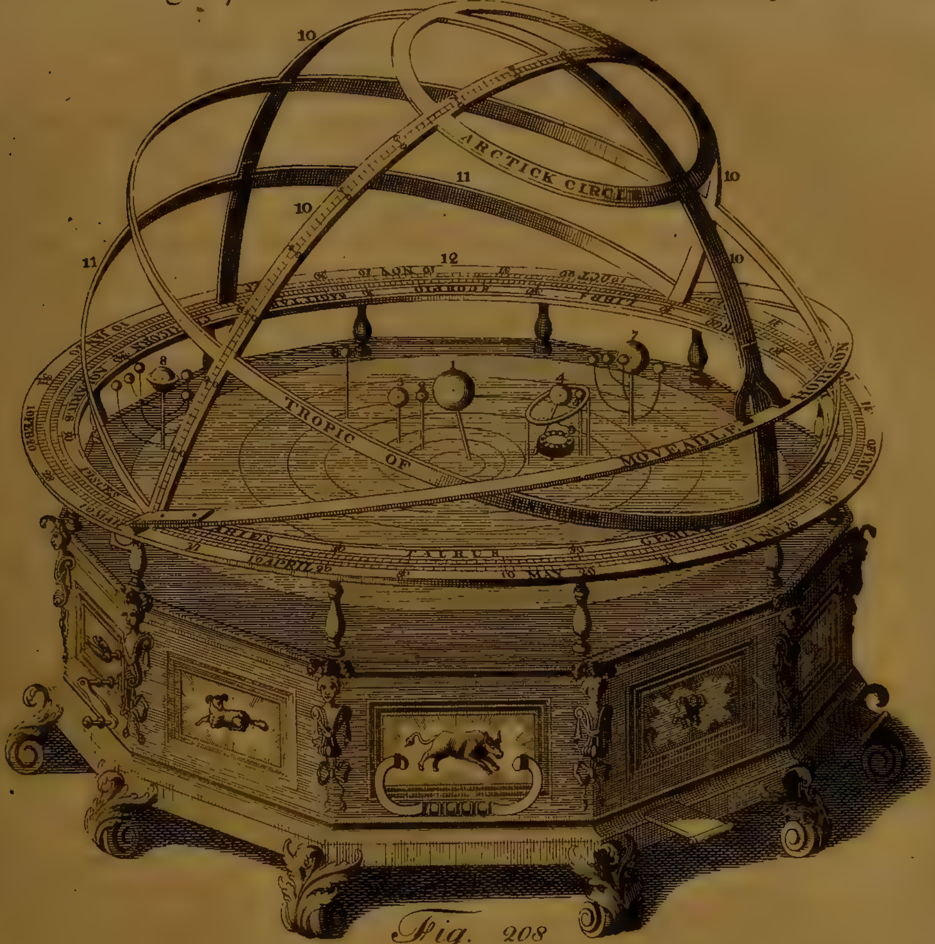
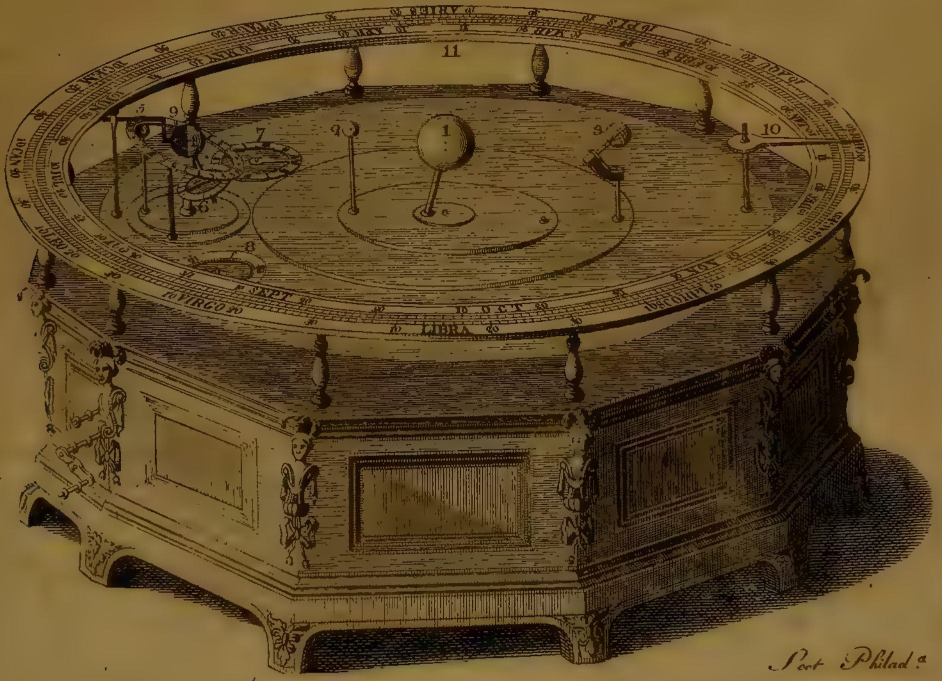


Fig. 208

FERGUSONS ORRERY



Scot Philad.a

Aſtronomical Machinery.

You ſee by this planetarium that the motions of the planets ſhould always be regular and uniformly the ſame; whereas on the contrary, we obſerve them always to move with a variable velocity, ſometimes faſter, then ſlower, and ſometimes not at all, as will be preſently ſhown. (5.) By the machine you ſee the planets move all the ſame way, viz. from weſt to eaſt continually: but in the heavens we ſee them move ſometimes direct from weſt to eaſt, ſometimes retrograde from eaſt to weſt, and at other times to be ſtationary. All which phenomena plainly prove this ſyſtem to be a falſe and abſurd hypotheſis.

The truth of the Copernican or Solar Syſtem of the world is hereby moſt clearly repreſented. For taking the earth from the *centre*, and placing thereon the uſual large braſs ball for the ſun, and reſtoring the earth to its proper ſituation among the planets, then every thing will be right and agree exactly with celeſtial obſervations. For turning the winch H, (1.) You will ſee the planets Mercury and Venus go both before and behind the ſun, or have two conjunctions. (2.) You will obſerve Mercury never to be more than a certain angular diſtance, 21°, and Venus 47°, from the ſun. (3.) That the planets, eſpecially Mars, will be ſometimes much nearer to the earth than at others, and therefore muſt appear larger at one time than at another. (4.) You will ſee that the planets cannot appear at the earth to move with an uniform velocity; for when neareſt they appear to move faſter, and ſlower when moſt remote. (5.) You will obſerve the planets will appear at the earth to move ſometimes directly from weſt to eaſt, and then to become retrograde from eaſt to weſt, and between both to be ſtationary or without any apparent motion at all. Which particulars all correſpond exactly with obſervations, and fully prove the truth of this excellent ſyſtem. Fig. 211. repreſents an apparatus to ſhow theſe latter particulars more evidently. An hollow wire, with a ſlit at top, is placed over the arm of the planet Mercury or Venus at E. The arm DG repreſents a ray of light coming from the planet at D to the earth, and is put over the centre which carries the earth at F. The planets being then put in motion, the planet D, as ſeen in the heavens from the earth at F, will undergo the ſeveral changes of poſition as above deſcribed. The wire prop that is over Mercury at E, may be placed over the other ſuperior planets, Mars, &c. and the ſame phenomena may be exhibited.

By this machine you at *once* ſee all the planets in motion about the ſun, with the ſame reſpective velocities and periods of revolution which they have in the heavens; the wheel-work being calculated to a minute of time, from the lateſt diſcoveries.

You will ſee here a demonſtration of the earth's motion about the ſun, as well as thoſe of the reſt of the planets: for if the earth were to be at reſt in the heavens, then the time between any two conjunctions of the ſame kind, or oppoſitions, would be the ſame with the periodical time of the planets, viz. 88 days in Mercury, 225 in Venus, &c.: whereas you here obſerve this time, inſtead of being 225 days, is no leſs than 583 days in Venus, occaſioned by the earth's moving in the mean time about the ſun the ſame way with the planet. And this ſpace of 583 days always paſſes between two like conjunctions of Venus in the heavens. Hence the moſt important point of aſtronomy is ſatisfactorily demonſtrated.

Aſtronomical Machinery.

The diurnal rotation of the earth about its axis, and a demonſtration of the cauſe of the different ſeaſons of the year, and the different lengths of days and nights, are here anſwered completely: for as the earth is placed on an axis inclining to that of the ecliptic in an angle of 23½ degrees, and is ſet in motion by the wheel-work, there will be evidently ſeen the different inclination of the ſun's rays on the earth, the different quantity thereof which falls on a given ſpace, the different quantity of the atmoſphere they paſs through, and the different continuance of the ſun above the horizon at the ſame place in different times of the year; which particulars conſtitute the difference betwixt heat and cold in the ſummer and winter ſeaſons.

As the globe of the earth is moveable about its inclined axis, ſo by having the horizon of London drawn upon the ſurface of it, and by means of the terminating wire going over it, by which is denoted, that on that ſide of the wire next the ſun is the enlightened half of the earth, and the oppoſite ſide the darkened half, you will here ſee very naturally repreſented the cauſe of the different lengths of day and night, by obſerving the unequal portions of the circle which the iſland of Great-Britain, or the city of London, or any other place, deſcribes in the light and dark hemiſpheres at different times of the year, by turning the earth on its axis with the hand. But in ſome of the better orreries on this principle, the earth revolves about its axis by wheel-work.

As to the eclipſes of the ſun and moon, the true cauſes of them are here very clearly ſeen: for by placing the lamp (fig. 212,) upon the centre, in room of the braſs ball denoting the ſun, and turning the winch until the moon comes into a right line betwen the centers of the lamp (or ſun) and earth, the ſhadow of the moon will fall upon the earth, and all who live on that part over which the ſhadow paſſes will ſee the ſun eclipſed more or leſs. On the other ſide, the moon paſſes (in the aforeſaid caſe) through the ſhadow of the earth, and is by that means eclipſed. And the orbit A (fig. 210.) is ſo moveable on the two joints called nodes, that any perſon may eaſily repreſent the due poſition of the modes and intermediate ſpaces of the moon's orbit; and thence ſhow when there will or will not be an eclipſe of either luminary, and what the quantity of each will be.

While the moon is continuing to move round the earth, the lamp on the centre will ſo illumine the moon, that you will eaſily ſee all the phaſes, as new, dichotomized, gibbous, full, waining, &c. juſt as they appear in the heavens. You will moreover obſerve all the ſame phaſes of the earth as they appear at the moon.

The ſatellites of Jupiter and Saturn are moveable only by the hand; yet may all their phenomena be eaſily repreſented, excepting the true relative motions and diſtances. Thus, if that gilt globe which before repreſented the ſun be made now to denote Jupiter, and four of the primary planets only be retained, then will the Jovian ſyſtem be repreſented; and by candle light only you will ſee (the machine being in motion) the immerſions and emerſions of the ſatellites into and out of Jupiter's ſhadow. You will ſee plainly the manner in which they tranſit his body, and their occultations behind it. You will obſerve the various ways in which one or more of theſe moons may at times diſappear. And if the machine be ſet by a white wall, &c. then by the projection of their ſhadows will be ſeen the reaſons why thoſe moons always appear on each ſide of Jupiter in a right line, why thoſe which are moſt remote may appear neareſt, and *è contrario*. And the ſame may be done for Saturn's five moons and his ring.

490 *The Method of Rectifying the Orrery, and the proper Manner of placing the Planets in their true Situations.*

Having dwelled thus much on the deſcription of orreries, it may be uſeful to young readers, to point out the method by which the orrery ſhould be firſt rectified, previous to the exhibition or uſing of it: and the following is extracted from Mr William Jones's deſcription of his new *Portable Orrery*, "The method of ſhowing the places, and relative aſpects of the planets on any day of the year in the planetarium, muſt be done by the aſſiſtance of an *ephemeris* or *almanac*, which among other almanacs is publiſhed annually by the Stationer's Company.

"This ephemeris contains a diary or daily account of the planets places in the heavens, in ſigns, degrees, and minutes, both as they appear to the eye ſuppoſed to be at the ſun, and at the earth, throughout the year. The firſt of theſe poſitions is called the *heliocentric place*, and the latter, the *geocentric place*. The heliocentric place is that made uſe of in orreries; the geocentric place, that in globes. As an example for finding their places, and ſetting them right in the orrery, we will ſuppoſe the ephemeris (by *White*, which for this purpoſe is conſidered the beſt) at hand, wherein at the bottom of the *left-hand* page for every month is the heliocentric longitudes (or places) of all the planets to every ſix days of the month; which is near enough for common uſe: a copy of one of theſe tables for March 1784 is here inſerted for the information of the tyro.

Days	Day increaſ.	Helioc. long. ♄	Helioc. long. ♃	Helioc. long. ♂	Helioc. long. ⊖	Helioc. long. ♀	Helioc. long. ☿
1	3 11	16 ♑ 45	17 ♒ 11	1 ♋ 30	11 ♍ 37	0 ♐ 35	7 ♏ 58
7	3 35	16 56	17 43	4 23	17 37	10 7	25 23
13	3 59	17 7	18 15	7 15	23 36	19 38	11 ♐ 59
19	4 23	17 17	18 47	10 6	29 33	29 8	28 33
25	4 47	17 28	19 19	12 55	5 ♎ 30	8 ♑ 38	15 ♑ 49

Now, as an example, we will ſuppoſe, that in order to ſet the planets of the orrery, we want their heliocentric places for the 21ſt of this month. Looking into the table, we take the 19th day, which is the neareſt to the day wanted: then, accordingly we find the place of Saturn (♄) is in 17° 17′, or 17 degrees (rejecting the minutes, being in this caſe uſeleſs); of Capricornus (♑), of Jupiter (♃), in 18° of Aquarius (♒), Mars (♀) in 10° of Cancer (♋), the earth (⊖), in 29° of Virgo (♍), Venus (♀), in 29° of Sagittarius (♐), Mercury (☿) in 28° of the ſame ſign; and in the ſame manner for any other day therein ſpecified. Upon even this circumſtance depends a very pleaſing aſtronomical praxis, by which the young tyro may at any time be able to entertain himſelf in a moſt rational and agreeable manner, viz. he may in a minute or two repreſent the true appearance of the planetary ſyſtem juſt as it really is in the heavens, and for any day he pleaſes, by aſſigning to each planet its proper place in its orbit; as in the following manner: For the 19th of March, as before, the place of Saturn is in 17° of Capricornus (♑); now, laying hold of the arm of Saturn in the orrery, you place it over or againſt the 17° of Capricorn on the ecliptic circle, conſtantly placed on or ſurrounding the inſtrument: thus doing the ſame for the other planets, they will have their proper heliocentric places for that day.

"Now in this ſituation of the planets, we obſerve, that if a perſon was placed on the earth, he would ſee Venus and Jupiter in the ſame line and place of the ecliptic, conſequently in the heavens they would appear together, or in conjunction; Mercury a little to the left or eaſtward of them, and nearer to the ſun; Saturn to the right, or the weſtward, farther from the Sun; Mars directly oppoſite to Saturn; ſo that when Saturn appears in the weſt, Mars appears in the eaſt, and *vice verſa*. Several other curious and entertaining particulars as depending on the above, may be eaſily repreſented and ſhown by the learner, particularly the foregoing when the winch is turned, and all the planets ſet into their reſpective motions."

491 We cannot cloſe this detail on orreries more agreeably than by the following account of an inſtrument of that ſort invented by Mr. James Ferguſon, to which he gives the name of a *Mechanical Paradox*, and which is actuated by means of what many, as he obſerves, even good mechanics, would be ready to pronounce impoſſible, viz. That the teeth of one wheel taking equally deep into the teeth of three others, ſhould affect them in ſuch a manner, that in turning it any way round its axis, it ſhould turn one of them the *ſame way*, another the *contrary way*, and the third *no way at all*.

The ſolution of the paradox is given under the article MECHANICS; after which, our author proceeds to give the following account of its uſes. "This machine is ſo much of an orrery, as is ſufficient to ſhow the different lengths of days and nights, the viciſſitudes of the ſeaſons, the retrograde motion of the nodes of the moon's orbit, the direct motion of the apogeal point of her orbit, and the months in which the ſun and moon muſt be eclipſed.

"On the great immoveable plate A (ſee fig. 213.) are the months and days of the year, and the ſigns and degrees of the zodiac ſo placed, that when the annual index *h* is brought to any given day of the year, it will point to the degree of the ſign in which the ſun is on that day. This index is fixed to the moveable frame BC,

Aſtronomical Machinery.

BC, and is carried round the immoveable plate with it, by means of the knob *n*. The carrying this frame and index round the immoveable plate, anſwers to the earth's annual motion round the ſun, and to the ſun's apparent motion round the ecliptic in a year.

" The central wheel D (being fixt on the axis *a*, which is fixt in the centre of the immoveable plate) turns the thick wheel E round its own axis by the motion of the frame: and the teeth of the wheel E take into the teeth of the three wheels F, G, H, whoſe axes turn within one another, like the axes of the hour, minute, and ſecond hands of a clock or watch, where the ſeconds are ſhown from the centre of the dial-plate.

" On the upper ends of theſe axes, are the round plates I, K, L; the plate I being on the axis of the wheel F, K on the axis of G, and L on the axis of H. So that which ever way theſe wheels are affected, their reſpective plates, and what they ſupport, muſt be affected in the ſame manner; each wheel and plate being independent of the others.

" The two upright wires M and N, are fixed into the plate I; and they ſupport the ſmall ecliptic OP, on which, in the machine, the ſigns and degrees of the ecliptic are marked. This plate alſo ſupports the ſmall terreſtrial globe *e* on its inclining axis *f*, which is fixed into the plate near the foot of the wire N. This axis inclines $23\frac{1}{2}$ degrees from a right line, ſuppoſed to be perpendicular to the ſurface of the plate I, and alſo to the plane of the ſmall ecliptic OP which is parallel to that plate.

" On the earth *e* is the creſcent *g*, which goes more than half way round the earth, and ſtands perpendicular to the plane of the ſmall ecliptic OP, directly facing the ſun Z: Its uſe is to divide the enlightened half of the earth next the ſun from the other half which is then in the dark; ſo that it repreſents the boundary of light and darkneſs, and therefore ought to go quite round the earth; but cannot in a machine, becauſe in ſome poſitions the earth's axis would fall upon it. The earth may be freely turned round on its axis by hand, within the creſcent, which is ſupported by the crooked wire *w*, fixt to it, and into the upper plate of the moveable frame BC.

" In the plate K are fixed the two upright wires Q and R: they ſupport the moon's inclined orbit ST in its nodes, which are the two oppoſite points of the moon's orbit where it interſects the ecliptic OP. The aſcending node is marked ☊, to which the deſcending node is oppoſite below *e*, but hid from view by the globe *e*. The half ☊ T *e* of this orbit is on the north-ſide of the ecliptic OP, and the other half *e* S ☊ is on the ſouth ſide of the ecliptic. The moon is not in this machine; but when ſhe is in either of the nodes of her orbit in the heavens, ſhe is then in the plane of the ecliptic: when ſhe is in T in her orbit, ſhe is in her greateſt north latitude; and when ſhe is at S, ſhe is in her greateſt ſouth latitude.

" In the plate L is fixed the crooked wire UU, which points downward to the ſmall ecliptic OP, and ſhows the motion of the moon's apogee therein, and its place at any given time.

" The ball Z repreſents the ſun, which is ſupported by the crooked wire XY, fixt into the upper plate of the frame at X. A ſtraight wire W proceeds from the ſun Z, and points always toward the centre of the earth *e*; but toward different points of its ſurface at different times of the year, on account of the obliquity of its axis, which keeps its paralleliſm during the earth's annual courſe round the ſun Z; and therefore muſt incline ſometimes toward the ſun, at other times from him, and twice in the year neither toward nor from the ſun, but ſidewiſe to him. The wire W is called *the ſolar ray*.

" As the annual-index *h* ſhows the ſun's place in the ecliptic for every day of the year, by turning the frame round the axis of the immoveable plate A, according to the order of the months and ſigns, the ſolar ray does the ſame in the ſmall ecliptic OP: for as this ecliptic has no motion on its axis, its ſigns and degrees ſtill keep parallel to thoſe on the immoveable plate. At the ſame time, the nodes of the moon's orbit ST (or points where it interſects the ecliptic OP) are moved backward, or contrary to the order of ſigns, at the rate of $19\frac{1}{3}$ degrees every Julian year; and the moon's apogeal wire UU is moved forward, or according to the order of the ſigns of the ecliptic, nearly at the rate of 41 degrees every Julian year; the year being denoted by a revolution of the earth *e* round the ſun Z; in which time the annual-index *h* goes round the circles of months and ſigns on the immoveable plate A.

" Take hold of the knob *n*, and turn the frame round thereby; and in doing this, you will perceive that the north pole of the earth *e* is conſtantly before the creſcent *g*, in the enlightened part of the earth toward the ſun, from the 20th of March to the 23d of September; and the ſouth pole all that time behind the creſcent in the dark; and from the 23d of September to the 20th of March, the north pole is conſtantly in the dark behind the creſcent, and the ſouth pole in the light before it; which ſhows, that there is but one day and one night at each pole, in the whole year; and that when it is day at either pole, it is night at the other.

" From the 20th of March to the 23d of September, the days are longer than the nights in all thoſe places of the northern hemiſphere of the earth which revolve through the light and dark, and ſhorter in thoſe of the ſouthern hemiſphere. From the 23d of September to the 20th of March the reverſe.

" There are 24 meridian ſemicircles drawn on the globe, all meeting in its poles; and as one rotation or turn of the earth on its axis is performed in 24 hours, each of theſe meridians is an hour diſtant from the other, in every parallel of latitude. Therefore, if you bring the annual-index *h* to any given day of the year, on the immoveable plate, you may ſee how long the day then is at any place of the earth, by counting how many of theſe meridians are in the light, or before the creſcent, in the parallel of latitude of that place; and this number being ſubtracted from 24 hours, will leave remaining the length of the night. And if you turn the earth round its axis, all thoſe places will paſs directly under the point of the ſolar ray, which the ſun paſſes vertically over on that day, becauſe they are juſt as many degrees north or ſouth of the equator as the ſun's declination is then from the equinoctial.

" At the two equinoxes, viz. on the 20th of March and 23d of September, the ſun is in the equinoctial, and conſequently has no declination. On theſe days, the ſolar ray points directly toward the equator, the earth's poles lie under the inner edge of the creſcent, or boundary of light and darkneſs; and in every parallel of latitude there are 12 of the meridians or hour circles before the creſcent, and 12 behind it; which ſhows that the days and nights then are each 12 hours long at all places of the earth. And if the earth be turned round its axis, you will ſee that all places on it go equally through the light and the dark hemiſpheres.

" On the 21ſt of of June, the whole ſpace within the north polar circle is enlightened, which is 23½ degrees from the pole, all around; becauſe the earth's axis then inclines 23½ degrees toward the ſun: but the whole ſpace within the ſouth polar circle is in the dark; and the ſolar ray points toward the tropic of Cancer on the earth, which is 23½ degrees north from the equator. On the 20th of December the reverſe happens, and the ſolar ray points toward the tropic of Capricorn, which is 23½ degrees ſouth from the equator.

" If you bring the annual-index *h* to the beginning of January, and turn the moon's orbit ST by its ſupporting wires Q and R till the aſcending node (marked ☊) comes to its place in the ecliptic OP, as found by an ephemeris, or by aſtronomical tables, for the beginning of any given year; and then move the annual-index by means of the knob *n*, till the index comes to any given day of the year afterward, the nodes will ſtand againſt their places in the ecliptic on that day; and if you move on the index till either of the nodes comes directly againſt the point of the ſolar ray, the index will then be at the day of the year on which the ſun is in the conjunction with that node. At the times of thoſe new moons which happen within ſeventeen days of the conjunction of the ſun with either of the nodes, the ſun will be eclipſed: and at the times of thoſe full moons, which happen within twelve days of either of theſe conjunctions, the moon will be eclipſed. Without theſe limits there can be no eclipſes either of the ſun or moon; becauſe, in nature, the moon's latitude or declination from the ecliptic is too great for the moon's ſhadow to fall on any part of the earth, or for the earth's ſhadow to touch the moon.

" Bring the annual-index to the beginning of January, and ſet the moon's apogeal wire UU to its place in the ecliptic for that time, as found by aſtronomical tables; then move the index forward to any given day of the year, and the wire will point on the ſmall ecliptic to the place of the moon's apogee for that time.

" The earth's axis *f* inclines always toward the beginning of the ſign Cancer on the ſmall ecliptic OP. And if you ſet either of the moon's nodes, and her apogeal wire to the beginning of that ſign, and turn the plate A about, until the earth's axis inclines toward any ſide of the room (ſuppoſe the north ſide), and then move the annual-index round and round the immoveable plate A, according to the order of the months and ſigns upon it, you will ſee that the earth's axis and beginning of Cancer will ſtill keep toward the ſame ſide of the room, without the leaſt deviation from it; but the nodes of the moon's orbit ST will turn progreſſively towards all the ſides of the room, contrary to the order of ſigns in the ſmall ecliptic OP, or from eaſt, by ſouth, to weſt, and ſo on; and the apogeal wire UU, will turn the contrary way to the motion of the nodes, or according to the order of the ſigns in the ſmall ecliptic, from weſt, by ſouth, to eaſt, and ſo on quite round. A clear proof that the wheel F, which governs the earth's axis and the ſmall ecliptic, does not turn any way round its own centre; that the wheel G, which governs the moon's orbit OP, turns round its own centre backward, or contrary both to the motion of the frame BC and thick wheel E; and that the wheel H, which governs the moon's apogeal wire UU, turns round its own centre forward, or in direction both of the motion of the frame and of the thick wheel E, by which the three wheels F, G, and H, are affected.

The wheels D, E, and F, have each 39 teeth in the machine; the wheel G has 37, and H 44.

"The paralleliſm of the earth's axis is perfect in this machine; the motion of the apogee very nearly ſo; the motion of the nodes not quite ſo near the truth, though they will not vary ſenſibly therefrom in one year. But they cannot be brought nearer, unleſs larger wheels, with higher numbers of teeth, are uſed.

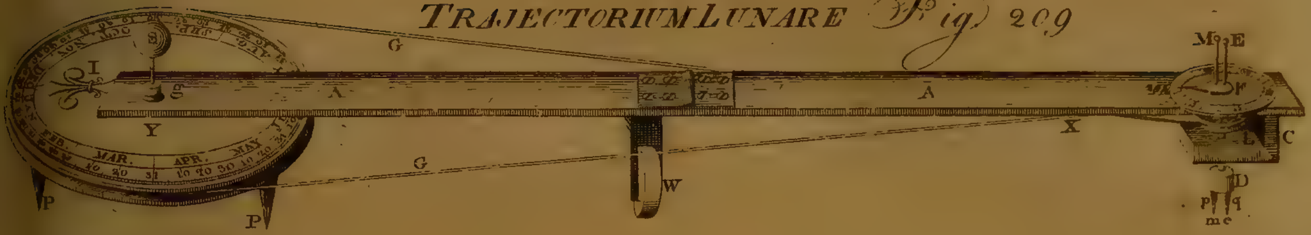
In nature, the moon's apogee goes quite round the ecliptic in eight years and 312 days, in direction of the earth's annual motion; and the nodes go round the ecliptic, in a contrary direction, in 18 years and 225 days. In the machine, the apogee goes round the ecliptic OP in eight years and four-fifths of a year, and the nodes in eighteen years and a half."

The COMETARIUM, (fig. 216.) This curious machine ſhows the motion of a comet or eccentric body moving round the ſun, deſcribing equal areas in equal times, and may be ſo contrived as to ſhow ſuch a motion for any degree of eccentricity. It was invented by the late Dr Deſaguliers. 492

The dark elliptical groove round the letters *a b c d e f g h i k l m* is the orbit of the comet Y; this comet is carried round in the groove according to the order of letters, by the wire W fixed in the ſun S, and ſlides on the wire as it approaches nearer to or recedes farther from the ſun, being neareſt of all in the perihelion *a*, and fartheſt in the aphelion *g*. The areas, *a* S *b*, *b* S *c*, *c* S *d*, &c. or contents of theſe ſeveral triangles, are all equal; and in every turn of the winch N, the comet Y is carried over one of theſe areas; conſequently, in as much time as it moves from *f* to *g*, or from *g* to *h*, it moves from *m* to *a*, or from *a* to *b*; and ſo of the reſt, being quickeſt of all at *a*, and ſloweſt at *g*. Thus the comet's velocity in its orbit continually decreaſes from the perihelion *a* to the aphelion *g*; and increaſes in the ſame proportion from *g* to *a*.

The elliptic orbit is divided into 12 equal parts or ſigns, with their reſpective degrees, and ſo is the circle *n o p q r s t u*, which repreſents a great circle in the heavens, and to which the comet's motion is referred by a ſmall knob on the point of the wire W. Whilſt the comet moves from *f* to *g* in its orbit, it appears to move only about five degrees in this circle, as is ſhown by the ſmall knob on the end of the wire W; but in as ſhort time as the comet moves from *m* to *a*, or from *a* to *b*, it appears to deſcribe the large ſpace *t n* or *n o* in the heavens, either of which ſpaces contains

TRAJECTORIUM LUNARE Fig. 209



PLANETARIUM by Jones

Fig. 210

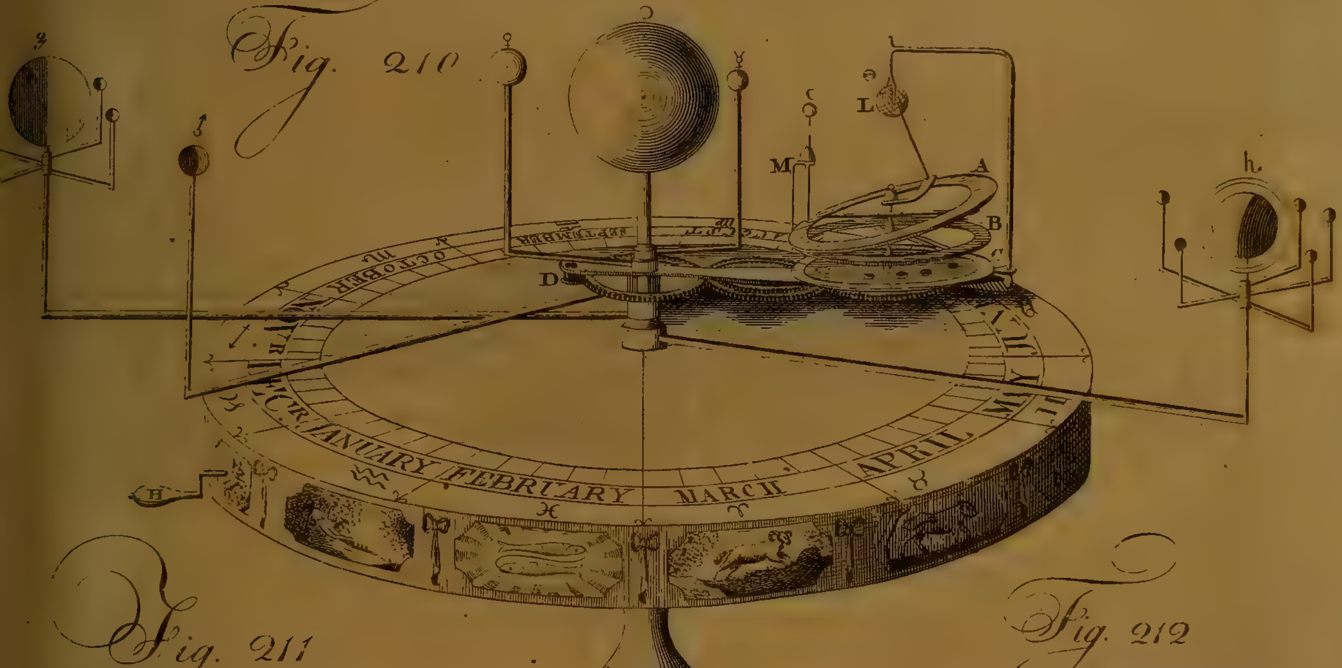


Fig. 211

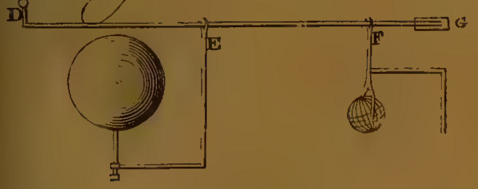
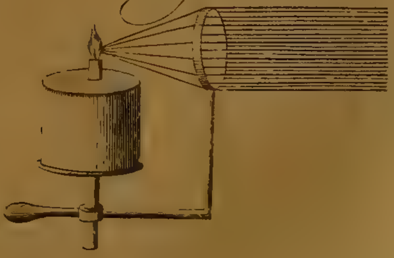


Fig. 212



Scot Philad.a

tains 120 degrees, or four ſigns. Were the eccentricity of its orbit greater, the greater ſtill would be the difference of its motion, and *vice verſa*.

ABCDEFGHIKLM is a circular orbit for ſhowing the equable motion of a body round the ſun S, deſcribing equal areas ASB, BSC, &c. in equal times with thoſe of the body Y in its elliptical orbit abovementioned; but with this difference, that the circular motion deſcribes the equal arcs AB, BC, &c. in the ſame equal times that the elliptical motion deſcribes the unequal arcs, *a b*, *bc*, &c.

Now, ſuppoſe the two bodies Y and 1 to ſtart from the points *a* and A at the ſame moment of time, and, each having gone round its reſpective orbit, to arrive at theſe points again at the ſame inſtant, the body Y will be forwarder in its orbit than the body 1 all the way from *a* to *g*, and from A to G: but 1 will be forwarder than Y through all the other half of the orbit; and the difference is equal to the equation of the body Y in its orbit. At the points *a* A, and *g* G, that is, that in the perihelion and aphelion they will be equal; and then the equation vaniſhes. This ſhows why the equation of a body moving in an elliptic orbit, is added to the mean or ſuppoſed circular motion from the perihelion to the aphelion, and ſubtracted from the aphelion to the perihelion, in bodies moving round the ſun, or from the perigee to the apogee, and from the apogee to the perigee in the moon's motion round the earth.

This motion is performed in the following manner by the machine, fig. 217. ABC is a wooden bar (in the box containing the wheel-work), above which are the wheels D and E, and below it the elliptic plates FF and GG; each plate being fixed on an axis in one of its focuſes, at E and K: and the wheel E is fixed on the ſame axis with the plate FF. Theſe plates have grooves round their edges preciſely of equal diameters to one another, and in theſe grooves is the cat-gut ſtring *g g*, *g g* croſſing between the plates at *h*. On H, the axis of the handle or winch N in fig. 216, is an endleſs ſcrew in fig. 217. working in the wheels D and E, whoſe numbers of teeth being equal, and ſhould be equal to the number of lines *a* S, *b* S, *c* S, &c. in fig. 216, they turn round their axes in equal times to one another, and to the motion of the elliptic plates. For, the wheels D and E having equal numbers of teeth, the plate FF being fixed on the ſame axis with the wheel E, and turning the equally big plate GG by a cat-gut ſtring round them both, they muſt all go round their axes in as many turns of the handle N as either of the wheels has teeth.

It is eaſy to ſee, that the end of *h* of the elliptical plate FF being farther from its axis E than the oppoſite end I is, muſt deſcribe a circle ſo much the larger in proportion, and therefore move through ſo much more ſpace in the ſame time; and for that reaſon the end *h* moves ſo much faſter than the end I, although it goes no ſooner round the centre E. But then the quick-moving end *h* of the plate FF leads about the ſhort end *h* K of the plate GG with the ſame velocity; and the ſlow-moving end I of the plate FF coming half round as to B, muſt then lead the long end *k* of the plate GG as ſlowly about: ſo that the elliptical plate FF and its axis E move uniformly and equally quick in every part of its revolution; but the elliptical plate GG, together with its axis K, muſt move very unequally in different parts of its revolution; the difference being always inverſely as the diſtance of any point of the circumference of GG from its axis at K: or in other words, to inſtance in two points, if the diſtance K *k* be four, five, or ſix times as great as the diſtance K *h*, the point *h* will move in that poſition, four, five, or ſix times as faſt as the point *k* does, when the plate GG has gone half round; and ſo on for any other eccentricity or difference of the diſtances K *k* and K *h*. The tooth I on the plate FF falls in between the two teeth at *k* on the plate GG; by which means the revolution of the latter is ſo adjuſted to that of the former, that they can never vary from one another.

On the top of the axis of the equally moving-wheel D in fig. 217. is the ſun S in fig. 216.; which ſun, by the wire fixed to it, carries the ball 1 round the circle ABCD, &c. with an equable motion, according to the order of the letters: and on the top of the axis K of the unequally-moving ellipſis GG, in fig. 217. is the ſun S in fig. 216. carrying the ball Y unequally round in the elliptical groove *a b c d*, &c. *N. B.* This elliptical groove muſt be preciſely equal and ſimilar to the verge of the plate GG, which is alſo equal to that of FF.

In this manner machines may be made to ſhow the true motion of the moon about the earth, or of any planet about the ſun, by making the elliptical plates of the ſame eccentricities, in proportion to the radius, as the orbits of the planets are, whoſe motions they repreſent; and ſo their different equations in different parts of their orbits may be made plain to ſight, and clearer ideas of theſe motions and equations acquired in half an hour, than could be gained from reading half a day about ſuch motions and equations.

The IMPROVED CELESTIAL GLOBE, fig. 187. On the north pole of the axis, above the hour-circle, is fixed an arch MKH of 23½ degrees; and at the end H is fixed an upright pin HG, which ſtands directly over the north pole of the ecliptic, and perpendicular to that part of the ſurface of the globe. On this pin are two moveable collets at D and H, to which are fixed the quadrantile wires N and O, having two little balls on their ends for the ſun and moon, as in the figure. The collet D is fixed to the circular plate F, whereon the 29½ days of the moon's age are engraven, beginning juſt under the ſun's wire N; and as this wire is moved round the globe, the plate F turns round with it. Theſe wires are eaſily turned, if the ſcrew G be ſlackened: and when they are ſet to their proper places, the ſcrew ſerves to fix them there, ſo as in turning the ball of the globe, the wires with the ſun and moon go round with it; and theſe two little balls riſe and ſet at the ſame times, and on the ſame points of the horizon, for the day to which they are rectified, as the ſoon and moon do in the heavens. 493

Becauſe the moon keeps not her courſe in the ecliptic (as the ſun appears to do), but has a declination of 5⅓ degrees on each ſide from it in every lunation, her ball may be ſcrewed as many degrees to either ſide of the ecliptic as her latitude or declination from the ecliptic amounts to at any given time.

The horizon is ſupported by two ſemicircular arches, becauſe pillars would ſtop the progreſs of the balls when they go below the horizon in an oblique ſphere.

To rectify this globe. Elevate the pole to the latitude of the place; then bring the ſun's place in the ecliptic for the given day to the brazen meridian, and ſet the hour-index to 12 at noon, that is, to the upper 12 on the hour-circle; keeping the globe in that ſituation, ſlacken the ſcrew G, and ſet the ſun directly over his place on the meridian; which done ſet the moon's wire under the number that expreſſes her age for that day on the plate F, and ſhe will then ſtand over her place in the ecliptic, and ſhow what conſtellation ſhe is in. Laſtly, faſten the ſcrew G, and adjuſt the moon to her latitude, and the globe will be rectified.

Having thus rectified the globe, turn it round, and obſerve on what points of the horizon the ſun and moon balls riſe and ſet, for theſe agree with the points of the compaſs on which the ſun and moon riſe and ſet in the heavens on the given day: and the hour-index ſhows the times of their riſing and ſetting; and likewiſe the time of the moon's paſſing over the meridian.

This ſimple apparatus ſhows all the varieties that can happen in the riſing and ſetting of the ſun and moon: and makes the forementioned phenomena of the harveſt moon plain to the eye. It is alſo very uſeful in reading lectures on the globes, becauſe a large company can ſee this ſun and moon go round, riſing above and ſetting below the horizon at different times, according to the ſeaſons of the year; and making their appulſes to different fixed ſtars. But in the uſual way, where there is only the places of the ſun and moon in the ecliptic to keep the eye upon, they are eaſily loſt ſight of, unleſs they be covered with patches.

494 The Trajectorium Lunare, fig. 208. This machine is for delineating the paths of the earth and moon, ſhowing what ſort of curves they make in the etherial regions. S is the ſun, and E the earth, whoſe centres are 95 inches diſtant from each other; every inch anſwering to 1,000,000 of miles. M is the moon, whoſe centre is $\frac{24}{100}$ parts of an inch from the earth's in this machine, this being in juſt proportion to the moon's diſtance from the earth. AA is a bar of wood, to be moved by hand round the axis *g* which is fixed in the wheel Y. The circumference of this wheel is to the circumference of the ſmall wheel L (below the other end of the bar) as $365\frac{1}{4}$ days is to $29\frac{1}{2}$, or as a year is to a lunation. The wheels are grooved round their edges, and in the grooves is the cat-gut ſtring GG croſſing between the wheels at X. On the axis of the wheel L is the index F, in which is fixed the moon's axis M for carrying her round the earth E (fixed on the axis of the wheel L in the time that the index goes round a circle of $29\frac{1}{2}$ equal parts, which are the days of the moon's age. The wheel Y has the months and days of the year all round its limb; and in the bar AA is fixed the index *l*, which points out the days of the months anſwering to the days of the moon's age, ſhown by the index F, in the circle of $29\frac{1}{2}$ equal parts at the other end of the bar. On the axis of the wheel L is put the piece D, below the cock C, in which this axis turns round; and in D are put the pencils *e* and *m* directly under the earth E and moon M; ſo that *m* is carried round *e* as M is round E

Lay the machine on an even floor, preſſing gently on the wheel Y, to cauſe its ſpiked feet (of which two appear at P and P, the third being ſuppoſed to be hid from ſight by the wheel) enter a little into the floor to ſecure the wheel from turning. Then lay a paper about four feet long under the pencils *e* and *m*, croſswiſe to the bar; which done, move the bar ſlowly round the axis *g* of the wheel Y; and as the earth E goes round the ſun S, the moon M will go round the earth with a duly proportioned velocity; and the friction wheel W running on the floor, will keep the bar from bearing too heavily on the pencils *e* and *m*, which will delineate the paths of the earth and moon. As the index I points out the days of the months, the index F ſhows the moon's age on theſe days, in the circle of $29\frac{1}{2}$ equal parts. And as this laſt index points to the different days in its circle, the like numeral figures may be ſet to thoſe parts of the curves of the earth's path and moon's, where the pencils *e* and *m* are at thoſe times reſpectively, to ſhow the places of the earth and moon. If the pencil *e* be puſhed a very little off, as if from the pencil *m*, to about $\frac{1}{40}$ part of their diſtance, and the pencil *m* puſhed as much towards *e*, to bring them to the ſame diſtances again, though not to the ſame points of ſpace; then, as *m* goes round *e*, *e* will go as it were round the centre of gravity between the earth *e* and moon *m*; but this motion will not ſenſibly alter the figure of the earth's path or the moon's.

If a pin, as *p*, be put through the pencil *m*, with its head, towards that of the pin *q* in the pencil *e*, its head will always keep thereto as *m* goes round *e*, or as the ſame ſide of the moon is ſtill obverted to the earth. But the pin *p*, which may be conſidered as an equatorial diameter of the moon, will turn quite round the point *m*, making all poſſible angles with the line of its progreſs, or line of the moon's path. This is an occular proof of the moon's turning round her axis.

Sect. XIII. *A Deſcription of the principal aſtronomical Inſtruments by which Aſtronomers make their moſt accurate Obſervations.*

By practical aſtronomy is implied the knowledge of obſerving the celeſtial bodies with reſpect to their poſition and time of the year, and of deducing from thoſe obſervations certain concluſions uſeful in calculating the time when any propoſed poſition of theſe bodies ſhall happen. 495

For this purpoſe, it is neceſſary to have a room or place conveniently ſituated, ſuitably contrived, and furniſhed with proper aſtronomical inſtruments. It ſhould have an uninterrupted view from the zenith down to (or even below) the horizon, at leaſt towards its cardinal points: and for this purpoſe, that part of the roof which lies in the direction of the meridian in particular, ſhould have moveable covers, which may eaſily be moved and put on again; by which means an inſtrument may be directed to any point of the heavens between the horizon and the zenith, as well to the northward as ſouthward.

This place, called an Obſervatory, ſhould contain ſome, if not all, of the following inſtruments.

I. A Pendulum Clock, for ſhowing equal time. 496

This ſhould ſhow time in hours, minutes, and ſeconds; and with which the obſerver, by hearing the beats of the pendulum, may count them by his ear, while his eye is employed on the motion of the celeſtial object he is obſerving. Juſt before the object arrives at the poſition deſcribed, the obſerver ſhould look on the clock and remark the time, ſuppoſe it 9 hours 15 minutes 25 ſeconds; then ſaying, 25, 26, 27, 28, &c. reſponſive to the beat of the pendulum, till he ſees through the inſtrument the object arrived at the poſition expected; which ſuppoſe to happen when he ſays 38, he then writes down 9 h. 15 min. 38 ſec. for the time of obſervation, annexing the year and the day of the month. If two perſons are concerned in making the obſervation, one may read the time audibly while the other obſerves through the inſtrument, the obſerver repeating the laſt ſecond read when the deſired poſition happens.

II. An Achromatic Refracting Telescope, or a Reflecting one, of two feet at leaſt in length, for obſerving particular phenomena. Theſe inſtruments are particularly deſcribed under Optics.

III. A Micrometer, for meaſuring ſmall angular diſtances. See Micrometer.

IV. Astronomical Quadrants, both mural and portable, for obſerving meridian and other altitudes of the celeſtial bodies.

497 1. The *Mural Quadrant* is in the form of a quarter of a circle, contained under two radii at right angles to one another, and an arch equal to one-fourth part of the circumference of the circle. It is the moſt uſeful and valuable of all the aſtronomical inſtruments; and as it is ſometimes fixed to the ſide of a ſtone or brick wall, and the plane of it erected exactly in the plane of the meridian, it in this caſe receives the name of *mural quadrant or arch.*

Tycho Brache was the firſt perſon who contrived this mural arch, viz who firſt applied it to a wall; and Mr Flamſtead, the firſt in England who with indefatigable pains fixed one up in the royal obſervatory at Greenwich.

Theſe inſtruments have uſually been made from five to eight feet radius, and executed by thoſe late celebrated artiſts, Siſſon, Graham, Bird, and other eminent mathematical inſtrument makers now in London. The conſtruction of them being generally the ſame in all the ſizes, we ſhall here deſcribe one made by the late Jon. Siſſon, under the direction of the late M. Graham. Fig. 214. repreſents the inſtrument as already fixed to the wall. It is of copper, and of about 5 feet radius. The frame is formed of flat bars, and ſtrengthened by edge bars affixed underneath perpendicularly to them. The radii HB, HA, being divided each into four equal parts, ſerve to find out the points D and E, by which the quadrant is freely ſuſpended on its props or iron ſupports that are faſtened ſecurely in the wall.

One of the ſupports E is repreſented ſeparately in *e* on one ſide of the quadrant. It is moveable by means of a long ſlender rod EF or *e f*, which goes into a hollow ſcrew in order to reſtore the inſtrument to its ſituation when it is diſcovered to be a little deranged. This may be known by the very fine perpendicular thread HA, which ought always to coincide with the ſame point A of the limb, and carefully examined to be ſo by a ſmall magnifying teleſcope at every obſervation. In order to prevent the unſteadineſs of ſo great a machine, there ſhould be placed behind the limb four copper ears with double cocks I, K, I, K. There are others along the radii HA and HB. Each of theſe cocks contains two ſcrews, into which is faſtened the ears that are fixed behind the quadrant.

Over the wall or ſtone which ſupports the inſtrument, and at the ſame height as the centre is placed horizontally the axis PO, which is perpendicular to the plane of the inſtrument, and which would paſs through the centre if it was continued. This axis turns on two pivots P. On this axis is fixed at right angles another branch ON, loaded at its extremity with a weight N capable of equipoiſing with its weight that of the teleſcope LM; whilſt the axis, by its extremity neareſt the quadrant, carries the wooden frame PRM, which is faſtened to the teleſcope in M. The counterpoiſe takes off from the obſerver the weight of the teleſcope when he raiſes it, and hinders him from either forcing or ſtraining the inſtrument.

The lower extremity (V) of the teleſcope is furniſhed with two ſmall wheels, which take the limb of the quadrant on its two ſides. The teleſcope hardly bears any more upon the limb than the ſmall friction of theſe two wheels; which renders its motion ſo extremely eaſy and pleaſant, that by giving it with the hand only a ſmall motion, the teleſcope will run of itſelf over a great part of the limb, balanced by the counterpoiſe N.

When the teleſcope is to be ſtopped at a certain poſition, the copper hand T is to be made uſe of, which embraces the limb and ſprings at the bottom. It is fixed by ſetting a ſcrew, which faſtens it to the limb. Then, in turning the regulating ſcrew, the teleſcope will be advanced; which is continued until the ſtar or other object whoſe altitude is obſerving to be on the horizontal fine thread in the teleſcope. Then on the plate X ſupporting the teleſcope, and carrying a vernier or nonius, will be ſeen the number of degrees and minutes, and even quarter of minutes, that the angular height of the object obſerved is equal to. The remainder is eaſily eſtimated within two or three ſeconds nearly.

There are ſeveral methods of ſubdividing the diviſions of a mural quadrant, which are uſually from five to ten minutes each; but that which is moſt commonly adopted is by the vernier or nonius, the contrivance of Peter Vernier a Frenchman. This vernier conſiſts of a piece of copper or braſs, CDAB (fig. 215.), which is a ſmall portion of X (fig. 214.), repreſented ſeparately. The length CD is divided into 20 equal parts, and placed contiguouſly on a portion of the diviſion of the limb of the quadrant containing 21 diviſions, and thereby dividing this length into 20 equal parts. Thus the firſt diviſion of the vernier piece marked 15, beginning at the point D, is a little matter backward, or to the left of the firſt diviſion of the limb, equal to 15″. The ſecond diviſion of the vernier is to the left of the ſecond diviſion of the limb double of the firſt difference, or 30″; and ſo on unto the twentieth and laſt diviſion on the left of the vernier piece; where the 20 differences being accumulated each of the twentieth part of the diviſion of the limb, this laſt diviſion will be found to agree exactly with the 21ſt diviſion on the limb of the quadrant.

The index muſt be puſhed the 20th part of a diviſion, or $15''$, to the right; for to make the ſecond diviſion on the vernier coincide with one of the diviſions of the limb, in like manner is moving two-twentieths, or $30''$, we muſt look at the ſecond diviſion of the index, and there will be a coincidence with a diviſion of the limb. Thus may be conceived that the beginning D of the Vernier, which is always the line of reckoning, has advanced two diviſions, or $30''$, to the right, when the ſecond diviſion, marked 30 on the vernier, is ſeen to correſpond exactly with one of the lines of the quadrant.

By means of this vernier may be readily diſtinguiſhed the exactitude of $15''$ of the limb of a quadrant five feet radius, and ſimply divided into $5'$. By an eſtimation by the eye, afterwards the accuracy of two or three ſeconds may be eaſily judged. On the ſide of the quadrant is placed the plate of copper which carries the teleſcope. This plate carries two verniers. The outer line CD divides five minutes into 20 parts, or $15''$ each. The interior line AB anſwers to the parts of another diviſion not having 90°, but 96 parts of the quadrant. It is uſually adopted by Engliſh aſtronomers on account of the facility of its ſubdiviſions. Each of the 96 portions of the quadrant is equivalent to $56'\ 15''$ of the uſual diviſions. It is divided on the limb into 16 parts, and the arch of the vernier AB contains 25 of theſe diviſions; and being divided itſelf into 24, immediately gives parts, the value of each of which is $8''\ 47\frac{1}{3}'''$. From this mode a table of reduction may eaſily be conſtructed, which will ſerve to find the value of this ſecond mode of dividing in degrees, minutes, and ſeconds, reckoning in the uſual manner, and to have even the advantage of two different modes; which makes an excellent verification of the diviſions on the limb of the quadrant and obſerved heights by the vernier.

498 2. *The Portable Aſtronomical Quadrant*, is that inſtrument of all others which aſtronomers make the greateſt uſe of, and have the moſt eſteem for. They are generally made from 12 to 23 inches. Fig. 219. is a repreſentation of the improved modern one as made by the late Mr Siſſon and by the preſent mathematical inſtrument makers. This is capable of being carried to any part of the world, and put up for obſervation in an eaſy and accurate manner. It is made of braſs, and ſtrongly framed together by croſſed perpendicular bars. The arch AC, and the teleſcope EF, are divided and conſtructed in a ſimilar manner to the mural quadrant, but generally without the diviſion of 96 parts. The counterpoiſe to the teleſcope T is repreſented at P, and alſo another counterpoiſe to the quadrant itſelf at P. The quadrant is fixed to a long axis, which goes into the pillar KR. Upon this axis is fixed an index, which points to, and ſubdivides by a vernier the diviſions of the azimuth circle K. This azimuth circle is extremely uſeful for taking the azimuth of a celeſtial body at the ſame time its altitude is obſerved. The upper end of the axis is firmly connected with the adjuſting frame GH; and the pillar is ſupported on the croſſed feet at the bottom of the pillar KR with the adjuſting ſcrews *a*, *b*, *c*, *d*.

When this inſtrument is ſet up for uſe or obſervation, it is neceſſary that two adjuſtments be very accurately made: One, that the plane or ſurface of the inſtrument be truly perpendicular to the horizon; the other that the line ſuppoſed to be drawn from the centre to the firſt line of the limb, be truly on a level or parallel with the horizon. The firſt of theſe particulars is done by means of the thread and plummet *p*; the thread of which is uſually of very fine ſilver wire, and it is placed oppoſite to a mark made upon the end of the limb of the inſtrument. The four ſcrews at the foot, *a*, *b*, *c*, *d*, are to be turned until a perfect coincidence is obſerved of the thread upon the mark, which is accurately obſerved by means of a ſmall teleſcope T, that fits on the limb. The other adjuſtment is effected by means of the ſpirit-level L, which applies on the frame GH, and the ſmall ſcrews turned as before until the bubble of air in the level ſettles in the middle of the tube. The dotted tube EB is a kind of prover to the inſtrument; for by obſerving at what mark the centre of it appears againſt, or by putting up a mark againſt it, it will at any time diſcover if the inſtrument has been diſplaced. The ſcrew S at the index, is the regulating or adjuſting ſcrew, to move the teleſcope and index, during the obſervation, with the utmoſt nicety.

V. ASTRONOMICAL *or* EQUATORIAL SECTOR. 499
This is an inſtrument for finding the difference in right aſcenſion and declination between two objects, the diſtance of which is too great to be obſerved by the micrometer. It was the invention of the late ingenious Mr George Graham, F. R. S. and is conſtructed from the following particulars. Let AB (fig. 32.) repreſent an arch of a circle containing 10 or 12 degrees well divided, having a ſtrong plate CD for its radius, fixed to the middle of the arch at D: let this radius be applied to the ſide of an axis H F I, and be moveable about a joint fixed to it at F, ſo that the plane of the ſector may be always parallel to the axis HI; which being parallel to the axis of the earth, the plane of the ſector will always be parallel to the plane of ſome hour-circle. Let a teleſcope CE be moveable about the centre C of the arch AB, from one end of it to the other, by turning a ſcrew at G; and let the line of ſight be parallel to the plane of the ſector. Now, by turning the whole inſtrument about the axis HI, till the plane of it be ſucceſſively directed, firſt to one of the ſtars and then to another, it is eaſy to move the ſector about the joint F, into ſuch a poſition, that the arch AB, when fixed, ſhall take in both the ſtars in their paſſage, by the plane of it, provided the difference of the declinations does not exceed the arch AB. Then, having fixed the plane of the ſector a little to the weſtward of both the ſtars, move the teleſcope CE by the ſcrew G; and obſerve by a clock the time of each tranſit over the croſs hairs, and alſo the degrees and minutes upon the arch AB, cut by the index at each tranſit; then in the difference of the arches the difference of the declinations, and by the difference of the times, we have the difference of the right aſcenſions of the ſtars.

The dimenſions of this inſtrument are theſe: The length of the teleſcope, or the radius of the ſector, is $2\frac{1}{2}$ feet; the breadth of the radius, near the end C, is $1\frac{1}{2}$ inch; and at the end D two inches. The breadth of the limb AB is $1\frac{1}{2}$ inch; and its length

ſix

Fig. 213.
Mechanical Paradox.

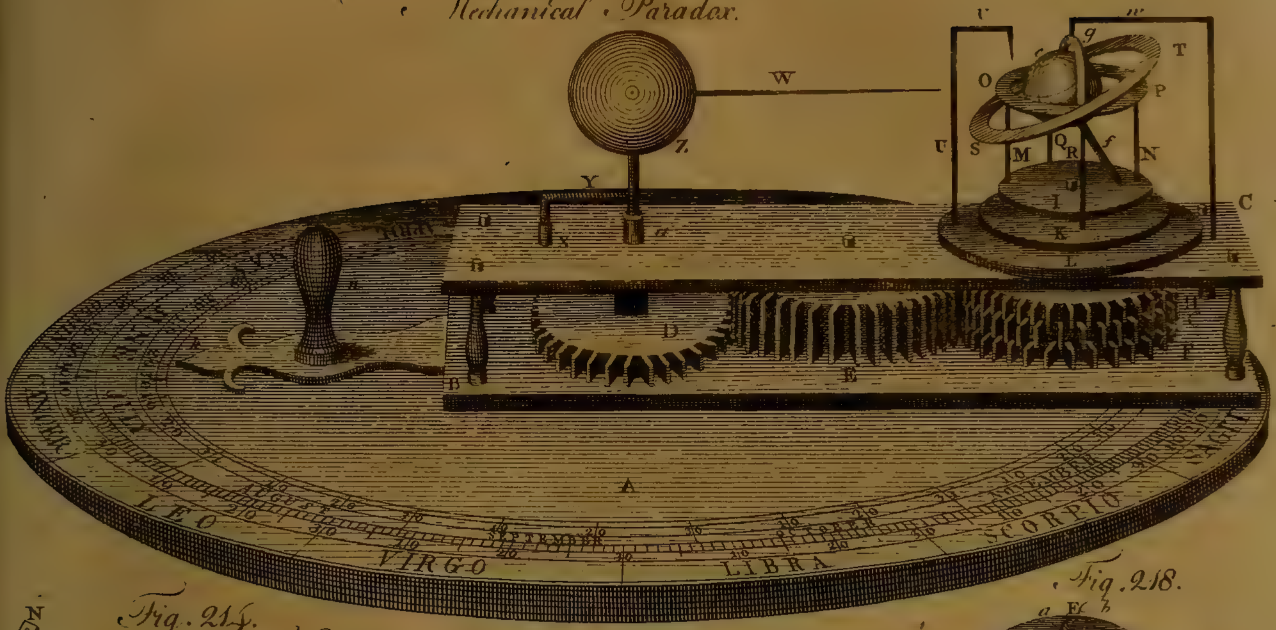


Fig. 218.

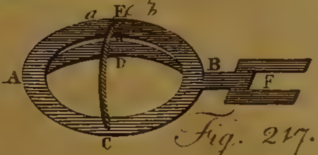


Fig. 214.
Mural Quadrant.

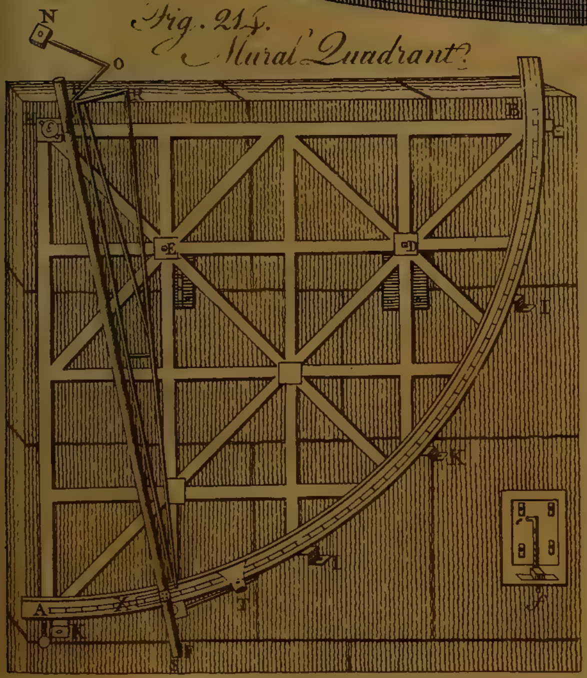


Fig. 216.
Cometarium.

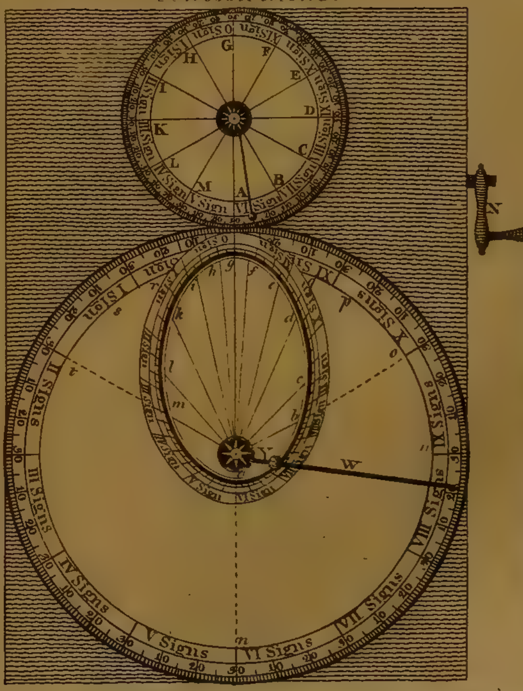


Fig. 217.

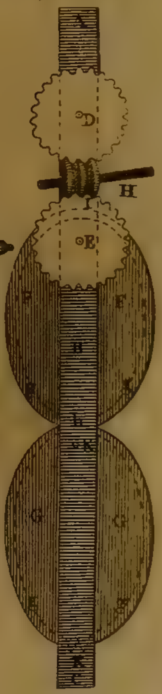
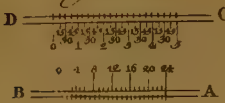


Fig. 215.



Thackara & Vallance sculp.

ſix inches, containing ten degrees divided into quarters and numbered from either end to the other. The teleſcope carries a nonius or ſubdividing plate, whoſe length, being equal to ſixteen quarters of a degree, is divided into fifteen equal parts; which, in effect, divides the limb into minutes, and, by eſtimation, into ſmaller parts. The length of the ſquare axis HIF is eighteen inches, and of the part HI twelve inches; and its thickneſs is about a quarter of an inch: the diameters of the circles are each five inches: the thickneſs of the plates, and the other meaſures, may be taken at the direction of a workman.

This inſtrument may be rectified, for making obſervations, in this manner: By placing the interſection of the croſs hairs at the ſame diſtance from the plane of the ſector, as the centre of the object-glaſs, the plane deſcribed by the line of ſight during the circular motion of the teleſcope upon the limb, will be ſufficiently true, or free from conical curvity; which may be examined by ſuſpending a long plumb-line at a convenient diſtance from the inſtrument; and by fixing the plane of the ſector in a vertical poſition, and then by obſerving, while the teleſcope is moved by the ſcrew along the limb, whether the croſs hairs appear to move along the plumb-line.

The axis *hfo* may be elevated nearly parallel to the axis of the earth, by means of a ſmall common quadrant; and its error may be corrected, by making the line of ſight follow the circular motion of any of the circumpolar ſtars, while the whole inſtrument is moved about its axis *hfo*, the teleſcope being fixed to the limb: for this purpoſe, let the teleſcope *kl* be directed to the ſtar *a*, when it paſſes over the higheſt point of its diurnal circle, and let the diviſion cut by the nonius be then noted; then, after twelve hours, when the ſtar comes to the loweſt point of its circle, having turned the inſtrument half round its axis, to bring the teleſcope into the poſition *mn*; if the croſs hairs cover the ſame ſtar ſuppoſed at *b*, the elevation of the axis *hfo* is exactly right; but if it be neceſſary to move the teleſcope into the poſition *uv*, in order to point to this ſtar at *c*, the arch *mu*, which meaſures the angle *mfu*, or *bfc*, will be known; and then the axis *hfo* muſt be depreſſed half the quantity of this given angle if the ſtar paſſed below *b*, or muſt be raiſed ſo much higher if above it; and then the trial muſt be repeated till the true elevation of the axis be obtained. By making the like obſervations upon the ſame ſtar on each ſide the pole, in the ſix-o'clock-hour-circle, the error of the axis, toward the eaſt or weſt may alſo be found and corrected, till the croſs hairs follow the ſtar quite-round the pole: for ſuppoſing *aopbc* to be an arch of the meridian (or in the ſecond practice of the ſix-o'clock-hour-circle), make the angle *afp* equal to half the angle *afc*, and the line *fp* will point to the pole; and the angle *ofp*, which is the error of the axis, will be equal to half the angle *bfc* or *mfu*, found by the obſervation; becauſe the difference of the two angles *afb*, *afc*, is double the difference of their halves *afo* and *afp*. Unleſs the ſtar be very near the pole, allowance muſt be made by refractions.

VI. Transit and Equal Altitude Inſtruments.

500 1. *The Tranſit Inſtrument* is uſed for obſerving objects as they paſs over the meridian. It conſiſts of a teleſcope fixed at right angles to an horizontal axis; which axis muſt be ſupported that what is called the line of collimation, or line of ſight of the teleſcope, may move in the plane of the meridian. This inſtrument was firſt made by the celebrated Mr Romeur in the year 1689, and has ſince received great improvements. It is made of various ſizes, and of large dimenſions in our great obſervatories; but the following is one of a ſize ſufficiently large and accurate for all the uſeful purpoſes.

The axis AB (fig. 220.), to which the middle of the teleſcope is fixed, is about 2¼ feet long, tapering gradually towards its ends, which terminate in cylinders well turned and ſmoothed. The teleſcope CD which is about four feet long and 1¼ inch diameter, is connected with the axis by means of a ſtrong cube or die G, and in which the two cones MQ, forming the axis are fixed. This cube or ſtock G ſerves as the principal part of the whole machine. It not only keeps together the two cones, but holds the two ſockets KH, of 15 inches length, for the two teleſcopic tubes. Each of theſe ſockets has a ſquare baſe, and is fixed to the cube by four ſcrews. Theſe ſockets are cut down in the ſides about eight inches, to admit more eaſily the tube of the teleſcope; but when the tube is inſerted, it is kept in firm by ſcrewing up the tightening ſcrews at the end of the ſockets at K and H. Theſe two ſockets are very uſeful in keeping the teleſcope in its greateſt poſſible degree of ſteadineſs. They alſo afford a better opportunity of balancing the teleſcope and rectifying its vertical thread, than by any other means.

In order to direct the teleſcope to the given height that a ſtar would be obſerved at, there is fixed a ſemicircle AN on one of the ſupporters, of about 8½ inches diameter, and divided into degrees. The index is fixed on the axis, at the end of which is a vernier, which ſubdivides the degrees into 12 parts or five minutes. This index is moveable on the axis, and may be cloſely applied to the diviſions by means of a tightening ſcrew.

Two upright poſts of wood or ſtone YY, firmly fixed at a proper diſtance, are to ſuſtain the ſupporters of this inſtrument. Theſe ſupporters are two thick braſs plates RR, having well ſmoothed angular notches in their upper ends, to receive the cylindrical arms of the axis. Each of theſe notched plates is contrived to be moveable by a ſcrew which ſlides them upon the ſurfaces of two other plates immoveably fixed upon the two upright pillars; one plate moving in an horizontal, and the other in a vertical, direction; or, which is more ſimple, theſe two modes are ſometimes applied only on one ſide, as at V and P, the horizontal motion by the ſcrew P, and the vertical by the ſcrew V. Theſe two motions ſerve to adjuſt the teleſcope to the planes of the horizon and meridian: to the plane of the horizon by the ſpirit-level EF, hung by DC on the axis MQ, in a parallel direction; and to the plane of the meridian in the following manner:

Obſerve by the clock when a circumpolar ſtar ſeen through this inſtrument tranſits both above and below the pole; and if the times of deſcribing the eaſtern and weſtern parts of its circuit are equal, the teleſcope is then in the plane of the meridian: otherwiſe the ſcrew P muſt be gently turned that it may move the teleſcope

ſcope ſo much that the time of the ſtar's revolution be biſected by both the upper and lower tranſits, taking care at the ſame time that the axis remains perfectly horizontal. When the teleſcope is thus adjuſted, a mark muſt be ſet at a conſiderable diſtance (the greater the better) in the horizontal direction of the interſection of the croſs wires, and in a place where it can be illuminated in the night-time by a lanthorn hanging near it; which mark being on a fixed object, will ſerve at all times afterwards to examine the poſition of the teleſcope by, the axis of the inſtrument being firſt adjuſted by means of the level.

501 *To adjuſt the Clock by the Sun's Tranſit over the Meridian.* Note the times by the clock when the preceding and following edges of the ſun's limb touch the croſs-wires. The difference between the middle time and 12 hours, ſhows how much the mean, or time by the clock, is faſter or ſlower than the apparent, or ſolar time, for that day; to which the equation of time being applied, will ſhow the time of mean noon for that day, by which the clock may be adjuſted.

502 2. *The Equal Altitude Inſtrument* is an inſtrument that is uſed to obſerve a celeſtial object when it has the ſame altitude on both the eaſt and weſt ſides of the meridian, or in the morning and afternoon. It principally conſiſts of a teleſcope about 30 inches long fixed to a ſextantal or ſemicircular divided arch; the centre of which is fixed to a long vertical axis; but the particulars of the inſtrument the reader will ſee explained in OPTICS, Part III.

503 3. *Compound Tranſit Inſtrument.* Some inſtruments have been contrived to anſwer both kinds of obſervations, viz. either a tranſit or equal altitudes. Fig. 222 repreſents ſuch an inſtrument, made firſt of all for Mr Le Monnier the French aſtronomer, by the late Mr Siſſon, under the direction of Mr Opaham, mounted and fixed up ready for obſervation.

AB is a teleſcope, which may be 3, 4, 5, or 6 feet long, whoſe cylindrical tube fits exactly into another hollow cylinder *a b*, perpendicular to the axis: theſe ſeveral pieces are of the beſt hammered plate braſs. The cylindrical extremity of this axis NN are of ſolid bell-metal, and wrought exquiſitely true, and exactly of the ſame ſize in a lathe; and it is on the perfection to which the cylinders or trunnions are turned that the juſtneſs of the inſtrument depends. In the common focus of the object-glaſs and eye-glaſs is placed a reticle (fig. 223.) conſiſting of three horizontal and parallel fine-ſtretched ſilver wires, fixed by pins or ſcrews to a braſs circle, the middle one paſſing through its centre, with a fourth vertical wire likewiſe paſſing through the centre, exactly perpendicular to the former three.

The horizontal axis MN (fig. 222.) is placed on a ſtrong braſs frame, into the middle of which a ſteel cylinder GH is fixed perpendicularly, being turned truly round, and terminating in a conical point at its lower extremity; where it is let into a ſmall hole drilled in the middle of the dove-tail ſlider; which ſlider is ſupported by a hollow cube fixed to the ſupporting piece IK, conſiſting of two ſtrong plates of braſs, joined together at right angles, to which are fixed two iron cramps LL, by which it is faſtened to the ſtone-wall of a ſouth window.

The upper part G of the ſteel ſpindle is embraced by a collar *d e f*, being in contact with the blunt extremity of three ſcrews, whoſe particular uſe will be explained by and by. O is another cylindrical collar cloſely embracing the ſteel ſpindle at about a third part of its length from the top; by the means of a ſmall ſcrew it may be looſened or pinched cloſe as occaſion requires. From the bottom of this collar proceeds an arm or lever acted upon by the two ſcrews *g h*, whereby the whole inſtrument, excepting the ſupporting piece, may be moved laterally, ſo that the teleſcope may be made to point at a diſtant mark fixed in the vertical of the meridian. *i k* is a graduated ſemicircle of thin braſs ſcrewed to the teleſcope, whereby it may be elevated ſo as to point to a known celeſtial object in the day-time. *l m* is a ſpirit-level parallel to the axis of rotation on the teleſcope, on which two trunnions hang by two hooks at M and N. Along the upper ſide of the glaſs tube of the level ſlides a pointer to be ſet to the end of the air-bubble; and when the poſition of the axis of rotation is ſo adjuſted by the ſcrews that the air-bubble keeps to the pointer for a whole revolution of the inſtrument, the ſpindle GH is certainly perpendicular to the horizon, and then the line of collimation of the teleſcope deſcribes a circle of equal altitude in the heavens. When the level is ſuſpended on the axis, raiſe or depreſs the tube of the level by twiſting the neb of the ſcrew *n* till you bring either end of the air-bubble to reſt at any point towards the middle of the tube, to which ſlide the index; then lift off the level, and, turning the ends of it contrary ways, hang it again on the trunnions; and if the air-bubble reſts exactly again the index as before, the axis of rotation is truly horizontal: If not, depreſs that end of the axis which lies on the ſame ſide of the pointer as the bubble does, by turning the neb of the ſcrew at N, till the bubble returns about halfway towards the pointer; then having moved the pointer to the place where it now reſts, invert the ends of the level again, and repeat the ſame practice till the bubble reſts exactly at the pointer in both poſitions of the level. If, after the teleſcope is turned upſide down, that is, after the trunnions are inverted end for end, you perceive that the ſame point of a remote fixed object is covered by the vertical wire in the focus of the teleſcope that was covered by it before the inverſion, it is certain that the line of ſight or collimation is perpendicular to the tranſverſe axis; but if the ſaid vertical wire covers any other point, the braſs circle that carries the hairs muſt be moved by a ſcrew-key introduced through the perforation in the ſide of the tube at X, till it appears to biſect the line joining theſe two points, as near as you can judge; then, by reverting the axis to its former poſition, you will find whether the wires be exactly adjuſted. *N. B.* The ball *o* is a counterpoiſe to the centre of gravity of the ſemicircle *i k*, without which the teleſcope would not reſt in an oblique elevation without being fixed by a ſcrew or ſome other contrivance.

The ſeveral beforementioned verifications being accompliſhed, if the teleſcope be elevated to any angle with the horizon and there ſtopped, all fixed ſtars which paſs over the three horizontal wires of the reticle on the eaſtern ſide of the meridian in aſcending, will have preciſely the ſame altitudes when in deſcending they again croſs the ſame reſpective wires on the weſt ſide, and the middle between the times of each reſpective equal altitude will be the exact moment of the ſtar's culminating or paſſing the meridian. By the help of a good pendulum-clock, the hour of their true meridional tranſits will be known, and conſequently the difference of right aſcenſion of different ſtars. Now, ſince it will be ſufficient to obſerve a ſtar which has north declination two or three hours before and after its paſſing the meridian, in order to deduce the time of its arrival at that circle; it follows, that having once found the difference of right aſcenſion of two ſtars about 60 degrees aſunder, and you again obſerve the firſt of theſe ſtand at the ſame altitude both in the eaſt and weſt ſide, you infer with certainty the moment by the clock at which the ſecond ſtar will be on the meridian that ſame night, and by this means the tranſit-inſtrument may be fixed in the true plane of the meridian till the next day; when, by depreſſing it to ſome diſtant land objects, a mark may be diſcovered whereby it may ever after be rectified very readily, ſo as to take the tranſits of any of the heavenly bodies to great exactneſs, whether by night or day.

When ſuch a mark is thus found, the teleſcope being directed carefully to it, muſt be fixed in that poſition by pinching faſt the end of the arm or lever between the two oppoſite ſcrews *g h*; and if at any future time, whether from the effect of heat or cold on the wall to which the inſtrument is fixed, or by any ſettling of the wall itſelf, the mark appears no longer well biſected by the vertical wire, the teleſcope may eaſily be made to biſect it again, by giving a ſmall motion to the pinching ſcrews.

The tranſit-inſtrument is now conſidered as one of the moſt eſſential particulars of the apparatus of an aſtronomical obſervatory.

Beſides the above may be mentioned,

The EQUATORIAL *or* PORTABLE OBSERVATORY; 504
an inſtrument deſigned to anſwer a number of uſeful purpoſes in practical aſtronomy, independent of any particular obſervatory. It may be made uſe of in any ſteady room or place, and performs moſt of the uſeful problems in the ſcience. The following is a deſcription of one lately invented by Mr Ramſden, from whom it has received the name of the *Univerſal Equatorial.*

The principal parts of this inſtrument (fig. 221.) are, 1. The azimuth or horizontal circle A, which repreſents the horizon of the place, and moves on a long axis B, called the *vertical axis.* 2. The equatorial or hour-circle C, repreſenting the equator, placed at right angles to the polar axis D, or the axis of the earth, upon which it moves. 3. The ſemicircle of declination E, on which the teleſcope is placed, and moving on the axis of declination, or the axis of motion of the line of collimation F. Theſe circles are meaſured and divided as in the following table:

Meaſures of the ſeveral circles and diviſions on them.	Radius In. dec.	Limb divided to	Nonius of 30 gives ſeconds	Divided on limb into parts of inc.	Divided by Nonius into parts of inch.
Azimuth or horizontal circle	5 1	15′	30″	45th	1350th
Equatorial or hour circle	5 1	15′ 1′ in time	30″ 2″	45th	1350th
Vertical ſemicircle for declination or latitude	5 5	15′	30″	42d	1260th

4. The teleſcope, which is an achromatic refractor with a triple object-glaſs, whoſe focal diſtance is 17 inches, and aperture 2.45 inches, and furniſhed with ſix different eye-tubes; ſo that its magnifying powers extend from 44 to 168. The teleſcope in this equatorial may be brought parallel to the polar axis, as in the figure, ſo as to point to the pole-ſtar in any part of its diurnal revolution; and thus it has been obſerved near noon, when the ſun has ſhone very bright. 5. The apparatus for correcting the error in altitude occaſioned by refraction, which is applied to the eye-end of the teleſcope, and conſiſts of a ſlide G moving in a groove or dove-tail, and carrying the ſeveral eye-tubes of the teleſcope, on which ſlide there is an index correſponding to five ſmall diviſions engraved on the dove-tail; a very ſmall circle, called the refraction circle H, moveable by a finger-ſcrew at the extremity of the eye-end of the teleſcope; which circle is divided into half-minutes, one entire revolution of it being equal to 3′ 18″, and by its motion raiſes the centre of the croſs-hairs on a circle of altitude; and likewiſe a quadrant I of $1\frac{1}{4}$ inch radius, with diviſions on each ſide, one expreſſing the degree of altitude of the object viewed, and the other expreſſing the minutes and ſeconds of error occaſioned by refraction, correſponding to that degree of altitude: to this quadrant is joined a ſmall round level K, which is adjuſted partly by the pinion that turns the whole of this apparatus, and partly by the index of the quadrant: for which purpoſe the refraction circle is ſet to the ſame minute, &c. which the index points to on the limb of the quadrant; and if the minute, &c. given by the quadrant exceed the 3′ 18″ contained in one entire revolution of the refraction circle, this muſt be ſet to the exceſs above one or more of its entire revolutions; then the centre of the croſs-hairs will apppear to be raiſed on a circle of altitude to the additional height which the error of refraction will occaſion at that altitude.

This inſtrument ſtands on three feet L diſtant from each other 14,4 inches; and when all the parts are horizontal is about 29 inches high: the weight of the equatorial and apparatus is only 59 lb. avoirdupoiſe, which are contained in a mahogany caſe weighing 58 lb.

The principal adjuſtment in this inſtrument is that of making the line of collimation to deſcribe a portion of an hour-circle in the heavens; in order to which, the azimuth circle muſt be truly level, the line of collimation or ſome correſponding line repreſented by the ſmall braſs rod M parallel to it, muſt be perpendicular to the axis of its own proper motion ; and this laſt axis muſt be perpendicular to the polar axis : on the braſs rod M there is occaſionally placed a hanging level N, the uſe of which will appear in the following adjuſtments :

The azimuth circle may be made level by turning the inſtrument till one of the levels is parallel to an imaginary line joining two of the feet ſcrews ; then adjuſt that level with theſe two feet ſcrews ; turn the circle half round, *i. e.* 180° ; and if the bubble be not then right, correct half the error by the ſcrew belonging to the level, and the other half error by the two foot ſcrews ; repeat this till the bubble comes right ; then turn the circle 90° from the two former poſitions, and ſet the bubble right, if it be wrong, by the foot ſcrew at the end of the level ; when this is done, adjuſt the other level by its own ſcrew, and the azimuth circle will be truly level. The hanging level muſt then be fixed to the braſs rod by two hooks of equal length, and made truly parallel to it : for this purpoſe make the polar axis perpendicular or nearly perpendicular to the horizon ; then adjuſt the level by the pinion of the declination-ſemicircle ; reverſe the level, and if it be wrong, correct half the error by a ſmall ſteel ſcrew that lies under one end of the level, and the other half error by the pinion of the declination-ſemicircle ; repeat this till the bubble be right in both poſitions. In order to make the braſs rod on which the level is ſuſpended at right angles to the axis of motion of the teleſcope or line of collimation, make the polar axis horizontal, or nearly ſo : ſet the declination-ſemicircle to 0°, turn the hour-circle till the bubble comes right ; then turn the declination-circle to 90° ; adjuſt the bubble by raiſing or depreſſing the polar axis (firſt by hand till it be nearly right, afterwards tighten with an ivory key the ſocket which runs on the arch with the polar axis, and then apply the ſame ivory key to the adjuſting ſcrew at the end of the ſaid arch till the bubble comes quite right) ; then turn the declination-circle to the oppoſite 90 ; if the level be not then right, correct half the error by the aforeſaid adjuſting ſcrew at the end of the arch, and the other half error by the two ſcrews which raiſe or depreſs the end of the braſs rod. The polar axis remaining nearly horizontal as before, and the declination-ſemicircle at 0°, adjuſt the bubble by the hour-circle ; then turn the declination-ſemicircle to 90°, and adjuſt the bubble by raiſing or depreſſing the polar axis ; then turn the hour-circle 12 hours ; and if the bubble be wrong, correct half the error by the polar axis, and the other half error by the two pair of capſtan ſcrews at the feet of the two ſupports on one ſide of the axis of motion of the teleſcope ; and thus this axis will be at right angles to the polar axis. The next adjuſtment is to make the centre of croſs-hairs remain on the ſame object, while you turn the eye-tube quite round by the pinion of the refraction apparatus : for this adjuſtment, ſet the index on the ſlide to the firſt diviſion on the dove-tail ; and ſet the diviſion marked 18″ on the refraction-circle to its index ; then look through the teleſcope, and with the pinion turn the eye-tube quite round ; and if the centre of the hairs does not remain on the ſame ſpot during that revolution, it muſt be corrected by the four ſmall ſcrews, two and two at a time (which you will find upon unſcrewing the neareſt end of the eye-tube that contains the firſt eye-glaſs) ; repeat this correction till the centre of the hairs remains on the ſpot you are looking at during an entire revolution. In order to make the line of collimation parallel to the braſs rod on which the level hangs, ſet the polar axis horizontal, and the declination-circle to 90°, adjuſt the level by the polar axis ; look through the teleſcope on ſome diſtant horizontal object, covered by the centre of the croſs hairs ; then invert the teleſcope, which is done by turning the hour-circle half round ; and if the centre of the croſs hairs does not cover the ſame object as before, correct half the error by the uppermoſt and lowermoſt of the four ſmall ſcrews at the eye-end of the large tube of the teleſcope ; this correction will give a ſecond object now covered by the centre of the hairs, which muſt be adopted inſtead of the firſt object : then invert the teleſcope as before ; and if the ſecond object be not covered by the centre of the hairs, correct half the error by the ſame two ſcrews which were uſed before : this correction will give a third object, now covered by the centre of the hairs, which muſt be adopted inſtead of the ſecond object ; repeat this operation till no error remains ; then ſet the hour-circle exactly to 12 hours (the declination-circle remaining at 90° as before) ; and if the centre of the croſs hairs does not cover the laſt object fixed on, ſet it to that object by the two remaining ſmall ſcrews at the eye-end of the large tube, and then the line of collimation will be parallel to the braſs rod. For rectifying the nonius of the declination and equatorial circles, lower the teleſcope as many degrees, minutes, and ſeconds, below 0° or Æ on the declination-ſemicircle as are equal to the complement of the latitude ; then elevate the polar axis till the bubble be horizontal, and thus the equatorial circle will be elevated to the co-latitude of the place ; ſet this circle to 6 hours ; adjuſt the level by the pinion of the declination-circle ; then turn the equatorial circle exactly 12 hours from the laſt poſition ; and if the level be not right, correct one half of the error by the equatorial circle, and the other half by the declination-circle ; then turn the equatorial circle back again exactly 12 hours from the laſt poſition ; and if the level be ſtill wrong, repeat the correction as before till it be right, when turned to either poſition ; that being done, ſet the nonius of the equatorial circle exactly to 6 hours, and the nonius of the declination-circle exactly to 0°.

The principal uſes of this equatorial are,

1. To find your meridian by one obſervation only : for this purpoſe, elevate the equatorial circle to the co-latitude of the place, and ſet the declination-ſemicircle to the ſun's declination for the day and hour of the day required ; then move the azimuth and hour-circles both at the ſame time, either in the ſame or contrary direction, till you bring the centre of the croſs hairs in the teleſcope exactly to cover the centre of the ſun ; when that is done, the index of the hour-circle will give the apparent or ſolar time at the inſtant of obſervation ; and thus the time is gained, though the ſun be at a diſtance from the meridian ; then turn the hour-circle till the index points preciſely at 12 o'clock, and lower the teleſcope to the horizon, in order to obſerve ſome point there-

ASTRONOMY.

Plate XC.

Fig. 219.

Portable ASTRONOMICAL Quadrant.

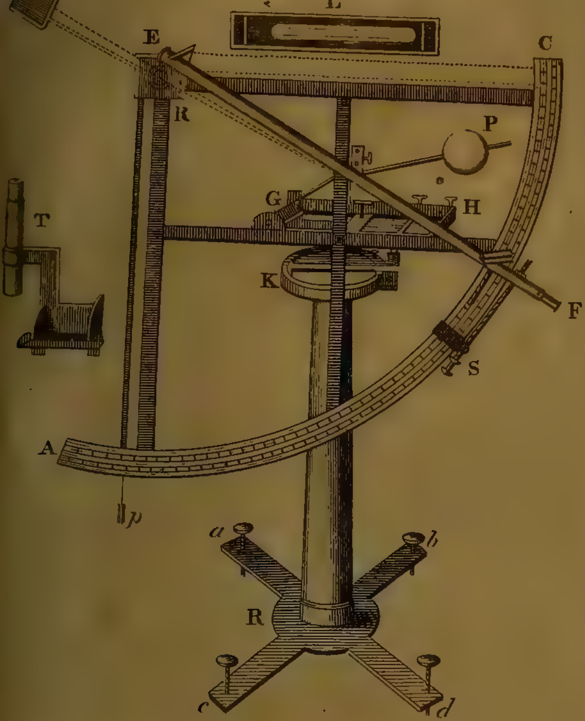


Fig. 220.

Tranſit Inſtrument

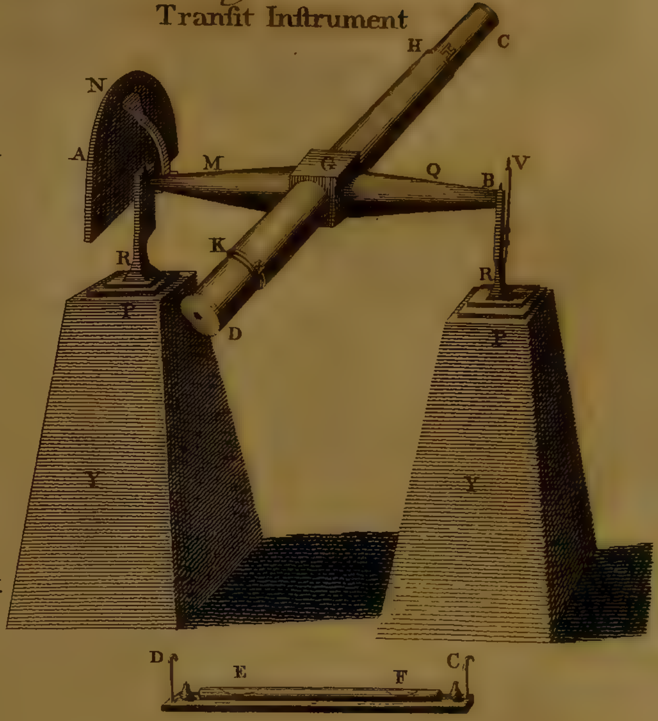


Fig. 221.

Univerſal Equatorial.

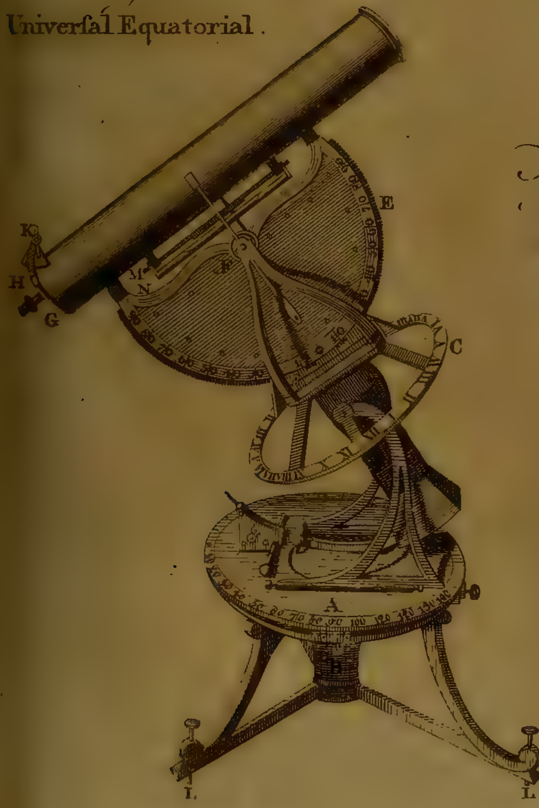
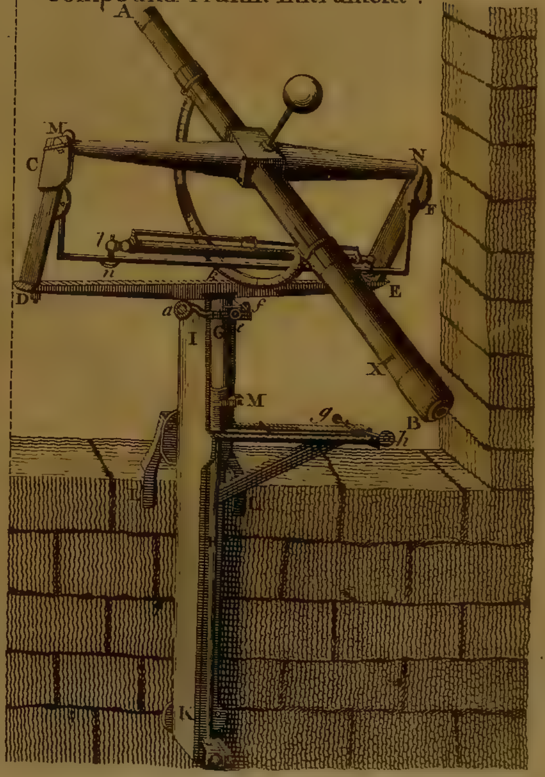


Fig. 223.

Fig. 222.

Compound Tranſit Inſtrument.



Thackara & Vallance sculp.

in the centre of your glaſs, and that point is your meridian mark found by one obſervation only; the beſt time for this operation is three hours before or three hours after 12 at noon.

2. To point the teleſcope on a ſtar, though not on the meridian, in full day-light. Having elevated the equatorial circle to the co-latitude of the place, and ſet the declination-ſemicircle to the ſtar's declination, move the index of the hour-circle till it ſhall point to the preciſe time at which the ſtar is then diſtant from the meridian, found in tables of the right aſcenſion of the ſtars, and the ſtar will then appear in the glaſs. Beſides theſe uſes peculiar to this inſtrument, it is alſo applicable to all the purpoſes to which the principal aſtronomical inſtruments, viz. a tranſit, a quadrant, and an equal-altitude inſtrument, are applied.

INDEX.

A.

Aberration of light, diſcovered by Dr Bradley, nº 32. Furniſhes an argument for the earth's motion, 337. Reaſon of the light's aberration particularly explained, ib.
Academy Royal at Paris founded by Merſennus, 30.
Albategnius, a celebrated Arabian aſtronomer reforms the ſcience, 17.
Alexander the Great obtains the aſtronomical obſervations of the Chaldeans, 6.
Alexandria: a famous aſtronomical ſchool ſet up there by Ptolemy Philadelphus, 12.
Algol, or Meduſa's head, a variable ſtar, changes its luſtre in four hours, 49.
Al Hazen an Arabian, ſhows the nature of refraction, &c. 17.
Almageſt of Ptolemy, an aſtronomical treatiſe on the means of reviving the ſcience in Europe, 18.
Alphonſo king of Caſtile cauſes aſtronomical tables to be conſtructed, 18.
Altitudes of the celeſtial bodies, how taken, 379.
Anaxagoras foretels an eclipſe, 10. His opinion concerning the ſun, 121.
Anaximander introduces the gnomon into Greece, &c. 10.
Anaximenes improves the aſtronomy of the Greeks, 10. Abſurd opinions of him and Anaximander concerning the ſun, 121.
Angles: errors unavoidable in the menſuration of ſmall ones, 339.
Antecedence, motion in explained, 292.
Antediluvians ſuppoſed to have made conſiderable progreſs in aſtronomy, 1.
Anticipation of the equinoxes explained, 349.
Aphelion of the planets defined, 254. Place of the aphelia of the different planets, 255. Motion of the aphelion accounted for, 268.
Apogeon of the moon defined, 291. Its motion determined, 294. Inequalities in its motion, 295. Occaſion an inequality in the moon's motion, 296. Apogeon of the planets explained, 325.
Apian, one of the ſucceſſors of Copernicus, his improvements in aſtronomy, 22.
Arabians cultivate the ſcience of aſtronomy when it was neglected in the weſt, 17.
Archimedes makes great diſcoveries in aſtronomy, 13.
Ariſtarchus determines the diſtance of the ſun by the moon's dichotomy, 12. This method particularly explained, 389. Its inſufficiency ſhown, 390.
Ariſtotle embraces the ſyſtem of aſtronomy afterwards called the *Ptolemaic*, 11. His opinion concerning comets, 164.
Aryſtillus and Timocharis firſt cultivate the aſtronomical ſcience in the ſchool of Alexandria, 12.
Aſcenſion, right, of the ſun and ſtars, how to find it, 411, 412.
Aſpects of the planets explained, 321.
Aſtral zodiac explained, 381.
Aſtronomical knowledge of the Antediluvians, 1. Of the Chineſe, 2. Of the Indians, 4. Of the Mexicans, 5. Of the Chaldeans and Egyptians, 6. Of the Phœnicians, 7. Of the Greeks, 8. Of the Arabians, 17. Revival of it in Europe, 18.
Aſtronomical inſtruments, deſcription of thoſe now in uſe, 495.
Aſtronomical ſector delineated, 499.
Aſtronomical problems, a method invented by Apian of reſolving them by inſtruments without tables or calculations, 22.
Aſtronomical quadrant invented by Nonius, 22. Divided by concentric circles and diagonals, ib. Method of dividing it ſhown by Apian, ib.
Atlas, a celeſtial one compoſed by Bayer, 26.
Atmoſphere: Whether the planet Venus has one ſurrounding her, 78. Mr Herſchel's account of the atmoſphere of Mars, 90. Atmoſpheres of comets very large, 111. Whether the ſun has an atmoſphere, 123. Whether the moon has any, 147.
Attraction: Conſequences of its action among the moſt diſtant ſtars, 215. Prevents them from remaining abſolutely at reſt, 234. Is diffuſed throughout the ſubſtance of all matter, 202. Acts equally through the whole univerſe, 305. Is an univerſal property of matter, 308. Solution of a difficulty concerning it derived from the moon's motion, 361.
Auzout applies a micrometer to teleſcopes, 31.

B.

Babylon: Aſtronomical obſervations made there for 1903 years, 6.
Barometer: Why it is not affected by the moon, 369.
Bayer, John, his celeſtial atlas and nomenclature of the ſtars, 26.
Bear, Greater, Chineſe delineation of that conſtellation, 3. Unfit for making obſervations at ſea, on account of its diſtance from the pole, 7.
Beam; The tail of a comet ſo called when it appears without the head being viſible, 112.
Bear, Leſſer: A proper guide for navigators, 7. Knowledge of this conſtellation introduced into Greece by Thales, 9.
Belts: One obſerved by Maraldi on the body of Mars, 80. Two others obſerved by him afterwards, ib. Belts of Jupiter diſcovered by Fontana, 89. Cannot be ſeen but by an excellent teleſcope, ib. Vary in their number from one to eight, ib. Sometimes ſeem to flow into one another, ib. Are extremely variable in the time of their continuance, ib. Black ſpots ſometimes viſible in them, ib. Two permanent belts diſcoverable on Saturn parallel to the edge of his ring, 106. Some bright belts diſcovered on this planet by Caſſini and Fatio, 106.
Belus, temple of at Babylon, ſuppoſed to have been an aſtronomical obſervatory, 6.
Bergman's account of the tranſit of Venus over the ſun, 78.
Bernoulli's conjectures concerning comets, 167.
Bianchini's obſervations on the planet Venus, 71. His diſpute with Caſſini concerning the time of her revolution on her axis, 73.
Bodin: His ridiculous opinion concerning comets, 166.
Bradley, Dr. ſucceeds Dr Halley as aſtronomer-royal, 33. Diſcovers the leſſer planetary inequalities, the aberration of

light, and nutation of the earth's axis, &c. 33. Corrects the lunar and other tables, and makes a vaſt number of celeſtial obſervations, ib.
Briggs, Henry, improves the logarithmic tables of Napier, and conſtructs much larger ones, 28.
Brightneſs of the ſun and fixed ſtars compared, 199.
Brydone, Mr Patrick, his obſervation of the velocity of a comet, 184. His conjectures concerning comets without tails, 187.

C.

Calippus invents a period of 76 years, 11.
Caſſini diſtinguiſhes himſelf as aſtronomer-royal at Paris, 33. Diſcovers the ſatellites, belts, &c. of Saturn, 31. His obſervations on the ſpots of Venus, 66. His concluſions concerning the revolution of that planet on her axis, 69. Diſpute betwixt his ſon and Bianchini on this ſubject, 73. Has a view of the ſatellite of Venus, 74. Obſerves the ſpots on Mars, 80. An obſervation of his concerning the atmoſphere of Mars doubted by Mr Herſchel, 90. His obſervation on the tail of the comet of 1680, 115. His explanation of the zodiacal light, 124.
Caſſiopeia: A new ſtar appears in that conſtellation in 1572, 45. Conjectures concerning it by Mr Pigot, 47.
Celeſtial ſpaces void of all ſenſible matter, 261.
Centre of gravity: Sun and planets revolve about a common one, and why, 297. Place of the common centre of gravity betwixt the earth and moon, 306.
Centripetal forces explained 257. How they may occaſion the revolution of a body round a centre, 258. And cauſe it deſcribe a curve of any kind, 259. Proved to extend throughout the ſolar ſyſtem, 265. Differently denominated according to the bodies in which they act, 266.
Chaldæa, a proper country for aſtronomical obſervations, 6.
Chaldæans diſpute with the Egyptians the honour of being the firſt cultivators of aſtronomy, 6. Extreme antiquity of their obſervations, ib. Account of their aſtronomical knowledge from Petavius, ib.
Chanceler, an Engliſhman, diſcovers the diagonal method of dividing quadrants, 25.
Chappe's obſervations on the tranſit of Venus, 79.
China ſuppoſed to have been peopled by Noah, 2.
Chineſe: Why ſo early inſtructed in the knowledge of aſtronomy, 2. Said to derive it from their firſt emperor Fohi, ſuppoſed to be Noah, ib. Their names for the ſigns of the zodiac, 3. Divide the heavens into 28 conſtellations ib. Method of delineating theſe conſtellations, ib. Were early acquainted with the pole ſtar, mariner's compaſs, &c. ib. Said to have calculated a great number of eclipſes, ib. Enormous errors in ſome of their calculations, ib. P. Gaubil's account of their aſtronomical knowledge, ib. Du Halde's account of Tcheu-cong's obſervatory, ib. Have an aſtronomical tribunal, ib. Aſtronomy now in a very low ſtate among them, and why, ib.
Chiron the Centaur makes a celeſtial ſphere, 11.
Clairault, Mr. his accuracy in calculating the return of the comet in 1759, 192.
Clark, Dr. A ſtar obſerved by his father through the ſpace betwixt the ring and body of Saturn, 104.
Climates ſettled by Pytheas of Marſeilles, 11.
Clock, aſtronomical, how uſed, 496. How adjuſted by the ſun's tranſit over the meridian, 501.
Cluſter of ſtars: Mr Herſchel's diſtinction betwixt this and a place of the heavens crowded with them, 223.
Cole's hypotheſis concerning comets, 188.
Comets ſuppoſed by ſome of the Chaldeans to be permanent bodies revolving like the planets, 6. Suppoſed by others to be only meteors, ib. Called wandering ſtars by Pythagoras, 11. Comet of 1500 obſerved by Warner, 21. The return of one predicted by Dr Halley, 33. General account of their appearance to the naked eye, 43. Four hundred and fifty ſuppoſed to belong to our ſolar ſyſtem, ib. Have a ſplendor inferior to the other heavenly bodies, and are apt to loſe great part of it ſuddenly, ib. Their appearance through teleſcopes, 110. Are ſurrounded with atmoſpheres of a prodigious ſize, 111. Have ſometimes different phaſes like the moon, ib. Dr Long's account of them, 112. Their heads ſeem to be compoſed of a ſolid nucleus and ſurrounding atmoſphere, 110, 112. Nucleus ſometimes breaks in pieces, 110, 112. Are generally furniſhed with luminous tails which diſtinguiſh them from other ſtars, 43, 112. Different appearances of their tails explained and accounted for, 113. Called bearded comets when the tail hangs downwards, 114. Extreme length of the tails of ſome comets, 114, 179. Hevelius obſerves the comet of 1665 to caſt a ſhadow on its tail, 115. This obſervation diſputed by Mr Hooke, ib. Comet of 1680 approaches within a ſixth part of the ſun's diameter to his ſurface, 116. Account of the comet of 1744, n° 117. Was thought capable of diſturbing the motion of Mercury, but did not, ib. Shown to be incapable of doing ſo by Dr Betts of Oxford, ib. Account of the different changes it underwent, ib. Undulation of our atmoſphere cauſes the tails of comets ſeem to ſparkle, and lengthen, and ſhorten, ib. Why the comet of 1759 made ſuch an inconſiderable appearance, 118. Hevelius's account of the appearances of different comets, 110, 115, 117, 118. Suppoſed to be the forerunners of various calamities, 162. Held by ſome of the ancient Greeks to be planets, 163. Suppoſed by Ariſtotle to be meteors, 164. This opinion contradicted by Seneca, who foretold that their true nature and motions would be diſcovered, ib. Only one ſpecies of them exiſts, 165. Their appearances vary by reaſon of their ſituation, &c. ib. Suppoſed by Kepler and Bodin to be animals or ſpirits, 166. By Bernoulli to be the ſatellites of a diſtant planet, 167. Tycho Brache revives the true doctrine concerning them, 168. Few comets have a diurnal, but all an annual parallax, ib. Suppoſed by ſome to move in ſtraight lines, ib. By Kepler, in parabolic trajectories, ib. Demonſtrated by Newton to move in very eccentric eclipſes, 169. Foundation of Dr Halley's prediction of the return of comets, 170, 190. Periodical times of different comets determined, 171. May ſometimes be inviſible during their perihelion, by reaſon of their being above our horizon in the day-time, 172. Ancient obſervation of a comet in this ſituation during an eclipſe of the ſun, ib. Why more comets are ſeen in the hemiſphere turned towards the ſun than in that removed from him, 173. Great differences in the eccentricities of the orbits of different comets, as well as of their velocities in them, 174. Planes of ſome of their orbits almoſt perpendicular to others, ib. Suppoſed by Hevelius to be tranſparent, 175. Demonſtrated by Newton to be opaque bodies reflecting the ſun's light, ib. Are of different magnitudes and at different diſtances, but moſt frequently ſmaller than the earth 176. Computations of the diſtances and diameters of ſome of them, ib. Eclipſes ſuppoſed to be occaſioned by them, 177. Their tails ſuppoſed by Tycho Brache, Des Cartes, and others, to be occaſioned by refraction, 178, 779. By Newton to be a vapour raiſed by the heat of the ſun, ib. By Mairan, to be formed of the ſun's at-

atmoſphere, 179. By de la Lande, to be occaſioned by the rarefaction of their own atmoſpheres, ib. Objections to Newton's opinion by Mr Rowning, ib. By Dr Hamilton of Dublin, who ſuppoſes their tails to be ſtreams of electric matter, 180. Sir Iſaac's account defended, 181. Objections to Dr Hamilton's hypotheſis, 182. Prodigious velocity of a comet obſerved by Mr Brydone, 184. Of that of 1680, according to Sir Iſaac Newton, 179. Exceſſive heat of that comet, according to the ſame author, 185, 186. Doubted by Dr. Long, 185. The deluge ſuppoſed by Whiſton to be occaſioned by a comet, ib. Apparent changes in the comets attributed by Newton to their atmoſpheres, 186. He ſuppoſes that the comet of 1680 muſt at laſt fall into the ſun, ib. That water and a kind of vital ſpirit are derived from the tails of comets, ib. Comets without tails ſuppoſed by Mr Brydone always to fall into the ſun, 187. Comets ſuppoſed by Mr Cole to be ſubject to the attraction of different centres, 188. How to calculate their periodical times, 189. Difference between the calculations of Mr Euler and thoſe of Newton and Halley, ib. Comet of 1744 ſeemed to move in a parabola, ib. Periodical times of comets may be changed by the attraction of the planets or other comets, 191. Comets ſuppoſed by Des Cartes to be without the ſolar ſyſtem, 298. Demonſtrated by Newton to paſs thro' the planetary regions, and to be generally inviſible at a ſmaller diſtance than Jupiter, 299. His explanation of their motions and directions how to calculate them, 300, 301. Why they move in places ſo different from thoſe of the planets, ib.

Cometarium, 492.

Conflagration, general, ſuppoſed by Whiſton to be occaſioned by a comet, 285.

Conjunction of Saturn and Jupiter, obſerved by Tycho in 1563, 24. Explanation of the conjunctions and oppoſitions of the planets, 320.

Conſequence, motion in, explained, 292.

Conſtellations of the Chineſe, how marked, 3. A number of ſtars arranged in them by the Chaldeans, 6. Moſt of them ſuppoſed by Sir Iſaac Newton to be invented about the time of the Argonautic expedition, 8. Uſes of this diviſion of the heavens, 403. Catalogue of them, 406.

Copernicus revives the Pythagorean ſyſtem of aſtronomy, 22. Determines the periodical time of the moon, 422.

Curve of any kind may be deſcribed by a body acted upon by projectile and centripetal forces, 259.

D.

Darkneſs at our Saviour's crucifixion ſuppoſed to be owing to an eclipſe by a comet, 177. Could not be owing to a ſolar eclipſe by the moon, 450.

Declination of the ſun: Improved tables of it conſtructed by Mr Wright, 26. Declination of the celeſtial bodies explained, 315. How to compute the declination of the ſun, 411.

De la Lande objects to Dr Wilſon's theory of the ſolar ſpots, 136. The Doctor's reply to his objections, 137. Remarks on La Lande's theory, 197. His opinion concerning the tails of comets, 185.

Deluge ſuppoſed by Whiſton to be occaſioned by a comet, 185.

Denſities of the heavenly bodies how determined, 310.

Des Cartes objects to the project of a reflecting teleſcope, 13. His opinion concerning the tails of comets, 179. His ſyſtem overthrown by Newton, 261.

Diagonals, method of dividing quadrants, &c. by them invented by Chanceler an Engliſhman, 25. Is not exact unleſs curved diagonals be made uſe of, ib.

Dialling in uſe among the Chaldeans long before the Greeks had any knowledge of it, 6.

Diameters, apparent, of the planets differ at different times, 326. Computation of their different diameters, ib.

Dilatation of the moon's orbit how cauſed, 285.

Direct motions of the planets explained, 323.

Dolland's achromatic teleſcopes: Caution to be obſerved in uſing them, 144.

Druids ſuppoſed to have been well ſkilled in aſtronomy, 11.

Dunn's account of the ſolar ſpots, 62. His obſervations on the tranſit of Venus, 78. His hypotheſis concerning variable ſtars, 196. His explanation of the horizontal moon, 375.

E.

Earth ſuppoſed to be ſpherical by the Egyptians, 6. Its rotation on its axis taught by Hicetas the Syracuſian, 11. A great circle of it meaſured by Eratoſthenes by means of a gnomon, 12. A degree of it meaſured again by order of of the caliph Al Mamun, 17. True figure of the earth diſcovered by Newton, 34. A degree meaſured under the equator and near the poles by order of the king of France, ib. Revolves with the moon about a common centre of gravity, 278. Effects of its motion on the apparent motions of the planets, 324. Its diſtance from the ſun, velocity in its orbit, &c. 333. Proofs of its motion, 334. From the proportional decreaſe of gravity, 335. Objections from the paralleliſm of its axis anſwered, 336. Proof of its motion from the aberration of light, 337. Objection from the apparent motion of the ſun anſwered, 340. Proof from the ſpheroidal figure of the earth, 341. From the celeſtial appearances as viewed from different planets, 343. Objection from the perpendicular deſcent of bodies anſwered, 344. Its diurnal motion illuſtrated by experiment, 345. Appears a moon to the inhabitants of our moon, 352. Has a ſpherical figure, and caſts a conical ſhadow, 427, 429.

Ebn Younes obſerves three lunar eclipſes with the utmoſt accuracy, by which the quantity of the moon's acceleration has ſince been determined, 17.

Eclipſes obſerved by the Chineſe, and made uſe of by them to ſettle their chronology, 3. Of Jupiter's ſatellites, 97. At what time theſe eclipſes are viſible, 102. Moon ſometimes diſappears when eclipſed, 146. A luminous ring ſeen round the moon in the time of total eclipſes in the ſun, 149. A comet ſeen during the time of a ſolar eclipſe, 172. Sometimes occaſioned by comets, 177. Eclipſes particularly defined, 426. Why there are ſo few eclipſes, 430. Their appearances determined from the motion of the moon's nodes, 431. A complete revolution of eclipſes in 223 lunations after the ſun, moon, and nodes, have once been in a line of conjunction, ib. To know when the ſame eclipſe returns again, 432. Eclipſes of the ſun which happen when the moon is in the aſcending node come in at the north pole, and in the deſcending node at the ſouth, ib. Exemplified from the ſolar eclipſe in 1764, n° 433. And from that of 1748, n° 434. All the phenomena of a ſingle eclipſe completed in about 1000 years, 435. Seldom more than two remarkable appearances of the ſame eclipſe during this period, 436. Example of eclipſes coming in by the north pole, 437. Very ancient eclipſes cannot be calculated by our tables, 438. Eclipſes in a year cannot be fewer than two, or more than ſeven, 439. Eclipſes of the ſun more frequent than thoſe of the moon, ib. Why more lunar eclipſes are obſerved than ſolar, 440. Total and annular eclipſes explained, 441. Illuſtration of the beginning and ending of a ſolar eclipſe, 443. How the apppearance of eclipſes is affected by the poſition of the earth's axis, 444. Of the duration of eclipſes in different parts of the earth, 445.

445. Lunar eclipſes explained, 446. Why the moon is generally viſible when eclipſed, 447. Difficulty in obſerving lunar eclipſes, 448. Uſe of eclipſes in determining the longitude of places, 449. Method of conſtructing tables for the calculation of eclipſes, 451. Directions for their uſe, 452. Requiſites for projecting an eclipſe of the ſun, 461. Geometrical projection of an eclipſe of the ſun, 470. Projection of lunar eclipſes, 471. Frequency of the eclipſes of Jupiter's ſatellites, 482. Acceleration of theſe eclipſes not owing to the motions of the ſatellites themſelves, 485.

Ecliptic, its obliquity determined by Albategnius to be 23° 35′, n° 17. Settled by Purbach at 23° 33½′, n° 19. The ſame with the heliocentric circle of the earth, or that in which it revolves round the ſun, 312. Called the *ecliptic* becauſe the ſun and moon are near it when eclipſed, ib. Its obliquity found to decreaſe, 407. How to find the obliquity of it, 409. To find the ſun's place in it, 411.

Egypt, a proper country for aſtronomical obſervations on account of the purity of the air, 6.

Egyptians, their knowledge in aſtronomy, 6. Suppoſed by Herodotus to have been inſtructed in the ſcience by Seſoſtris, ib. Knew the true figure of the earth, the cauſe of eclipſes, &c. ib. Attempted to meaſure the magnitudes of the earth and ſun, but by very erroneous methods, ib. Their knowledge of aſtronomy entirely loſt in the time of the emperor Auguſtus, ib.

Electric matter cannot be managed but by allowing it to direct its own motions, 182. Is capable of making a violent reſiſtance in certain caſes, ib.

Equal altitude inſtrument deſcribed, 502.

Equation of time explained, 383.

Equatorial ſector deſcribed, 499.

Equatorial or *portable obſervatory* deſcribed, 504.

Equinoxes, preceſſion of them explained, 348. Cauſe of their anticipation, 349.

Eratoſthenes attempts to meaſure a degree of the earth's circumference, 12.

Eternity of the world diſproved from the ſyſtem being evidently periſhable, 272.

Eudoxus firſt introduces geometry into aſtronomy, 11.

Euler, difference between his calculations and thoſe of Newton and Halley concerning the periodical return of the comet of 1680, n° 189.

Europe, aſtronomy revived in it, 18.

Eccentricity of the moon's orbit found out by Hipparchus, 14. Of the orbits of the different planets, 255. Inequality in the eccentricity of the moon's orbit occaſioned by the motion of her apogeon, 296. How to determine the eccentricity of the earth's orbit, 415.

F.

Falling bodies, calculation of their velocity, 277.

Fatio's obſervations on the ſolar eclipſe in 1706, n° 149.

Ferguſon's explanation of the horizontal moon, 374. His method of drawing a meridian line, 376.

Ferner's obſervations on the tranſit of Venus, 78.

Final cauſes, Nicholſon's opinion on them, 160.

Fixed Stars. See *Stars*.

Flamſtead appointed aſtronomer-royal at Greenwich, 33. Makes a catalogue of the ſtars, ib. His computation of the height of the moon's atmoſphere, 149.

Fouchy's obſervations on the tranſit of Venus, 78.

French aſtronomers, their improvements, 35.

Full moon, how to calculate the time of it by the tables, 454, 455, 456, 457.

G.

Gaber, the Arabian, founds the preſent method of trigonometry, 17.

Galileo firſt brings teleſcopes to any perfection, 27. Diſcovers the uncommon ſhape of Saturn, 103. Diſcovers the ſpots on the ſun, 58. His method of meaſuring the height of the lunar mountains, 141.

Guaging the heavens, Mr Herſchel's method of doing ſo, 210, 220.

Geocentric latitude of a ſuperior planet, how found, 316.

Geometry firſt introduced into aſtronomy by Eudoxus, 11.

Georgium Sidus, a new planet, 40. Hiſtory of its diſcovery, 328, *& ſeq.* Computations of its diſtance, 330.

Globe: the firſt made by Anaximander, 10. The courſe of the ſun, &c. exhibited in a globe by Pythagoras, 11.

Globe, improved celeſtial one, 493.

Graham makes great improvements in mathematical inſtruments, 32.

Gravity firſt aſſumed as a moving principle by Kepler, 26. Moon retained in her orbit by it, 275. Its properties demonſtrated by pendulums, 303. To determine its power on any planet, 309.

Greeks: their knowledge in aſtronomy, 8. Improved by Thales, 9. By Anaximander, &c. 10.

Gregory, James, of Aberdeen, firſt ſhows how a reflecting teleſcope might be conſtructed, 31.

H.

Hadley improves the reflecting teleſcope, and invents the reflecting quadrant, 32.

Halley, Dr ſucceeds Mr. Flamſtead as aſtronomer-royal, 33. Diſcovers the acceleration of the moon, ib. His hiſtory of new ſtars, 45. His account of a ſolar eclipſe in 1715, 150. Predicts the return of comets, 170, 190.

Hamilton, Dr. of Dublin, his hypotheſis concerning the tails of comets, 180.

Harveſt-moon accounted for, 370. Why the ſame phenomenon is not obſerved at other times, 371.

Heavens, Mr Wollaſton's method of making a map of them, 55. Mr Herſchel's opinion concerning their conſtruction, 202, 214. They cannot be properly repreſented by a ſphere, ib. His method of meaſuring their dimenſions, 220.

Heliocentric circles of the planets, the ſame with their orbits round the ſun, 311. Heliocentric latitude of any body defined, 315.

Herſchel's account of the ſpots on the planet Mars, 82. Makes great diſcoveries in the ſtarry regions, 119. And a vaſt number of nebulæ, 117. His obſervations on the height of the lunar mountains, 143. Diſcovers volcanoes in the moon, 145. Solution of the celeſtial phenomena on his hypotheſis of the conſtruction of the heavens, 208. His method of guaging the heavens, 210. His account of the interior conſtruction of the heavens, 214. Length of the line by which he meaſures the dimenſions of the heavens, 222. Arguments in favour of his hypotheſis from the obſervations of Mr Mayer, 241.

Hevelius, a celebrated aſtronomer of Dantzic, 30. Account of his obſervations, ib. His diſpute with Dr Hooke about teleſcopic ſights, ib. Dr Halley pays him a viſit in order to decide it, ib. Extreme accuracy of the inſtruments of Hevelius, ib. His account of the ſolar ſpots, 59, 61. His method of meaſuring the height of the lunar mountains, 141. His opinions concerning comets, 175, 186.

Hipparchus diſcovers the motions of the ſtars from the obſervations of Timocharis and Aryſtillus, 12. Firſt applies himſelf to the ſtudy of all the parts of aſtronomy, 14. Diſcovers the orbits of the planets to be eccentric, ib. Collects accounts of eclipſes, forms theories of the celeſtial motions, and attempts to calculate the ſun's diſtance, ib. This method particularly explained, 387. Its inſufficiency ſhown, 388.

Hirſt's obſervations on the atmoſphere of Venus, 78.

Hooke's diſpute with Hevelius about the ſuperiority of teleſcopic ſights, 30. Obſerves the motion of a ſpot on the diſk

diſk of Jupiter, 92.

Horizontal moon explained by Al Hazen, 17. By Mr Ferguſon, 374. By Mr Dunn, 375.

Horizontal parallax of the moon, how to find it, 375.

Horrox firſt obſerves the tranſit of Venus over the ſun's diſk in 1639, n° 29.

Huygens makes great improvements in the conſtruction of teleſcopes, 31. Diſcovers the ring of Saturn, 104. His ſuppoſition concerning the planetary inhabitants criticiſed by Dr Long, 157.

Hydra, account of a variable ſtar in that conſtellation, 50.

I.

Indentation, how a ſpot may appear to make one in the ſun's limb, 138.

Indians, their great progreſs in aſtronomy according to Mr Bailly, 4. Extreme antiquity of their obſervations, ib. Inferior planets, how to find their geocentric places, 322.

Inſtruments: great inaccuracy of thoſe formerly uſed by aſtronomers, 20. Apian ſolves aſtronomical problems by means of them alone, 22. Great accuracy of thoſe of Hevelius, 30. Firſt improved in England, 32.

Joſephus, his ſentiments concerning the aſtronomy of the antediluvians, 1.

Irregularities ariſing from the motion of the moon in an ellipſis, 290. Sir Iſaac Newton's computation of them, 297.

Jupiter's ſatellites diſcovered by Galileo, 27. His apparent diameter meaſured by Hevelius and Halley, 31. Accurate tables of the motions of his ſatellites compoſed by Wargentin, 35. His belts firſt diſcovered by Fontana, 91. Sometimes parallel to one another, and at other times not, ib. The motion of the planet on his axis determined by the motion of ſpots appearing in the belts, 92. Has no difference of ſeaſons, 94. Is attended by four moons or ſatellites, 95. Theſe in their revolutions make a ſmall angle with the orbit of their primary, ib. Their greateſt latitude only 2° 55′ ib. Their diſtances and periodical times, 96. At what times they appear direct, retrograde, &c. ib. Of their occultations and eclipſes, 97. Appear like lucid ſpots on the body of their primary, when paſſing betwixt us and it, ib. Sometimes appear as dark ſpots in that caſe, 98. This ſuppoſed to be owing to ſpots on their bodies, ib. Vary alſo in their light and apparent magnitude from the ſame cauſe, 99. Sometimes ſeem leſs than their ſhadows, ib. Appear always round, without putting on any of the phaſes of our moon, ib. In what caſes their ſhadows may be ſeen on the diſk of Jupiter, 100. Three of them eclipſed in every revolution, 101. At what times the eclipſes and occultations of theſe moons become viſible to us, 102. Of the light enjoyed by Jupiter and the other ſuperior planets, 162. His day equivalent to 3330 times our moon-light, 162. Comets retarded in their courſe by the attraction of this planet, 191. Effect of this attraction on the comet of 1681, ib. The motion of Saturn likewiſe influenced by it, 269. The power of his attraction diſcovered by the revolutions of his ſatellites, 274. This planet contains $158\frac{2}{3}$ times as much matter as the earth, 309. but is $4\frac{1}{4}$ times leſs denſe, 310. How to find the longitude of places on earth by the eclipſes of Jupiter's ſatellites, 482, et ſeq. Frequency of theſe eclipſes, ib. The ſatellites never eclipſe one another, ib. At what times the immerſions or emerſions are to be obſerved, 483. *See Belts and Eclipſes.*

K.

Keill's method of finding the diſtance of the ſun by obſerving exactly the phaſis of the moon, 392. Inſufficiency of it ſhowed, 393.

Kepler, his diſcoveries concerning the planetary motions, 26. Imagines the planets and comets to be animated beings, 166. Shows that the comets do not move in ſtraight lines, 168.

L.

La Caille conſtructs excellent ſolar tables, allowing for the attraction of the planets, 36. Determines the parallax of the ſun not to be above ten ſeconds, ib.

Latitude of any phenomenon, its diſtance from the ecliptic, 315. How to find the latitude of any place on earth, 408. To find the latitudes of the ſtars, 413.

Lexel profeſſor at Peterſburgh, his obſervations on the Georgium Sidus, 330.

Libration of the moon, an apparent inequality in her motion, owing to her equable revolution on her axis, 420.

Lightning, ſuppoſed to be frequent in the moon, 153.

Light, its progreſſive motion diſcovered by the eclipſes of Jupiter's ſatellites, 33. Why it is not refracted by the moon's atmoſphere, 148. That enjoyed by the ſuperior planets compared with our day, 162. In what caſes it may be ſuppoſed to return to the body that emits it, 198. Its aberration, 337. Its velocity, 338, 484.

Local zodiac explained, 318.

Logarithmic tables, by whom compoſed, 28.

Logarithms, ſaid to be known by the Prince of Heſſe before they were diſcovered by Napier, 23. Of their diſcovery by the latter, 26.

Long, Dr his opinion of the obſervations concerning the atmoſphere of Venus, 79. His explanation of the diſappearance of the fifth ſatellite of Saturn, 108. His account of comets, 112. Of the ſpots of the ſun, 59. His conjectures concerning them, 127. Suppoſes that ſome of the dark ſpots of the moon may be ſeas, 146. His anſwer to the arguments againſt a lunar atmoſphere, 147. His opinion on the plurality of worlds, 157. His conjectures why comets may ſometimes be inviſible in their perihelion, 172.

Longitude, the method of diſcovering it at ſea, by the appulſes of the moon to fixed ſtars propoſed by Warner, 21. Of diſcovering the longitudes of places on earth by the eclipſes of Jupiter's ſatellites, 27, 482. What ſatellites are moſt proper for this purpoſe, ib. Warner's method brought to perfection by Nevil Maſkelyne, 36. Longitudes of the celeſtial bodies defined, 319. Longitude eaſily found by the lunar inhabitants, 354. How to find the longitudes of the ſtars, 413.

Louville's obſervations on a luminous ring round the moon in a ſolar eclipſe, 152.

Lunar inhabitants, how they can meaſure the year, 353.

M.

Mairan's opinion concerning the tails of comets, 179.

Map of the heaven's, Mr Wollaſton's method of conſtructing one, 55.

Maraldi's obſervations on the ſpots of Mars, 80. Obſerves belts on his diſk, ib.

Mariners compaſs early known to the Chineſe, 3.

Mars firſt obſerved on his diſk by Caſſini, who determines his revolution in 24 hours 40′ n° 80. Erroneouſly ſuppoſed by others to revolve only in 13 hours, ib. Maraldi's obſervations on them, ib. His belts ſometimes parallel to his equator, and ſometimes not, ib. Bright ſpots about his poles, 81. Mr Herſchel's account of theſe ſpots, 82. The circle of motion of the north polar ſpot at ſome diſtance from the pole itſelf, 83. Not ſo with the ſouth polar ſpot, ib. Exact poſition of the poles of this planet, 84. Of the ſeaſons in Mars, 85. How to compute the declination of the ſun on this planet, ib. A conſiderable reſemblance betwixt the earth and Mars, 86. The white ſpots about the poles ſuppoſed to be occaſioned by ſnow, 87. Has a ſpheroidal form, 88. Difference betwixt his equatorial and polar diameters, 89. Of his atmoſphere, 90. Denſity of of it probably over-rated, ib. His parallax, 394.

Maſkelyne, Mr Nevil, ſucceeds Mr Bliſs in the office of aſtronomer-royal, 36. His account of the proper motions of ſeveral ſtars, 237. His detection of errors in the obſervation of very ſmall angles, 339.

Maupertius, his conjectures concerning the appearance and diſappearance of ſtars, 165.

Mayer, extraordinary exactneſs of his tables, 35. Account of ſome of his obſervations on moving ſtars, 241.

Mechanical paradox deſcribed by Mr Ferguſon, 491.

Mercury, appearance of that planet to the naked eye, 40. Sometimes appears as a dark ſpot in the face of the ſun, 63. Has the phaſis of the moon, 64. Thought to be in danger from the comet of 1744, n° 117. The heat about the polar regions of this planet poſſibly may not be greater than that of the warmer regions of the earth, 161.

Meridian line: Ferguſon's method of drawing one 376. Another more exact, 377.

Merſennus founds the Royal Academy of Sciences at Paris, 30. Propoſes a reflecting teleſcope, 31.

Meton invents a cycle of 19 years, 11.

Mexicans: their method of dividing the year, &c. 5.

Michell's conjectures concerning the nature of the fixed ſtars, 197.

Micrometer firſt applied to teleſcopes by Mr Auzout, 31. The ſame invented before by Mr Gaſcoigne, ib. Object-glaſs micrometer invented by Mr Short, 32.

Milky-way: its white colour aſcribed by Pythagoras to a number of ſmall ſtars, 11. Reſolved entirely into ſmall ſtars by Mr Herſchel's teleſcope, 203. Incredible number of ſtars obſerved in it, ib. Why it ſeems to ſurround the heavens, 207. Of the ſun's place in it, 209. Why every ſtar in this ſtratum will have its own milky way, ib.

Montaigne obſerves the ſatellite of Venus at the tranſit in 1761, n° 76.

Montanere's account of changes among the fixed ſtars, 46.

Moon comes into the ſame ſituation with regard to the nodes, apogee, &c. once in 600 years, 1. Her motion diſcovered by the Chaldeans not to be uniform, 6. Cauſe of her eclipſes known to the Egyptians, ib. Held to be an opaque body reflecting the rays of the ſun by Thales, 9. And by Pythagoras, 11. Said to be habitable by him and Anaxagoras, 10, 11. The ſpots and phaſes of the moon obſerved by Hevelius, 30. Occultation of Jupiter obſerved by him and Dr Halley, ib. Her apparent motion, 38. Appearance through a teleſcope, 63. Great inequalities on her ſurface, 140. Method of meaſuring the height of her mountains, 141. Their height greatly over-rated, 142. Mr Herſchel's obſervations on them, 143. His method of meaſuring their height, ib. Volcanoes diſcovered in the moon, 145. Conjectures concerning her ſubſtance, 146. Suppoſed by ſome to have an obſcure light of her own, ib. Sometimes diſappears entirely in the time of a lunar eclipſe, ib. Remarkable appearances in 1703, ib. Spots on her diſk generally ſuppoſed to be hollows, ib. Some of them thought by Dr Long and others to be water, ib. Whether the moon has any atmoſphere, 147. The light cannot be refracted by this atmoſphere on account of its rarity, 148. Exiſtence of an atmoſphere argued from the appearance of a luminous ring about the moon in a total eclipſe of the ſun, 149. Obſervations on an eclipſe of this kind in 1706, ib. Cap. Stanyan's obſervations at Bern in Switzerland, ib. Fatio's obſervations at Geneva, ib. Flamſtead from theſe obſervations concludes the lunar atmoſphere to be 180 geographical miles high, ib. Caſſini's general account of this eclipſe from a number of relations, ib. Dr Halley's account of a ſolar eclipſe in 1715, n° 150. Obſerves flaſhes like lightning to proceed from the dark edge of the moon, 151. Louville's obſervations on this eclipſe, ib. Suppoſes the flaſhes to be real lightning, 153. Great height of the moon's atmoſphere accounted for, 154. All the phenomena otherwiſe ſolved by the French academicians, 155. Whethe the light of the fixed ſtars is refracted in paſſing by the moon, 156. Maraldi's concluſion againſt a lunar atmoſphere, ib. Moon moves round the earth in an ellipſis, 273. Retained in her orbit by the power of gravity, 275. Her motion particularly explained, 276. Moves with the earth about a common centre of gravity, 278. Inequalities in her motion explained, 282. Comes neareſt the earth when leaſt attracted by it, 284. Cauſe of the dilatation of her orbit, 285. Plane of her orbit changed by the action of the ſun, 286. Nodes of her orbit explained, 287. Inclination of her orbit, 288. Irregularities ariſing from her motion in an ellipſis, 290. Her apogeon and perigeon explained, 291. Motion of her apogeon determined, 294. Inequality of it occaſions an inequality of the eccentricity of her orbit, 296. Newton's computation of the lunar irregularities, 297. General account of her motions, &c. 350, *et ſeq.* Her phaſes explained, 351, 355. Delineated, 424. Never appears perfectly round, 356. Agreeable repreſentation of her phaſes, 357. Delineation of her path round the ſun, 359. Her path always concave towards the ſun, 360. Why her edge always appears even, 362. Revolution of her nodes, 372. To find her horizontal parallax, 384. The beſt method as recommended by Mr Ferguſon, 385. Difficulties in the calculation of her place in her orbit, 419. Moves equably on her axis, which occaſions an apparent inequality called her *libration*, 420. Irregularities of her motion explained by Sir Iſaac Newton, 421. Her periodical time diſcovered by Copernicus, 422. Her diurnal and horary motion, how found, 423. Place of her nodes how found, 425. Her figure ſpherical, 428. Figure of her ſhadow conical, 429. Why more eclipſes of the moon than of the ſun are obſerved, 440. Exceſs of the lunar above the ſolar diameter, 441. Extent of her ſhadow and penumbra, 442. Why ſhe is viſible when eclipſed, 447. Projection of eclipſes of the moon, 471.

Moon-light long in winter at the poles, 373.

Motions, apparent, of the planets explained, 323.

Mountains of the moon. See *Moon*. Attraction of terreſtrial mountains diſcovered by the mathematicians ſent to meaſure a degree of the earth, 34.

Mural arch deſcribed, 497.

N.

Napier, baron of Merchiſton, invents logarithms, 26.

Navigation: Aſtronomy firſt applied to its purpoſes by the Phœnicians, 7.

Nebulæ, whitiſh ſpecks in the heavens, ſo called, 120. Great numbers of them diſcovered by Mr. Herſchel, ib. Planetary nebulæ, why ſo called, ib. Reſolved into a multitude of ſmall ſtars by Mr. Herſchel's teleſcope, 212. Are arranged into ſtrata, 213. Variety of ſhapes aſſumed by them, 214. Obſervations on them by Mr. Herchel, 215. Conjectures concerning their formation, 216. Arguments from obſervations on them, that the univerſe is compoſed of nebulæ, 218. Extent of the nebulæ in which we live, 224.

New-moon, how to calculate the time of it, 452, 453.

Newton, Sir Iſaac, makes the firſt reflecting teleſcope, 31. Reforms the theoretical part of aſtronomy, ib. His opinion concerning the ſun and fixed

fixed ſtars, 122. Determines the true paths of the comets, 169. His opinion concerning their bodies, 175. Of their tails, 179. Of the changes which apparently take place in them, 186. Of the appearance of new ſtars, 194. Explanation of the ſolar ſyſtem on his principles, 253, *et ſeq.*
Nicholſon on final cauſes, 160.
Nodes of the planets explained, 254, 317. Of the moon's orbit, 287. Motion of them explained, 289. Revolution of thoſe of the moon, 372. How to find the place of the moon's nodes, 425.
Nonageſimal degree explained, 358.
Nonius, his method of dividing quadrants by means of concentric circles, 22.
Noon: How to find the exact time of it, 378.

O.

Occultations of Jupiter's ſatellites, when they happen, 97. 102. Of the ſtars by the moon, 156.
Oldenburg founds the Royal Society at London, 30.
Orbits of the planets deſcribed, 254.
Orrery, a kind of one invented by Archimedes. 13. Rowley's deſcribed, 487. Ferguſon's, 488. How to rectify the orrery, and place the planets in their proper ſituations, 490.
Oſymandyas, a celebrated Egyptian monarch, his tomb deſcribed, 6.

P.

Parallax of the fixed ſtars beſt found by means of double ſtars, 399. To find the horizontal parallax of the moon 384, 385. Various methods of finding the parallax of the ſun, 386—392. All of them inſufficient, 393. By the parallax of Mars or Venus, 394, 395. How to compute his diſtance from his parallax, 396.
Particles of matter attract each other according to the ſame law obſerved in other bodies, 307.
Pendulums: The laws of gravity explained by them, 303.
Perigeon of the moon explained, 291. Of the planets, 325.
Perihelion of the planets explained, 254.
Periodical times of the planets, how found, 414.
Phaſes. See *Moon*.
Phœnicians firſt apply aſtronomy to navigation, 57.
Pigot, Mr Edward, his account of variable ſtars, 47.
Planetarium, Jones's, deſcribed, 489.
Planetary nebulæ. See *Nebulæ*.
Planets, law of their motion diſcovered by Kepler, 26. Why ſo called, 40. Apparent magnitudes, &c. 40, 41, 42. See *Mercury*, *Venus*, &c.
Plato embraces the Ptolemaic ſyſtem of aſtronomy, 11.
Plurality of worlds, arguments for and againſt it, 157.
Pole-ſtar known to the Chineſe, 3. Height of it at Samarcand 39° 37′ 23″, n° 17. Seems immoveable in the heavens, 39.
Poles, long moonlight in winter at them, 373.
Preceſſion of the equinoxes pointed out by Warner, 21. Explained, 348.
Ptolemy, his ſyſtem of aſtronomy, 16.
Purbach's diſcoveries, 18.
Pytheas, an ancient aſtronomer of Marſeilles, travels to Thule to ſettle the climates, 11.

Q.

Quadrant of an enormous ſize belonging to Ulug Beg, 17. Tycho Brache makes one capable of obſerving ſingle minutes, 21. Reflecting quadrant invented by Hadley, 32. An inſtrument of the ſame kind formerly propoſed by Sir Iſaac Newton, ib. Aſtronomical quadrant deſcribed, 497. Portable one deſcribed, 498.

R.

Reciprocal duplicate proportion explained, 264.
Reflecting teleſcope propoſed by Marſennus, 31. Carried into execution by Sir Iſaac Newton, 32.
Refraction firſt treated of by Al Hazen, 17.
Refrangibility, different, of the rays of light, an obſtacle to the improvement of teleſcopes, 31.
Revolution of a body round a centre explained, 258.
Regiomontanus, an excellent aſtronomer, 20.
Ricciolus's method of finding the ſun's parallax, 391. Inſufficient, 393.
Robinſon, Profeſſor, his account of the Georgium Sidus, 528, *et ſeq.*
Rowning's objection to Sir Iſaac Newton's hypotheſis concerning the tails of comets, 179.
Royal Society founded by Oldenburg, 30.

S.

Saros a Chaldean period of 223 lunations, 6.
Satellites. See *Venus*, *Jupiter*, *Saturn*, and *Georgium Sidus*.
Saturn diſcovered by Huygens to be encompaſſed by a ring, 31, 104. Account of its appearances, ib. The ring probably revolves on its axis, 105. Belts diſcovered on him, 106. Is attended by five ſatellites, 107. Account of their diſtances and periodical times, ib. Are very ſeldom eclipſed, ib. Fifth ſatellite ſometimes diſappears, 108. Affects the periodical times of comets by its attraction, 191. Has irregularities in its motion unaccountable on the principles of gravitation, 269.
Scheiner's account of the ſolar ſpots, 61.
Scheuchzer's account of a ſolar eclipſe, 149.
Seaſons of the year particularly explained, 345, 346.
Secondary planets, their motions explained, 273, *et ſeq.*
Semita luminoſa. See *Zodiacal* light.
Serpentarius, a new ſtar appears in that conſtellation, 45.
Short obſerves the ſatellite of Venus, 75.
Sidereal ſyſtem, proofs of ours being a nebula, 221. Sidereal year has 366 days, 181.
Solar ſyſtem, velocity of its ſuppoſed motion, 233.
Solſtices, ſummer and winter, explained, 345.
Spherical conchoid, a new curve deſcribed by Mr Herſchel, 244.
Spots. See *Sun*, *Jupiter*, &c.
Stanyan, Captain, his obſervations on a ſolar eclipſe, 149.
Stars, fixed, their motion in longitude diſcovered by Hipparchus, 12. Catalogue of fixed ſtars made by him, 15. Another by Ulug Beg, 17. Places of 400 of them ſettled by the Landgrave of Heſſe, 23. Another catalogue made by Tycho Brache, 24. Theſe ſtars ſeemingly deſtructible and generable, 44. Dr Halley's hiſtory of new ones, 45. Montanere's account of changes among them, 46. Mr Pigot's remarks on thoſe which change their luſtre, 47, *et ſeq.* Number of fixed ſtars greatly increaſed by teleſcopes, 119. Of their occultations by the moon, 156. Suppoſed to be ſuns, 192. Conjectures concerning the variable ſtars, 194, 195, 196, 201, 235. Mr Michell's conjectures concerning their nature, 197. Compariſon of their brightneſs with that of the ſun, 199. Some ſtars ſuppoſed to be ſatellites of others, 197. Their ſuppoſed motion, and that of the ſolar ſyſtem, 237, *et ſeq.* Their diſtance immeaſurable, 398. Why they ſeem ſo big to the naked eye, 399. Their different magnitudes, 400. Teleſcopic ſtars, 401. Unformed ſtars, 402.
Star-gauge. See *Gauging*.
Strata. See *Nebulæ*.
Sun, his diſtance determined by Ariſtarchus, 12. By Eratoſthenes, ib. His apparent motion, 37. Account of his appearance through teleſcopes, his ſpots, and conjectures concerning them, 58 *et ſeq.* 121 *et ſeq.* See alſo *Moon*, *Ecliptic*, *Declination*, *&c.*
Superior planets. See *Mars*, *Jupiter*, *Saturn*, and *Georgium Sidus*.
Swan, variable ſtar in that conſtellation, 51, 52, 53.

T.

Teleſcopes introduced into aſtronomy by Galileo, 27. Their improvement, 31.
Teleſcopic ſights invented by Hooke, 30.

Thales improves the aſtronomy of the Greeks, 9.
Thunder and lightning frequent in the moon, 153.
Tides: their cauſe diſcovered by Kepler, 26, 363. Particularly explained by Sir Iſaac Newton, 363, *et ſeq.*
Time-keeper firſt propoſed by Gemma Friſius for finding the longitude at ſea, 22.
Timocharis. See *Aryſtillus*.
Tranſit-inſtrument deſcribed, 500.
Trigonometry improved by the Arabians, 17.
Triplicate proportion explained, 293.
Tycho Brache, a celebrated Daniſh aſtronomer, account of his diſcoveries, 25.
V. U.
Venus known by Pythagoras to be the morning and evening ſtar, 11. Her tranſit over the ſun firſt obſerved by Mr Horrox, 29. Spots diſcovered on her diſk by Burratini, 65. Obſervations of Caſſini and others on them, 66, *et ſeq.* Diſpute concerning the revolution on her axis, 73. Of her ſatellite, 74—77. Of her atmoſphere, 78, 79. Of the quantity of heat this planet enjoys, 161. Of her parallax, 395.
Ulug Beg, his obſervatory and magnificent apparatus, 17. Makes a catalogue of the ſtars, ib.
Univerſe, Mr Herſchel's opinion of its conſtruction, 202.
Univerſal equatorial deſcribed, 504.
Volcanoes. See *Moon*.
Uraniburg, Tycho Brache's obſervatory deſcribed, 25.
W.
Wargentin compoſes exact tables of the motions of Jupiter's ſatellites, 35.
Warner's diſcoveries and improvements, 21.
Wax-candle, its flame 8000 times leſs bright than the ſun, 199.
Weight of bodies increaſes towards the poles 342.
Whale, variable ſtar in that conſtellation, 48.
Whiſton, his hypotheſis concerning the general deluge and conflagration, 185.
Wilſon, Dr, his account of the ſolar ſpots, 61. His inveſtigation of their nature, 133, *et ſeq.* Reply to De la Lande's objections, 317. Remarks on Le la Lande's theory of theſe ſpots, 139.
Wollaſton's method of making a map of the heavens, 55. His account of the ſolar ſpots, 61. Objections to Dr Wilſon's theory with his reply, 137.
Y.
Year: how the lunar inhabitants can meaſure theirs, 344.
Z.
Zodiac, how divided by the Chineſe, 3. Comets are not confined within its limits, 170. Definition of it, 312. How divided, 318.
Zodiacal light, conjectures concerning it, 124.

ASTROPE-WELLS, near Banbury in Oxfordſhire, are recommended as excellent in female obſtructions, the gravel, hypochondriac, and ſimilar diſorders. The water is a briſk, ſpirituous, pleaſant-taſted chalybeate, and is alſo gently purgative. It ſhould be drank from three to five quarts in the forenoon.

ASTROSCOPE, a kind of aſtronomical inſtrument, compoſed of two cones, on whoſe ſurface the conſtellations, with their ſtars, are delineated, by means whereof the ſtars may eaſily be known. The aſtroſcope is the invention of William Schukhard, formerly profeſſor of mathematics at Tubingen, who publiſhed a treatiſe expreſsly on it in 1698.

ASTRUC (John), a celebrated phyſician, was born in the year 1684, at the little town of Savoy, in the province of Languedoc. His father, who was a proteſtant clergyman, beſtowed particular pains upon the earlieſt part of his education. After which he went to the univerſity of Montpelier, where he was created maſter of arts in the year 1700. He then began the ſtudy of medicine; and, in two years, obtained the degree of bachelor, having, upon that occaſion, written a diſſertation on the cauſe of fermentation, which he defended in a very ſpirited manner. On the 25th of January 1703 he was created doctor of phyſic; after which, before arriving at extenſive practice, he applied to the ſtudy of medical authors, both ancient and modern, with uncommon aſſiduity. The good effects of his ſtudy ſoon appeared; for, in the year 1710, he publiſhed a treatiſe concerning muſcular motion, from which he acquired very high reputation. In the year 1717, he was appointed to teach medicine at Montpelier; which he did with ſuch perſpicuity and eloquence, that it was univerſally ſaid he had been born to be a profeſſor. His fame ſoon roſe to ſuch a height, that the king aſſigned him an annual ſalary; and he was, at the ſame time, appointed to ſuperintend the mineral waters in the province of Languedoc. But as Montpelier did not afford ſufficient ſcope for his aſpiring genius, he went to Paris with a great ſtock of manuſcripts, which he intended to publiſh, after ſubjecting them to the examination of the learned. Soon after, however, he left it, having in the year 1729 accepted the office of firſt phyſician to the king of Poland, which was then offered to him. His ſtay in Poland, however, was but of ſhort duration, and he again returned to Paris. Upon the death of the celebrated Geoffroy, in the year 1731, he was appointed Regius Profeſſor of medicine at Paris. The duties of this office he diſcharged in ſuch a manner as to anſwer even the moſt ſanguine expectations. He taught the practice of phyſic with ſo great applauſe, as to draw from other univerſities to that of Paris a great concourſe of medical ſtudents, foreigners as well as natives of France. At the ſame time he was not more celebrated as a profeſſor than a practitioner. And, even at an advanced age, he perſiſted with unwearied aſſiduity in that intenſe ſtudy which firſt raiſed his reputation. Hence it is, that he has been enabled to tranſmit to poſterity ſo many valuable monuments of his medical erudition. He died, univerſally regretted, on the 15th of May 1766, in the 82d year of his age.

ASTURIA, an ancient kingdom of Spain, ſubdued by Auguſtus emperor of Rome.—The inhabitants of this country, along with thoſe of Cantabria, aſſerted their liberty long after the reſt of Spain had received the Roman yoke. So great was their deſire of liberty, that, after being cloſely ſhut up by the Roman army, they endured the moſt terrible calamities of famine, even to the devouring of one another, rather than ſubmit to the enemy. At length, however, the Aſturians were for ſurrendering: but the Cantabrians oppoſed this meaſure, maintaining that they ought all to die ſword in hand like brave men. Upon this the two nations quarrelled, notwithſtanding their deſperate ſituation; and a battle enſuing, 10,000 of the Aſturians were driven to the intrenchments of the Romans, whom they begged in the moſt moving manner to receive them on any terms they pleaſed. But Tiberius the emperor's ſon-in-law refuſing to admit them into the camp, ſome of theſe unhappy people put an end to their lives by falling upon their own ſwords; others lighting great fires threw themſelves into them, while ſome poiſoned themſelves by drinking the juice of a venomous herb.

The campaign being put an end to by winter, the next year the Aſturians ſummoned all their ſtrength and reſolution againſt the Romans; but notwithſtanding their utmoſt efforts of valour and deſpair, they were entirely defeated in a moſt bloody battle which laſted two days, and for that time entirely ſubdued. A few years afterwards they rebelled, in conjunction with the Cantabrians; but were ſoon reduced by the Romans, who maſſacred moſt of the young men that were capable of bearing arms. This did not prevent them from revolting anew in a ſhort time afterwards; but without ſucceſs, being obliged to ſubmit to the Roman power, till the ſubverſion of that empire by the Goths.

Asturias, anciently the kingdom of Aſturia, is now a principality of modern Spain, bounded by Biſcay on the eaſt, Galicia on the weſt, Caſtile and Old Leon on the ſouth, and the ſea on the north. Its greateſt length is about 110 miles, and its breadth 54. On the ſouth it is ſeparated from Caſtile and Old Leon by high mountains covered with woods. The province is tolerably fertile, but thinly inhabited. The inhabitants value themſelves much on being deſcended from the ancient Goths. Even the poor peaſants, who are fain to go to ſeek work in other provinces, call themſelves *illuſtrious Goths* and *Mountaineers*, thinking it ignominious to marry even with great and rich families of another race. This pride is flattered by the reſpect paid them by the reſt of the nation, and the privileges beſtowed upon them by the government. The hereditary prince of Spain is ſtyled *prince of the Aſturias*. The moſt remarkable places in this principality are Oviedo, Gyon, Santillana, and St Andero.

ASTYAGES, ſon of Cyaxares, the laſt king of the Medes. He dreamed that from the womb of his daughter Mandane, married to Cambyſes king of Perſia, there ſprung a vine that ſpread itſelf over all Aſia. She being with child, he reſolved to kill the infant as ſoon as born. Its name was Cyrus; and Harpagus, being ſent to deſtroy it, preſerved it: which Aſtyages after a long time hearing of, he cauſed Harpagus to eat his own ſon. Harpagus called in Cyrus, who dethroned his grandfather, and thereby ended the monarchy of the Medes. See Media and Persia.

ASTYANAX, the only ſon of Hector and Andromache. After the taking of Troy, he was thrown from the top of a tower by Ulyſſes's orders.

ASTYNOMI, in Grecian antiquity, magiſtrates in Athens, correſponding to the ædiles of the Romans; they were ten in number. See Ædile.

ASYLUM, a ſanctuary, or place of refuge, where criminals ſhelter themſelves from the hands of juſtice. The word is compounded of the primitive particle α, and συλαω, *I hurt*; becauſe no perſon could be taken out of an aſylum without ſacrilege.

The aſyla of altars and temples were very ancient; and likewiſe thoſe of tombs, ſtatues, and other monuments of conſiderable perſonages. Thus, the temple of Diana at Epheſus was a refuge for debtors, the tomb of Theſeus for ſlaves. Among the Romans, a celebrated aſylum was opened by Romulus between the mounts Palatine and Capitoline, in order to people Rome, for all ſorts of perſons indiſcriminately, fugitive ſlaves, debtors, and criminals of every kind. The Jews had their aſyla; the moſt remarkable of which were, the ſix cities of refuge, the temple, and the altar of burnt-offerings.

It was cuſtomary among the Heathens to allow refuge and impunity even to the vileſt and moſt flagrant offenders: ſome out of ſuperſtition, and others for the ſake of peopling their cities: and it was by this means, and with ſuch inhabitants, that Thebes, Athens, and Rome, were firſt ſtocked. We even read of aſylums at Lyons and Vienne among the ancient Gauls; and there are ſome cities in Germany which ſtill preſerve the ancient right of aſylum. Hence on the medals of ſeveral ancient cities, particularly in Syria, we meet with the inſcription ΑΣΥΛΟΙ, to which is added ΙΕΡΑΙ. This quality of aſylum was given them, according to M. Spanheim, in regard to their temples, and to the gods revered by them.

The emperors Honorius and Theodoſius granting the like immunities to churches, the biſhops and monks laid hold of a certain tract or territory, without which they fixed the bounds of the ſecular juriſdiction: and ſo well did they manage their privileges, that convents in a little time became next akin to fortreſſes; where the moſt notorious villians were in ſafety, and braved the power of the magiſtrate.

Theſe privileges at length were extended not only to the churches and church-yards, but alſo to the biſhops houſes; whence the criminal could not be removed without a legal aſſurance of life, and an entire remiſſion of the crime. The reaſon of the extenſion was, that they might not be obliged to live altogether in the churches, &c. where ſeveral of the occaſions of life could not be decently performed.

But at length theſe aſyla or ſanctuaries were alſo ſtripped of moſt of their immunities, becauſe they ſerved to make guilt and libertinage more bold and daring. In England, particularly, they were entirely aboliſhed. See Sanctuary.

ASYMMETRY, the want of proportion between the parts of any thing; being the contrary of *ſymmetry*.

ASYMPTOTE, in geometry, a line which continually approaches nearer to another; but, though continued infinitely, will never meet with it: Of theſe are many kinds. In ſtrictneſs, however, the term *aſymptotes* is appropriated to right lines, which approach nearer and nearer to ſome curves of which they are ſaid to be *aſymptotes*; but if they and their curves are indefinitely continued, they will never meet. See *Conic Sections*.

ASYNDETON, in grammar, a figure which omits the conjunctions in a ſentence. As in *veni, vidi, vici*, where ET is left out: or in that of Cicero concerning Catiline, *abiit, exceſſit, evaſit, erupit*: or in that verſe of Virgil,

Ferte citi flammas, date vela, impellite remos.

Aſyndeton ſtands oppoſed to polyſyndeton, where the copulatives are multiplied.

ATABULUS, in phyſiology, a provincial wind in Apulia, of a dry pinching quality, and very noxious in its effects. The ancient naturaliſts ſpeak of the Atabulus in terms of horror, on account of the ravage it made among the fruits of the earth, which it ſcorched or withered up.

ATABYRIS, a very high mountain in the iſland of Rhodes, on which, according to Strabo and Diodorus Siculus, there ſtood a temple of Jupiter Atabyrius, whoſe worſhip a colony of Rhodians carried into Sicily, where a temple was built to the ſame deity at Agrigentum.

ATALANTA, an iſland in the Euripus of Eubœa, near the Locri Opuntii, ſaid to have been originally a city of the Locri, but torn from the continent in the time of an earthquake, and during an irruption of mount Ætna. This happened in the fourth year of the 93d Olympiad, in the reign of Artaxerxes Mnemon (Pliny, Oroſius).

ATALANTIS, Atlantica, or Atlantis. See Atlantis.

ATARAXY, a term uſed by the ſtoics and ſceptics, to denote that calmneſs of mind which ſecures us from all emotions ariſing from vanity and ſelf-conceit.

ATARGATIS fanum, the temple of a goddeſs worſhipped by the Syrians and Parthians, having the face of a woman and tail of a fiſh, and called *Derceto* by the Greeks. Her temple ſtood in the city Bambyce, called afterwards *Hierapolis.* It was extremely rich, inſomuch that Craſſus, in his march againſt the Parthians, ſpent ſeveral days in weighing the treaſure. Voſſius makes the name of this goddeſs Phœnician, from *Addir-dag*, "the great fiſh."

ATARNEA, an ancient town of Myſia, ſituated between Adramyttium and Pitane, remarkable for the marriage of Ariſtotle with the ſiſter or concubine of the tyrant Hermias; alſo for the dottage of that philoſopher.

ATAXY, in a general ſenſe, the want of order: With phyſicians, it ſignifies irregularity of criſes and paroxyſms of fevers.

ATCHE, in commerce, a ſmall ſilver coin uſed in Turkey, and worth only one-third of the Engliſh penny.

ATCHIEVEMENT, in heraldry, denotes the arms of a perſon or family, together with all the exterior ornaments of the ſhield; as helmet, mantle, creſt, ſcrolls, and motto, together with ſuch quarterings as may have been acquired by alliances, all marſhalled in order.

ATCHIEVE. This term is derived from the French *achever*, i. e. to finiſh or make an end of; but ſignifies, in its ordinary acceptation, to perform great actions or exploits.

ATE, the goddeſs of miſchief, in the Pagan theology. She was daughter of Jupiter, and caſt down from heaven at the birth of Hercules. For Juno having deceived Jupiter, in cauſing Euriſtheus to be born before Hercules, Jupiter expreſſed his reſentment on Ate, as the author of that miſchief: and threw her headlong from heaven to earth, ſwearing ſhe ſhould never return thither again (*Homeri Il.* xix. 125.) The name of this goddeſs comes from αταω, *noceo*, to "hurt." Her being the daughter of Jupiter, means, according to mythologiſts, that no evil happens to us but by the permiſſion of Providence; and her baniſhment to earth denotes the terrible effects of divine juſtice among men.

ATEGUA, or Attegua, an ancient town of Spain, placed by ſome in the road from Antiquara, now Antequera, to Hiſpalis, or Seville; by others near Alcala Real; which laſt is the more probable ſituation, becauſe the flumen ſalſum, now the Salado, was in its neighbourhood. Now *Tebala Vieja*, or *Teivela.*

ATELLA, an ancient town of Campania in Italy, between Capua and Neapolis. From this town the *Atellanæ fabulæ*, or *Atellani ludi*, took their name. Theſe were alſo called *Oſci*, from their inventor, in whoſe territory Atella lay. They were generally a ſpecies of farce, interlarded with much ribaldry and buffoonery; and ſometimes were exordia or interludes preſented between the acts of other plays. The actors in theſe farces were not reckoned among the common players, nor deemed infamous; but retained the rights of their tribe, and might be liſted for ſoldiers, the privilege only of free men. The ruins of this town are ſtill to be ſeen about 11 miles from the modern Averſa, which was built out of its materials.

ATEMPO giusto, in muſic, ſignifies to ſing or play in an equal, true, and juſt time.

ATERGATIS, in mythology, a goddeſs of the Syrians, ſuppoſed to be the mother of Semiramis. She was repreſented with the face and breaſts of a woman, but the reſt of her body reſembled a fiſh. Voſſius ſays the term ſignifies *without fiſh*, and conjectures that the votaries of this deity abſtained from fiſh.

ATERNUM, a town of Lucania in Italy, now *Aterni*, (Cluverus): Alſo a town in the territory of the Piceni, now *Peſcara*, a port-town of Naples, ſituated on the Adriatic, E. Long. 15. 25. N. Lat. 42. 30.

ATESTE, a town in the territory of Venice in Italy, now called *Eſte.* E. Long. 12. 6. N. Lat. 45. 25.

ATHAMADULET, the prime miniſter of the Perſian empire, as the grand vizier is of the Turkiſh empire. He is great chancellor of the kingdom, preſident of the council, ſuperintendant of the finances, and is charged with all foreign affairs.

ATHAMANTA, spignel: A genus of the dinynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 45th order, *Umbellatæ.* The fruit is oblong and ſtriated; and the petals are inflected and emarginated. Of this genus Linnæus enumerates nine ſpecies; but none of them merit particular notice, except the cretenſis, otherwiſe called *daucus creticus*, which grows wild in the Levant and the warmer parts of Europe. The leaves are irregularly diſpoſed, and formed like thoſe of fennel. The flower-ſtalk riſes about two feet high, ſending out many branches, terminated at the top by compound umbels, compoſed of near 20 ſmall ones. Theſe have white flowers with five petals, which are ſucceeded by oblong, hairy, channelled fruit, divided into two parts, containing one oblong hairy ſeed. The ſeeds have a warm biting taſte, with an agreeable aromatic ſmell. They are kept in the ſhops as a medicine, are carminative, and ſaid to be diuretic; but are little uſed in practice. The plant may be propagated from ſeeds, which ſhould be ſown on an open bed of light dry ground; the following autumn the plants ſhould be taken up, and planted at about a foot diſtance in a bed of light ſandy earth, where the roots will continue ſeveral years.

ATHANASIA, GOLDILOCKS: A genus of the polygamia æqualis order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ diſcoides*. The receptacle is chaffy; the pappus is chaffy, and very ſhort; and the calyx is imbricated. There are 20 ſpecies, all tender plants except one; and none of them poſſeſſed of beauty, or any remarkable property.

ATHANASIAN CREED; a formulary, or confeſſion of faith, long ſuppoſed to have been drawn up by Athanaſius biſhop of Alexandria, in the fourth century, to juſtify himſelf againſt the calumnies of his Arian enemies. But it is now generally allowed among the learned not to have been his. Dr Waterland aſcribes it to Hilary biſhop of Arles, for the following among other reaſons: 1. Becauſe Honoratus of Marſeilles, the writer of his life, tells us, that he compoſed an *Expoſition of the Creed*: a properer title for the *Athanaſian*, than that of *Creed* ſimply which it now bears. 2. Hilary was a great admirer and follower of St Auſtin; and the whole compoſition of this creed is in a manner upon St Auſtin's plan, both with reſpect to the Trinity and incarnation. 3. It is agreeable to the ſtyle of Hilary, as far as we can judge from the little that is left of his works. Upon the whole, he concludes, that Hilary biſhop of Arles, about the year 430, compoſed *The Expoſition of Faith*, which now bears the name of the *Athanaſian Creed*, for the uſe of the Gallican clergy, and particularly thoſe of the dioceſe of Arles: That, about the year 570, it became famous enough to be commented upon; but that all this while, and for ſeveral years lower, it had not yet acquired the name of *Athanaſian*, but was ſimply ſtyled *The Catholic Faith*: That, before 670, Athanaſius's admired name came in to recommend and adorn it, being in itſelf an excellent ſyſtem of the Athanaſian principles of the Trinity and incarcation, in oppoſition chiefly to the Arians, Macedonians, and Apollinarians. This is the hypotheſis of the learned author of the *Critical Hiſtory of the Athanaſian Creed*.

As to the reception of this creed in the Chriſtian churches, we find, that it obtained in France in the time of Hincmar, or about 850; that it was received in Spain about 100 years later than in France, and in Germany much about the ſame time. As to our own country, we have clear and poſitive proofs of this creed being ſung alternately in our churches in the tenth century. It was in common uſe in ſome parts of Italy, particularly in the dioceſe of Verona, about the year 960, and was received at Rome about the year 1014. As to the Greek and oriental churches, it has been queſtioned whether any of them ever received this creed at all; though ſome very conſiderable writers are of a contrary perſuaſion. It appears then, that the reception of this creed has been both general and ancient; and may vie with any, in that reſpect, except the Nicene, or Conſtantinopolitan, the only general creed common to all the churches.

As to the matter of this creed, it is given as a ſummary of the true orthodox faith, and a condemnation of all hereſies ancient and modern. Unhappily, however, it has proved a fruitful ſource of unprofitable controverſy and unchriſtian animoſity even down to the preſent time.

ATHANASIUS (St), biſhop of Alexandria, and one of the greateſt defenders of the faith againſt the Arians, was born in Egypt. He followed St Alexander to the council of Nice, in 325, where he diſputed againſt Arius, and the following year was made biſhop of Alexandria; but, in 335, was depoſed by the council of Tyre: when, having recourſe to the emperor Conſtantine, the Arian deputies accuſed him of having hindered the exportation of corn from Alexandria to Conſtantinople; on which the emperor, without ſuffering him to make his defence, baniſhed him to Treves. The emperor, two years after, gave orders that he ſhould be reſtored to his biſhopric: but, on his return to Alexandria, his enemies brought freſh accuſations againſt him, and choſe Gregory of Cappadocia to his ſee; which obliged Athanaſius to go to Rome to reclaim it of Pope Julius. He was there declared innocent, in a council held in 342, and in that of Sardica in 347, and two years after was reſtored to his ſee by order of the emperor Conſtans; but after the death of that prince, he was again baniſhed by the emperor Conſtantius, which obliged him to retire into the deſerts. The Arians then elected one George in his room; who being killed in a popular ſedition under Julian in 360, St Athanaſius returned to Alexandria, but was again baniſhed under Julian, and reſtored to his ſee under Jovian. He addreſſed to that emperor a letter, in which he propoſed that the Nicene creed ſhould be the ſtandard of the orthodox faith, and condemned thoſe who denied the divinity of the Holy Ghoſt. He was alſo baniſhed by Valens in 367, and afterwards recalled. St Athanaſius died on the 2d of May 373.

His works principally contain a defence of the myſtery of the Trinity, and of the incarnation and divinity of the Word and Holy Spirit. There are three editions of his works which are eſteemed; that of Commelin, printed in 1600; that of Peter Nannius, in 1627; and that of father Montfaucon. As to the creed which bears his name, ſee the preceding article.

ATHANATI, in Perſian antiquity, a body of cavalry, conſiſting of 10,000 men, always complete. They were called *athanati* (a word originally Greek, and ſignifying *immortal*), becauſe, when one of them happened to die, another was immediately appointed to ſucceed him.

ATHANOR. Chemiſts have diſtinguiſhed by this name a furnace ſo conſtructed that it can always maintain an equal heat, and which ſhall laſt a long time without addition of freſh fuel.

The body of the athanor has nothing in it particular, and is conſtructed like ordinary furnaces. But at one of its ſides, or its middle, there is an upright hollow tower, which communicates with the fire-place by one or more ſloping openings. This tower ought to have a lid which exactly cloſes its upper opening.

When the athanor is to be uſed, as much lighted coal is put in the fire-place as is judged neceſſary, and the tower is filled to the top with unlighted fuel. The tower is then to be exactly cloſed with its lid. As faſt as the coal in the fire-place is conſumed, that in the tower falls down and ſupplies its place. As the coal contained in the tower has no free communication with the external air, it cannot burn till it falls into the fire-place.

The athanor being much celebrated and uſed by ancient chemiſts, it has been particularly deſcribed by many authors, and was formerly found in all laboratories. At preſent this furnace is much leſs employed, and is even neglected. The reaſon of this is, that all the ancient chemiſts were in ſearch of the art of making gold; and being excited by this powerful deſire, and confidence of ſucceſs, they ſpared no trouble nor expence to accompliſh this deſign. They undertook, without heſitation, operations which required great length of time and unremitted heat. Whereas now, theſe alluring hopes having vaniſhed, the cultivators of chemiſtry have no other view than to extend and perfect the theory of this eſſential part of natural philoſophy. This motive, although undoubtedly much nobler than the former, ſeems, however, to be leſs powerful over moſt men. For now, all long and laborious operations whence chemiſtry might receive great advantages, are neglected, as being tireſome and diſguſtful. There is, in fact, a conſiderable difference betwixt the hope of explaining a philoſophical phenomenon, and that of obtaining an ingot of gold capable of producing many others. Hence the inſtruments employed in long operations, and particularly the athanor, are now much neglected; and alſo becauſe the fuel in the tower is apt to ſtick there or fall down at once in too great quantity. The lamp-furnace, which is a true athanor, may be ſucceſsfully employed in operations which do not require much heat.

ATHAROTH, or ATROTH, (anc. geog.) the name of ſeveral towns. Two appear to have been in Samaria, in the tribe of Ephraim; the one four miles to the north of Sebaſte, or the city of Samaria; the other in the confines of Benjamin and Ephraim, yet ſo as to be of the reſort of Ephraim rather than of Benjamin (Joſhua). This is the *Atroth-Addar* mentioned Joſhua xvi. 5. from which to Upper Beth-horon extends the greateſt breadth of the tribe of Ephraim.

ATHEISM, the diſbelief of a Deity. See ATHEIST.

ATHEIST, a perſon who does not believe the exiſtence of a Deity. Many people, both ancient and modern, have pretended to atheiſm, or have been reckoned atheiſts by the world; but it is juſtly queſtioned whether any man ſeriouſly adopted ſuch a principle. Theſe pretenſions, therefore, muſt be founded on pride or affectation.

Atheiſm, as abſurd and unreaſonable as it is, has had its martyrs. Lucilio Vanini, an Italian, native of Naples, publicly taught atheiſm in France, about the beginning of the 16th century; and, being convicted of it at Tolouſe, was condemned to death. Being preſſed to make public acknowledgement of his crime, and to aſk pardon of God, the king, and juſtice, he anſwered, he did not believe there was a God; that he never offended the king; and, as for juſtice, he wiſhed it to the devil. He confeſſed that he was one of twelve, who parted in company from Naples to ſpread their doctrine in all parts of Europe. His tongue was firſt cut out, and then his body burnt, April 9. 1619.

Cicero repreſents it as a probable opinion, that they who apply themſelves to the ſtudy of philoſophy believe there are no gods. This muſt, doubtleſs, be meant of the academic philoſophy, to which Cicero himſelf was attached, and which doubted of every thing. On the contrary, the Newtonian philoſophers are continually recurring to a Deity, whom they always find at the end of their chain of natural cauſes. Some foreigners have even charged them with making too much uſe of the notion of a God in philoſophy, contrary to the rule of Horace:

> *Nec Deus interſit, niſi dignus vindici nodus.*

Among us, the philoſophers have been the principal advocates for the exiſtence of a Deity. Witneſs the writings of Sir Iſaac Newton, Boyle, Ray, Cheyne, Nieuwentyt, &c. To which may be added many others, who, though of the clergy (as was alſo Ray), yet have diſtinguiſhed themſelves by their philoſophical pieces in behalf of the exiſtence of a God; *e. gr.* Derham, Bentley, Whiſton, Samuel and John Clarke, Fenelon, &c. So true is that ſaying of Lord Bacon, that though a ſmattering of philoſophy may lead a man into atheiſm, a deep draught will certainly bring him back again to the belief of a God and Providence.

ATHELING, ADELING, EDLING, ETHLING, or ETHELING, among the Anglo-Saxons, was a title of honour, properly belonging to the heir-apparent, or preſumptive, to the crown. This honourable appellation was firſt conferred by king Edward the Confeſſor on Edgar, to whom he was great uncle, when, being without any iſſue of his own, he intended to make him his heir.

ATHELSTAN, a Saxon king of England, natural ſon of Edward the elder, and grandſon of the great Alfred. He ſucceeded to the crown in 925, and reigned 16 years. There was a remarkable law paſſed by this prince, which ſhows his juſt ſentiments of the advantages of commerce, as well as the early attention to it in this country: it declared, that any merchant who made three voyages on his own account beyond the Britiſh channel or narrow ſeas, ſhould be intitled to the privilege of a thane, or gentleman.

ATHENÆA, in antiquity, a feaſt celebrated by the ancient Greeks in honour of Minerva, who was called *Athene*.

ATHENÆUM, in antiquity, a public place wherein the profeſſors of the liberal arts held their aſſemblies, the rhetoricians declaimed, and the poets rehearſed their performances. Theſe places, of which there were a great number at Athens, were built in the manner of amphitheatres, encompaſſed with ſeats, called *cunei*. The three moſt celebrated Athenæa were thoſe at Athens, at Rome, and at Lyons, the ſecond of which was built by the emperor Adrian.

ATHENÆUS, a phyſician, born in Cilicia, cotemporary with Pliny, and founder of the pneumatic ſect. He taught that the fire, air, water, and earth, are not the true elements, but that their qualities are, viz. heat, cold, moiſture, and dryneſs; and to theſe he added a fifth element, which he called *ſpirit*, whence his ſect had its name.

ATHENÆUS, a Greek grammarian, born at Naucratis in Egypt in the 3d century, one of the moſt learned men of his time. Of all his works we have none extant but his Deipnoſophis, *i. e.* the ſophiſts at table; there is an infinity of facts and quotations in this work which render it very agreeable to admirers of antiquity.

There was alſo a mathematician of this name, who wrote a treatiſe on mechanics, which is inſerted in the works of the ancient mathematicians, printed at Paris in 1693, in folio, in Greek and Latin.

ATHENAGORAS, an Athenian philoſopher, flouriſhed about the middle of the 2d century; and was remarkable for his zeal for Chriſtianity, and his great learning, as appears from the apology which he addreſſed to the emperors Marcus Aurelius Antoninus and Lucius Commodus.

ATHENODORUS, a famous ſtoic philoſopher, born at Tarſus, went to the court of Auguſtus, and was made by him tutor to Tiberius. Auguſtus had a great eſteem for him, and found him by experience a man of virtue and probity. He uſed to ſpeak very freely to the emperor. He, before he left the court to return home, warned the emperor not to give himſelf up to anger, but, whenever he ſhould be in a paſſion, to rehearſe the 24 letters of the alphabet before he reſolved to ſay or do any thing. He did not live to ſee his bad ſucceſs in the education of Tiberius.

ATHENOPOLIS, a town of the Maſſilienſes, an ancient nation of Gaul. It is conjectured by Harduin to be the ſame with *Telo Martius*, now *Toulon*; by others to be the ſame with *Antipolis* or *Antibes*.

ATHENREE, a town of Ireland in the county of Galway, and province of Connaught. W. Long. 8.5. N. Lat. 53. 14. It is governed by a portrieve, and hath a barrack for three companies of foot. It hath been a place of conſiderable ſtrength; but, like the numerous churches and caſtles which ſurround it, has felt the reſiſtleſs force of time. Some of the walls and towers, however, are ſtill remaining, as monuments of its former grandeur.

ATHENS, a celebrated city of Greece, and capital of the ancient kingdom of Attica, ſituated in E. Long. 53. N. Lat. 38. 5. See ATTICA.

1 By whom founded.

In early times, that which was afterwards called the *citadel* was the whole city; and went under the name of *Cecropia*, from its founder Cecrops, whom the Athenians in after times affirmed to have been the firſt builder of cities, and called this therefore by way of eminence *Polis*, i. e. the city. In the reign of Erichthonius it loſt the name of *Cecropia*, and acquired that of *Athens*, on what account is not certain; the moſt probable is, that it was ſo named in reſpect to the goddeſs Minerva, whom the Greeks call *Athene*, who was alſo eſteemed its protectreſs. This old city was ſeated on the top of a rock in the midſt of a large and pleaſant plain, which, as the number of inhabitants increaſed, became full of buildings, which induced the diſtinction of Acro and Catapolis, *i. e.* of the upper and lower city. The extent of the citadel was 60 ſtadia; it was ſurrounded by olive trees, and fortified, as ſome ſay, with a ſtrong paliſade; in ſucceeding times it was encompaſſed with a ſtrong wall, in which there were nine gates, one very large one, and the reſt ſmall. The inſide of the citadel was adorned with innumerable edifices. The moſt remarkable of which were, 1. The magnificent temple of Minerva, ſtyled *parthenion*, becauſe that goddeſs was a virgin. The Perſians deſtroyed it; but it was rebuilt with ſtill greater ſplendor by the famous Pericles, all of the fineſt marble, with ſuch ſkill and ſtrength, that, in ſpite of the rage of time and barbarous nations, it remains perhaps the firſt antiquity in the world, and ſtands a witneſs to the truth of what ancient writers have recorded of the prodigious magnificence of Athens in her flouriſhing ſtate. 2. The temple of Neptune and of Minerva; for it was divided into two parts: one ſacred to the god, in which was the ſalt fountain ſaid to have ſprung upon the ſtroke of his trident; the other to the goddeſs protectreſs of Athens, wherein was the ſacred olive which ſhe produced, and her image which fell down from heaven in the reign of Erichthonius. At the back of Minerva's temple was the public treaſury, which was burnt to the ground through the knavery of the treaſurers, who, having miſapplied the revenues of the ſtate, took this ſhort method of making up accounts.

2 Remarkable buildings.

The lower city comprehended all the buildings ſurrounding the citadel, the fort Munychia, and the havens Phalerum and Piræus, the latter of which was joined to the city by walls five miles in length; that on the north was built by Pericles, but that on the ſouth by Themiſtocles; but by degrees the turrets which were at firſt erected on thoſe walls were turned into dwelling-houſes for the accommodation of the Athenians, whoſe large city was now become too ſmall for them. The city, or rather the lower city, had 13 great gates, with the names of which it is not neceſſary to trouble the reader. Among the principal edifices which adorned it, we may reckon, 1. The temple of Theſeus, erected by Conon, near its centre. Adjacent thereto, the young people performed their exerciſes. It was alſo a ſanctuary for diſtreſſed perſons, ſlaves or free. 2. The Olympian temple erected in honour of Jupiter, the honour of Athens, and of all Greece. The foundation of it was laid by Piſiſtratus: it was carried on but ſlowly in ſucceeding times, 700 years elapſing before it was finiſhed, which happened under the reign of Adrian, who was particularly kind to Athens: this was the firſt building in which the Athenians beheld pillars. 3. The pantheon, dedicated to all the gods; a moſt noble ſtructure, ſupported by 120 marble pillars, and having over its great gate two horſes carved by Praxiteles: it is yet remaining, as we ſhall have occaſion to ſhow hereafter when we come to ſpeak of the preſent ſtate of this famous city. In ſeveral parts of it were *ſtaoi* or porticos, wherein people walked in rainy weather, and from whence a ſect of philoſophers were denominated *ſtoics*, becauſe their maſter Zeno taught in thoſe porticos.

3 Ceramicus.

There were at Athens two places called *Ceramicus*, from Ceramus the ſon of Bacchus and Ariadne; one within the city, containing a multitude of buildings of all ſorts; the other in the ſuburbs, in which was the academy and other edifices. The Gymnaſia of Athens were many; but the moſt remarkable were the Lyceum, Academia, and Cynoſarges. The Lyceum ſtood on the banks of Iliſſus; ſome ſay it was built by Piſiſtratus, others by Pericles, others by Lycurgus. Here Ariſtotle taught philoſophy, inſtructing ſuch as came to hear him as they walked, whence his diſciples are generally thought to derive the name of *peripatetics*. The ceramicus without the city was the diſtance of ſix ſtadia from its walls. The academy made part thereof; as to the name of which there is ſome diſpute. Some affirm that it was ſo called from Academus, an ancient hero, who, when Helen was ſtolen by Theſeus, diſcovered the place where ſhe lay hid to Caſtor and Pollux: for which reaſon the Lacedemonians, when they invaded Attica always ſpared this place. Dicæarchus writes, that Caſtor and Pollux had two Arcadians in their army, the one named *Echedemus*, the other *Marothus*; from the former of theſe he ſays this place took its name, and that the borough of Marathon was ſo called from the other. It was a marſhy unwholeſome place, till Cimon was at great pains to have it drained; and then it became extremely pleaſant and delightful, being adorned with ſhady walks, where Plato read his lectures, and from thence his ſcholars were ſtyled *academics*.

4 Cynoſarges

The Cynoſarges was a place in the ſuburbs not far from the Lyceum: it was famous on many accounts; but particularly for a noble gymnaſium erected there, appointed for the ſpecial uſe of ſuch as were Athenians only by one ſide. In after times Themiſtocles derived to himſelf ill-will, by carrying many of the nobility to exerciſe with him here, becauſe, being but of the half blood, he could exerciſe no where elſe but in this gymnaſium. Anthiſthenes inſtituted a ſect of philoſophers, who from the name of this diſtrict, as many think, were ſtyled *Cynics*.

5 Havens.

The havens of Athens were three. Firſt the Pyræus, which was diſtant about 35 or 40 ſtadia from the city, till joined thereto by the long walls beforementioned, after which it became the principal harbour of the city. It had three docks; Cantharos, Aphrodiſium, and Zea: the firſt was ſo called from an ancient hero, the ſecond from the goddeſs Venus who had there two temples, and the third from bread-corn. There were in this port five porticos, which joining together formed one great one called from thence *Macra Stoa*, or the grand portico. There were likewiſe two great markets or fora; one near the long portico, the other near the city. The ſecond port was Munichia, a promontory not far diſtant from Pyræus; a place very ſtrong by nature, and afterwards rendered far ſtronger by art. It was of this that Epimenides ſaid, if the Athenians foreſaw what miſchief it would one day produce to them, they would eat it away with their teeth. The third was Phalerum, diſtant from the city, according to Thucydides 35 ſtadia, but according to Pauſanias only 20. This was the moſt ancient harbour of Athens, as Pyræus was the moſt capacious.

6 Preſent ſtate.

Of this city, as it ſtands at preſent, we have the following account by Dr Chandler. "It is now called *Athini*; and is not inconſiderable, either in extent or the number of inhabitants. It enjoys a fine temperature, and ſerene ſky. The air is clear and wholeſome, though not ſo delicately ſoft as in Ionia. The town ſtands beneath the Archopolis or citadel; not encompaſſing the rock as formerly, but ſpreading into the plain, chiefly on the weſt and north-weſt. Corſairs infeſting it, the avenues were ſecured, and in 1676 the gates were regularly ſhut after ſunſet. It is now open again; but ſeveral of the gateways remain, and a guard of Turks patrols at midnight. Some maſſes of brick work, ſtanding ſeparate, without the town, belonged perhaps to the ancient wall, of which other traces alſo appear. The houſes are moſtly mean and ſtraggling; many with large areas or courts before them. In the lanes, the high walls on each ſide, which are commonly whitewaſhed, reflect ſtrongly the heat of the ſun. The ſtreets are very irregular; and anciently were neither uniform nor handſome. They have water conveyed in channels from mount Hymettus, and in the bazar or market-place is a large fountain. The Turks have ſeveral moſques and public baths. The Greeks have convents for men and women; with many churches, in which ſervice is regularly performed; and beſides theſe, they have numerous oratories or chapels, ſome in ruins or conſiſting of bare walls, frequented only on the anniverſaries of the ſaints to whom they are dedicated. A portrait of the owner on a board is placed in them on that occaſion, and removed when the ſolemnity of the day is over.

7 Citadel, or city of Cecrops.

"The city of Cecrops is now a fortreſs with a thick irregular wall, ſtanding on the brink of precipices, and incloſing a large area about twice as long as broad. Some portions of the ancient wall may be diſcovered on the outſide, particularly at the two extreme angles; and in many places it is patched with pieces of columns, and with marbles taken from the ruins. A conſiderable ſum had been recently expended on the ſide next Hymettus, which was finiſhed before we arrived. The ſcaffolding had been removed to the end toward Pentele; but money was wanting, and the workmen were withdrawn. The garriſon conſiſts of a few Turks, who reſide there with their families, and are called by the Greeks *Caſtriani*, or the ſoldiers of the caſtle. The rock is lofty, abrupt, and inacceſſible, except the front, which is towards the Piræus; and on that quarter is a mountainous ridge, within cannon-ſhot. It is deſtitute of water fit for drinking; and ſupplies are daily carried up in earthen jars, on horſes and aſſes, from one of the conduits in the town.

"The acropolis furniſhed a very ample field to the ancient virtuoſi. It was filled with monuments of Athenian glory, and exhibited an amazing diſplay of beauty, of opulence, and of art; each contending as it were for the ſuperiority. It appeared as one entire offering to the Deity, ſurpaſſing in excellence and aſtoniſhing in richneſs. Heliodorus, named Periegetes *the guide*, had employed on it 15 books. The curioſities of various kinds, with the pictures, ſtatues, and pieces of ſculpture, were ſo many and ſo remarkable, as to ſupply Polemo Periegetes with matter for four volumes; and Strabo affirms, that as many would be required in treating of other portions of Athens and of Attica. In particular, the number of ſtatues was prodigious. Tiberius Nero, who was fond of images, plundered the acropolis as well as Delphi and Olympia; yet Athens, and each of theſe places, had not fewer than 3000 remaining in the time of Pliny. Even Pauſanias ſeems here to be diſtreſſed by the multiplicity of his ſubject. But this banquet, as it were, of the ſenſes has long been withdrawn; and is now become like the tale of a viſion. The ſpectator views with concern the marble ruins intermixed with mean flat-roofed cottages, and extant amid rubbiſh; the ſad memorials of a nobler people; which, however, as viſible from the ſea, ſhould have introduced modern Athens

thens to more early notice. They who reported it was only a ſmall village, muſt, it has been ſurmiſed, have beheld the acropolis through the wrong end of their teleſcopes.

“ The acropolis has now, as formerly, only one entrance, which fronts the Piræus. The aſcent is by traverſes and rude fortifications furniſhed with cannon, but without carriages, and neglected. By the ſecond gate is the ſtation of the guard, who ſits croſs-legged under cover, much at his eaſe, ſmoking his pipe, or drinking coffee, with his companions about him in like attitudes. Over this gate-way is an inſcription in large characters on a ſtone turned upſide down, and black from the fires made below. It records a preſent of a pair of gates.

8 Propyléa.

“ Going farther up, you come to the ruins of the propyléa, an edifice which graced the entrance into the citadel. This was one of the ſtructures of Pericles, who began it when Euthymenes was archon, 435 years before Chriſt. It was completed in five years, at the expence of 2012 talents. It was of marble, of the Doric order, and had five doors to afford an eaſy paſſage to the mulitudes which reſorted on buſineſs or devotion to the acropolis.

“ While this fabric was building, the architect Mneſicles, whoſe activity equalled his ſkill, was hurt by a fall, and the phyſicians deſpaired of his life; but Minerva, who was propitious to the undertaking, appeared, it was ſaid, to Pericles, and preſcribed a remedy, by which he was ſpeedily and eaſily cured. It was a plant or herb growing round about the acropolis, and called afterwards *parthenium*.

9 Temple of Victory.

“ The right wing of the propyléa was a temple of Victory. They related that Ægeus had ſtood there, viewing the ſea, and anxious for the return of his ſon Theſeus, who was gone to Crete with the tributary children to be delivered to the Minotaur. The veſſel which carried them had black ſails ſuiting the occaſion of its voyage; and, it was agreed, that, if Theſeus overcame the enemy, their colour ſhould be changed to white. The neglect of this ſignal was fatal to Ægeus, who, on ſeeing the ſails unaltered, threw himſelf down headlong from the rock, and periſhed. The idol was named *Victory without wings*; it was ſaid, becauſe the news of the ſucceſs of Theſeus did not arrive but with the conqueror. It had a pomegranate in the right hand, and an helmet in the left. As the ſtatue was without pinions, it was hoped the goddeſs would remain forever on the ſpot.

“ On the left wing of the propyléa, and fronting the temple of Victory, was a building decorated with paintings by Polygnotus, of which an account is given by Pauſanias. This edifice, as well as the temple, was of the Doric order, the columns fluted, and without baſes. Both contributed alike to the uniformity and grandeur of the deſign; and the whole fabric, when finiſhed, was deemed equally magnificent and ornamental. The interval between Pericles and Pauſanias conſiſts of ſeveral centuries. The propyléa remained entire in the time of this topographer; and, as will be ſhown, continued nearly ſo to a much later period. It had then a roof of white marble, which was unſurpaſſed either in the ſize of the ſtones or in the beauty of their arrangement; and before each wing was an equeſtrian ſtatue.

“ The propyléa have ceaſed to be the entrance of the acropolis. The paſſage, which was between the columns in the centre, is walled up almoſt to their capitals, and above is a battery of cannon. The way now winds before the front of the ancient ſtructure; and turning to the left hand among rubbiſh and mean walls, you come to the back part, and to the five door-ways. The ſoil without is riſen higher than the top of the two ſmaller. There, under the vault and cannon, lies an heap of large ſtones, the ruin of the roof.

“ The temple of Victory, ſtanding on an abrupt rock, has its back and one ſide encumbered with the modern ramparts. The columns in the front being walled up, you enter it by a breach in the ſide, within the propyléa. It was uſed by the Turks as a magazine for powder, until about the year 1656, when a ſudden exploſion, occaſioned by lightning, carried away the roof, with a houſe erected on it, belonging to the officer who commanded in the acropolis, whoſe family, except a girl, periſhed. The women of the Aga continued to inhabit in this quarter, but it is now abandoned and in ruins.

10 Roof carried off by an exploſion.

“ The cell of the temple of Victory, which is of white marble, very thick, and ſtrongly cemented, ſufficiently witneſſes the great violence it has undergone; the ſtones in many places being disjointed, as it were, and forced from their original poſition. Two of theſe making an acute angle, the exterior edges touching, without a crevice; and the light abroad being much ſtronger than in the room, which has a modern roof and is dark; the portion in contact becoming pellucid, had illumined the vacant ſpace with a dim colour reſembling that of amber. We were deſired to examine this extraordinary appearance, which the Greeks regarded as a ſtanding miracle, and which the Turks, who could not confute them, beheld with equal aſtoniſhment. We found in the gape ſome coals, which had been brought on a bit of earthen ware for the purpoſe of burning incenſe, as we ſuppoſed, and alſo a piece of wax-taper, which probably had been lighted in honour of the ſaint and author of the wonder; but our Swiſs unfortunately carrying his own candle too far in, the ſmoke blackened the marble, and deſtroyed the phenomenon.

“ The building oppoſite to the temple has ſerved as a foundation for a ſquare lofty tower of ordinary maſonry. The columns of the front are walled up; and the entrance is by a low iron gate in the ſide. It is now uſed as a place of confinement for delinquents; but in 1676 was a powder magazine. In the wall of a rampart near it are ſome fragments of exquiſite ſculpture, repreſenting the Athenians fighting with the Amazons. Theſe belong to the freeze, which was then ſtanding. In the ſecond century, when Pauſanias lived, much of the painting was impaired by age, but ſome remained, and the ſubjects were chiefly taken from the Trojan ſtory. The traces are ſince vaniſhed.

“ The pediment of the temple of Victory, with that of the oppoſite wing, is deſcribed as remaining in 1676, but on each building a ſquare tower had been erected. One of the ſteps in the front of the propyléa was entire, with the four columns, their entablature and the pediment. The portico, to which the five door-ways belonged, conſiſted of a large ſquare room, roofed ed with ſlabs of marble, which were laid on two great marble beams, and ſuſtained by four beautiful columns. Theſe were Ionic, the proportions of this order beſt ſuiting that purpoſe, as taller than the Doric; the reaſon it was likewiſe preferred in the pronaos of the temple of Victory. The roof of the propyléa, after ſtanding above 2000 years, was probably deſtroyed, with all the pediments, by the Venetians in 1687, when they battered the caſtle in front, firing red-hot bullets, and took it, but were compelled to reſign it again to the Turks in the following year. The exterior walls, and in particular, a ſide of the temple of Victory, retain many marks of their hoſtilities.

11 Temple of Minerva.

“ The chief ornament of the acropolis was the parthenion or great temple of Minerva, a moſt ſuperb and magnificent fabric. The Perſians had burned the edifice, which before occupied the ſite, and was called *hecatompedon*, from its being 100 feet ſquare. The zeal of Pericles and of all the Athenians was exerted in providing a far more ample and glorious reſidence for their favourite goddeſs. The architects were Callicrates and Ictinus; and a treatiſe on the building was written by the latter and Carpion. It was of white marble, of the Doric order, the columns fluted and without baſes, the number in front eight: and adorned with admirable ſculpture. The ſtory of the birth of Minerva was carved in the front pediment; and in the back, her conteſt with Neptune for the country. The beaſts of burden, which had conveyed up the materials, were regarded as ſacred, and recompenſed with paſtures; and one, which had voluntarily headed the train, was maintained during life, without labour, at the public expence.

12 Her ſtatue.

“ The ſtatue of Minerva, made for this temple by Phidias, was of ivory, 26 cubits or 39 feet high. It was decked with pure gold to the amount of 44 talents, ſo diſpoſed by the advice of Pericles as to be taken off and weighed if required. The goddeſs was repreſented ſtanding, with her veſtment reaching to her feet. Her helmet had a ſphinx for the creſt, and on the ſides were griffins. The head of Meduſa was on her breaſt-plate. In one hand ſhe held her ſpear, and in the other ſupported an image of Victory about four cubits high. The battle of the Centaurs and Lapithæ was carved on her ſandals; and on her ſhield, which lay at her feet, the war of the gods and giants, and the battle of the Athenians and Amazons. By her ſpear was a ſerpent, in alluſion to the ſtory of Erichthonius; and on the pedeſtal, the birth of Pandora. The Sphinx, the Victory, and Serpent, were accounted eminently wonderful. This image was placed in the temple in the firſt year of the 87th Olympiad, in which the Peloponneſian war began. The gold was ſtripped off by the tyrant Lachares, when Demetrius Poliorcetes compelled him to fly. The ſame plunderer plucked down the golden ſhields in the acropolis, and carried away the golden Victories, with the precious veſſels and ornaments provided for the Panathenæan feſtival.

“ The parthenion remained entire for many ages after it was deprived of the goddeſs. The Chriſtians converted it into a church, and the Mahometans into a moſque. It is mentioned in the letters of Cruſius, and miſcalled the *pantheon*, and the *temple of the unknown God*. The Venetians under Koningſmark, when they beſieged the acropolis in 1687, threw a bomb, which demoliſhed the roof, and ſetting fire to ſome powder, did much damage to the fabric. The floor, which is indented, ſtill witneſſes the place of its fall. This was the ſad forerunner of farther deſtruction; the Turks, breaking the ſtones, and applying them to the building of a new moſque, which ſtands within the ruin, or to the repairing of their houſes and the walls of the fortreſs. The vaſt pile of ponderous materials, which lay ready, is greatly diminiſhed; the whole ſtructure will gradually be conſumed and diſappear.

13 Temple converted into a moſque.

“ The temple of Minerva in 1676 was, as Wheeler and Spon aſſert, the fineſt moſque in the world, without compariſon. The Greeks had adapted the fabric to their ceremonial by conſtructing at one end a ſemicircular receſs for the holy tables, with a window: for before it was enlightened only by the door, obſcurity being preferred under the heathen ritual, except on feſtivals, when it yielded to ſplendid illuminations; the reaſon, it has been ſurmiſed, why temples are commonly found ſimple and unadorned on the inſides. In the wall beneath the window were inſerted two pieces of the ſtone called *phengites*, a ſpecies of marble diſcovered in Cappadocia in the time of Nero; and ſo tranſparent that he erected with it a temple to Fortune, which was luminous within, when the door was ſhut. Theſe pieces were perforated, and the light which entered was tinged with a reddiſh or yellowiſh hue. The picture of the Panagia or Virgin Mary, in Moſaic, on the ceiling of the receſs, remained; with two jaſper columns belonging to the ſcreen, which had ſeparated that part from the nave; and within, a canopy ſupported by four pillars of porphyry, with Corinthian capitals of white marble, under which the table had been placed; and behind it, beneath the window, a marble chair for the archbiſhop; and alſo a pulpit, ſtanding on four ſmall pillars in the middle aile. The Turks had white-waſhed the walls to obliterate the portraits of ſaints, and the other paintings, with which the Greeks decorate their places of worſhip; and had erected a pulpit on the right hand for their iman or reader. The roof was diſpoſed in ſquare compartments; the ſtones maſſive: and ſome had fallen in. It had been ſuſtained in the pronaos by ſix columns; but the place of one was then ſupplied by a large pile of rude maſonry, the Turks not having been able to fill up the gap more worthily. The roof of the naos was ſupported by colonnades ranging with the door, and on each ſide; conſiſting of 22 pillars below, and of 23 above. The odd one was over the entrance, which by that diſpoſition was left wide and unembarraſſed. In the portico were ſuſpended a few lamps, to be uſed in the moſque at the ſeaſons when the muſſelmans aſſemble before day-break, or to be lighted up round the minaret, as is the cuſtom during their Ramazan or Lent.

14 Magnificent ruin.

“ It is not eaſy to conceive a more ſtriking object than the parthenion, though now a mere ruin. The columns within the naos have all been removed: but on the floor may be ſeen the circles which directed the workmen in placing them; and at the farther end is a groove acroſs it, as for one of the partitions of the cell. The receſs erected by the Chriſtians is demoliſhed; and from the rubbiſh of the ceiling the Turkiſh boys collect bits of the Moſaic, of different colours, which compoſed the picture. We are told at Smyrna, that this ſubſtance had taken a poliſh, and been ſet in buckles. This cell is about half demoliſhed; and in the columns which ſurround it, is a large gap near the middle. On the walls are ſome traces of the paintings. Before the portico is a reſervoir ſunk in the rock, to ſupply the Turks with water for the purifications cuſtomary on entering their moſques. In it, on the left hand, is the rubbiſh of the pile erected to ſupply the place of a column; and on the right, a ſtaircaſe, which leads out on the architrave, and has a marble or two with inſcriptions, but worn ſo as not to be legible. It belonged to the minaret, which has been deſtroyed.

15 Sculptures. “ The travellers, to whom we are indebted for an account of the moſque, have likewiſe given a deſcription of the ſculpture then remaining in the front. In the middle of the pediment was ſeen a bearded Jupiter, with a majeſtic countenance, ſtanding, and naked; the right arm broken. The thunderbolt, it has been ſuppoſed, was placed in that hand, and the eagle between his feet. On his right was a figure, it is conjectured, of Victory, clothed to the mid-leg; the head and arms gone. This was leading on the horſes of a car, in which Minerva ſat, young and unarmed; her head-dreſs, inſtead of a helmet, reſembling that of a Venus. The generous ardour and lively ſpirit viſible in this pair of celeſtial ſteeds, was ſuch as beſpoke the hand of a maſter, bold and delicate, of a Phidias or Praxiteles. Behind Minerva was a female figure, without a head, ſitting, with an infant in her lap; and in this angle of the pediment was the emperor Hadrian with his arm round Sabina, both reclining, and ſeeming to regard Minerva with pleaſure. On the left ſide of Jupiter were five or ſix other trunks to complete the aſſembly of deities, into which he received her. Theſe figures were all wonderfully carved, and appeared as big as life. Hadrian and his conſort, it is likely, were complimented by the Athenians with places among the marble gods in the pediment, as benefactors. Both of them may be conſidered as intruders on the original company; and poſſibly their heads were placed on trunks, which before had other owners. They ſtill poſſeſs their corner, and are eaſy to be recogniſed, though not unimpaired. The reſt of the ſtatues are defaced, removed, or fallen. Moroſini was ambitious to enrich Vence with the ſpoils of Athens; and by an attempt to take down the principal group, haſtened their ruin. In the other pediment is a head or two of ſea-horſes finely executed, with ſome mutilated figures; and on the architrave beneath them are marks of the fixtures of votive offerings, perhaps of the golden ſhields, or of feſtoons ſuſpended on ſolemn occaſions, when the temple was dreſſed out to receive the votaries of the goddeſs.

16 Erecthéum. “ Neptune and Minerva, once rival deities, were joint and amicable tenants of the Erecthéum, in which was an altar of Oblivion. The building was double, a partition-wall dividing it into two temples, which fronted different ways. One was the temple of Neptune Erectheus, the other of Minerva Polias. The latter was entered by a ſquare portico connected with a marble ſkreen, which fronts towards the propyléa. The door of the cell was on the left hand; and at the farther end of the paſſage was a door leading down into the Pandroſéum, which was contiguous.

17 Temple of Neptune Erectheus. “ Before the temple of Neptune Erectheus was an altar of Jupiter *the ſupreme*, on which no living thing was ſacrificed, but they offered cakes without wine. Within it was the altar of Neptune and Erectheus; and two, belonging to Vulcan and a hero named *Butes*, who had tranſmitted the prieſthood to his poſterity, which were called *Butadæ*. On the walls were paintings of this illuſtrious family, from which the prieſteſs of Minerva Polias was alſo taken. It was aſſerted that Neptune had ordained the well of ſalt water, and the figure of a trident in the rock, to be memorials of his contending for the country. The former, Pauſanias remarks, was no great wonder, for other wells of a ſimilar nature were found inland; but this, when the ſouth wind blew, afforded the ſound of waves.

18 Of Minerva Polias. “ The temple of Minerva Polias was dedicated by all Attica, and poſſeſſed the moſt ancient ſtatue of the goddeſs. The demi or towns had other deities, but their zeal for her ſuffered no diminution. The image, which they placed in the acropolis, then the city, was in after ages not only reputed conſummately holy, but believed to have fallen down from heaven in the reign of Erichthonius. It was guarded by a large ſerpent, which was regularly ſerved with offerings of honied cakes for his food. This divine reptile was of great ſagacity, and attained to an extraordinary age. He wiſely withdrew from the temple, when in danger from the Medes; and, it is ſaid, was living in the ſecond century. Before this ſtatue was an owl; and a golden lamp. This continued burning day and night. It was contrived by a curious artiſt, named *Callimachus*, and did not require to be repleniſhed with oil oftener than once a-year. A brazen palm-tree, reaching to the roof, received its ſmoke. Ariſtion had let the holy flame expire while Sylla beſieged him, and was abhorred for his impiety. The original olive-tree, ſaid to have been produced by Minerva, was kept in this temple. When the Medes ſet fire to the acropolis, it was conſumed; but, they aſſerted, on the following day, was found to have ſhot up again as much as a cubit. It grew low and crooked, but was eſteemed very holy. The prieſteſs of Minerva was not allowed to eat of the new cheeſe of Attica; and, among her perquiſites, was a meaſure of wheat, and one of barley, for every birth and burial. This temple was again burned when Callias was archon, 24 years after the death of Pericles. Near it was the tomb of Cecrops, and within it Erectheus was buried.

“ The ruin of the Erecthéum is of white marble; the architectural ornaments of very exquiſite workmanſhip, and uncommonly curious. The columns of the front of the temple of Neptune are ſtanding with the architrave; and alſo the ſkreen and portico of Minerva Polias, with a portion of the cell retaining traces of the partition-wall. The order is Ionic. An edifice revered by ancient Attica, as holy in the higheſt degree, was in 1676 the dwelling of a Turkiſh family, and is now deſerted and neglected; but many ponderous ſtones and much rubbiſh muſt be removed before the well and trident would appear. The former, at leaſt, might probably be diſcovered. The portico is uſed as a powder-magazine; but we obtained permiſ-

Athens.

ſion to dig and to examine the outſide. The door-way of the veſtibule is walled up, and the ſoil riſen nearly to the top of the door-way of the Pandroſéum. By the portico is a battery commanding the town, from which aſcends an amuſing hum. The Turks fire from it, to give notice of the commencement of Ramazan or of their Lent, and of bairam or the holy-days, and on other public occaſions.

"The pandroſéum is a ſmall, but very particular building, of which no ſatisfactory idea can be communicated by deſcription. The entablature is ſupported by women called *Caryatides*. Their ſtory is thus related. The Greeks, victorious in the Perſian war, jointly deſtroyed Carya, a city of the Peloponneſus, which had favoured the common enemy. They cut off the males, and carried into captivity the women, whom they compelled to retain their former dreſs and ornaments, though in a ſtate of ſervitude. The architects of thoſe times, to perpetuate the memory of their puniſhment, repreſented them, as in this inſtance, each with a burden on her head, one hand uplifted to it; and the other hanging down by her ſide. The images were in number ſix, all looking toward the parthenion. The four in front, with that next to the propyléa, remain, but mutilated, and their faces beſmeared with paint. The ſoil is riſen almoſt to the top of the baſement on which they are placed. This temple was open or latticed between the ſtatues; and in it alſo was a ſtunted olive-tree, with an altar of Jupiter Hercéus ſtanding under it. The propyléa are nearly in a line with the ſpace dividing it from the parthenion; which diſpoſition, beſides its other effects, occaſioned the front and flank of the latter edifice to be ſeen at once by thoſe who approached it from the entrance of the acropolis.

19 Of Jupiter Olympius.

"The ruin of the temple of Jupiter Olympius conſiſts of prodigious columns, tall and beautiful, of the Corinthian order, fluted; ſome ſingle, ſome ſupporting their architraves; with a few maſſive marbles beneath; the remnant of a vaſt heap, which only many ages could have conſumed and reduced into ſo ſcanty a compaſs. The columns are of very extraordinary dimenſions, being about ſix feet in diameter, and near 60 in height. The number without the cell was 116 or 120. Seventeen were ſtanding in 1676: but a few years before we arrived, one was overturned with much difficulty, and applied to the building a new moſque in the bazar or market-place. This violence was avenged by the baſhaw of Negropont, who made it a pretext for extorting from the vaiwode or governor 15 purſes; the pillar being, he alleged, the property of their maſter the Grand Signior. It was an angular column, and of conſequence in determining the dimenſions of the fabric. We regretted that the fall of this mighty maſs had not been poſtponed until we came, as it would have afforded an opportunity of inſpecting and meaſuring ſome members which we found far too lofty to be attempted. On a piece of the architrave, ſupported by a couple of columns, are two parallel walls, of modern maſonry, arched about the middle, and again near the top. You are told it has been the habitation of a hermit, doubtleſs of a Stylites; but of whatever building it has been part, and for whatever purpoſe deſigned, it muſt have been erected thus high in air, while the immenſe ruin of this huge ſtructure was yet ſcarcely diminiſhed, and the heap inclined ſo as to render it acceſſible. It was remarked that two ſtones of a ſtep in the front had coaleſced at the extremity, ſo that no juncture could be perceived; and the like was diſcovered alſo in a ſtep of the parthenion. In both inſtances it may be attributed to a concretory fluid, which pervades the marble in the quarry. Some portion remaining in the pieces, when taken green as it were, and placed in mutual contact, it exſuded and united them by a proceſs ſimilar to that in a bone of an animal when broken and properly ſet.

Athens, Atherina.

20 Detached pieces of antique ſculpture, &c.

"Beſides the more ſtable antiquities, many detached pieces are found in the town, by the fountains, in the ſtreets, the walls, the houſes, and churches. Among theſe are fragments of ſculpture; a marble chair or two, which probably belonged to the Gymnaſia or theatres; a ſun-dial at the catholicon or cathedral, inſcribed with the name of the maker; and, at the archiepiſcopal houſe cloſe by, a very curious veſſel of marble, uſed as a ciſtern to receive water, but once ſerving, it is likely, as a public ſtandard or meaſure. Many columns occur; with ſome maimed ſtatues, and pedeſtals, ſeveral with inſcriptions, and almoſt buried in earth. A cuſtom has prevailed, as at Chios, of fixing in the wall, over the gate-ways and doors of the houſes, carved ſtones, moſt of which exhibit the funeral ſupper. In the courts of the houſes lie many round ſtelæ, or pillars, once placed on the graves of the Athenians; and a great number are ſtill to be ſeen applied to the ſame uſe in the Turkiſh burying grounds before the acropolis. Theſe generally have conciſe inſcriptions containing the name of the perſon, and of the town and tribe to which the deceaſed belonged. Demetrius the Phalerian, who endeavoured to reſtrain ſepulchral luxury, enacted, that no perſon ſhould have more than one, and that the height ſhould not exceed three cubits. Another ſpecies, which reſembles our modern head-ſtones, is ſometimes adorned with ſculpture, and has an epitaph in verſe. We ſaw a few mutilated Hermæ. Theſe were buſts on long quadrangular baſes, the heads frequently of braſs, invented by the Athenians. At firſt they were made to repreſent only Hermes or Mercury, and deſigned as guardians of the ſepulchres in which they were lodged; but afterwards the houſes, ſtreets, and porticos of Athens, were adorned with them, and rendered venerable by a multitude of portraits of illuſtrious men and women, of heroes, and of gods: and, it is related, Hipparchus, ſon of Piſiſtratus, erected them in the demi or burough-towns, and by the road-ſide, inſcribed with moral apophthegms in elegiac verſe; thus making them vehicles of inſtruction."

ATHERINA, in ichthyology, a genus of fiſhes of the order of abdominales. The characters of this genus are theſe: The upper jaw is plain: the rays of the branchioſtege membrane are ſix; and the ſide-belt or line ſhines like ſilver. The ſpecies are two, viz. 1. The hepſetus, with about 12 rays in the fin next the anus. It is found in the Mediterranean. It is alſo very common in the ſea near Southampton, England, where, it is called a *ſmelt*. The higheſt ſeaſon is from March to the latter end of May, or beginning of June; in which month it ſpawns. It never deſerts the place; and is conſtantly taken except in hard froſt. It is alſo found on other coaſts of that iſland. The length is above 4¼ inches, and the tail is much forked. The fiſh is ſemipellucid, covered with ſcales; the colour ſilvery, tinged with yellow: beneath the ſide-line is a row of ſmall black ſpots. 2. The menidea, with 24 rays in the fin next the anus. This is a very ſmall pellucid fiſh, with many black points interſperſed; it has many teeth in the lips, but none in the tongue or jaws. It is found in the freſh waters of Carolina, and ſpawns in April.

ATHEROMA, in ſurgery, a tumor without pain or diſcoloration of the ſkin, containing, in a membranous bag, matter reſembling pap, intermixed with hard and ſtony particles. Theſe tumors are eaſily cured by inciſion.

ATHERTON, or ATHERSTON, a town of Warwickſhire in England, ſituated on the river Stour, in W. Long. 1. 30. N. Lat. 52. 40. It is a conſiderable town, and had formerly a monaſtery; but now is beſt known by its fair, which is the greateſt in England for cheeſe.

ATHESIS (anc. geog.), a river of the Ciſalpine Gaul, which, riſing in the Rhetian Alps, in Mount Brenna, in the county of Tirol, runs ſouthwards and waſhes Tridentum and Verona, which laſt it divides; and after paſſing this, bends its courſe eaſtwards, in a parallel direction with the Po, and falls into the Adriatic between Foſſa Claudia and Philiſtina: it ſeparated the Euganei, an ancient people, from the Veneti. The people dwelling on it are called *Atheſini* (Pliny). Its modern name is the *Adige*.

ATHLETÆ, in antiquity, perſons of ſtrength and agility, diſciplined to perform in the public games. The word is originally Greek, αθλητης; formed from αθλος, *certamen*, "combat;" whence alſo αθλον, the prize or reward adjudged the victor.—Under Athletæ were comprehended wreſtlers, boxers, runners, leapers, throwers of the diſk, and thoſe practiſed in other exerciſes exhibited in the Olympic, Pythian, and other ſolemn ſports; for the conquerors wherein there were eſtabliſhed prizes.

ATHLETIC HABIT, denotes a ſtrong hale conſtitution of body. Anciently it ſignified a full fleſhy corpulent ſtate, ſuch as the athletæ endeavoured to arrive at. The athletic habit is eſteemed the higheſt pitch of health: yet is it dangerous, and the next door to diſeaſe; ſince, when the body is no longer capable of being improved, the next alteration muſt be for the worſe. The chief object of the athletic diet, was to obtain a firm, bulky, weighty body; by force of which, more than art and agility, they frequently overpowered their antagoniſt: hence they fed altogether on dry ſolid, and viſcuous meats. In the earlier days, their chief food was dry figs and cheeſe, which was called *arida ſaginatio* ξηρα τροφη, and Ασκησις διαξηρων ισχαδων. Oribaſius, or, as others ſay, Pythagoras, firſt brought this in diſuſe, and ſubſtituted fleſh in lieu thereof. They had a peculiar bread called κοληπια: They exerciſed, eat, and drank, without ceaſing: they were not allowed to leave off eating when ſatiated, but were obliged to cram on till they could hold no more; by which means they at length acquired a degree of voracity which to us ſeems incredible, and a ſtrength proportional. Witneſs what Pauſanias relates of the four celebrated athletæ, Polydamus the Theſſalian, Milo the Crotonian, Theagenes the Thaſian, and Euthymus the Locrian: The ſecond is ſaid to have carried a bull on his back a conſiderable way, then to have knocked him down with a blow of his fiſt, and laſtly, as ſome add, devoured him at a meal.

ATHLONE, a town of Weſtmeath, in Ireland, lying in W. Long. 8. 0. N. Lat. 53. 20. It is ſituated on both ſides of the Shannon, and both parts are united by a ſtrong, high-raiſed, and well-built bridge, in the middle of which ſtands a monument, with ſome figures cut in marble, together with Queen Elizabeth's arms, and ſome inſcriptions declaring the time and the founders of the building. The caſtle was founded by King John on ſome land belonging to St Peter's abbey, for which he granted a compenſation. It is built on a high-raiſed round hill, reſembling one of the Daniſh raths or forts. Here were formerly two convents or monaſteries. Athlone was formerly ſtrongly fortified, and conſidered as of very great importance. In the year 1691, a part of the Engliſh army under General Ginckle, in the very face of the Iriſh, who were ſtrongly entrenched on the oppoſite ſhore, fording the river, formed, and took poſſeſſion of the town, not loſing more than 50 men in the attack; which is eſteemed as bold and ſucceſsful an enterpriſe as any recorded in hiſtory. There are generally two troops of horſe and four companies of foot quartered at Athlone. This town gives the title of *earl* to the family of Ginckle, as a reward for the noble ſervices performed by the General.

ATHOL, the moſt northern diſtrict of Perthſhire in Scotland, extending in length 43 miles, and in breadth 30. It is bordered on the north by Badenoch, on the weſt by Lochaber, on the eaſt and ſouth-eaſt by Mar and Gowrie, on the ſouth by Stratherne and Perth Proper, and on the ſouth-weſt by Braidalbane. The country is very rough and mountainous, and contains part of the ancient Caledonian foreſt; but theſe mountains are interſperſed with fruitful vallies. Here are ſeveral villages, but no towns of any conſideration. The moſt noted place is Blair Caſtle, ſeated on the river Tilt, near its influx into the Gurrey, a pleaſant limpid ſtream that falls into the Tay. This caſtle belongs to the Duke of Athol, who derives his title from this diſtrict, and lives here with great magnificence. In the ſame neighbourhood we ſee the paſs of Gillicranky, rendered memorable by the battle fought here in the beginning of King William's reign, between that monarch's general M'Kay, and the Highlanders adhering to king James. See GILLICRANKY.

ATHOS, a celebrated mountain of Chalcidia in Macedonia, ſituated E. Long. 26. 20. N. Lat. 40. 10. The ancients entertained extravagant notions concerning its height. Mela affirmed it to be ſo high as to reach above the clouds; and Martianus Capellinus, that it was ſix miles high. It was a received opinion, that the ſummit of mount Athos was above the middle region of the air, and that it never rained there; becauſe the aſhes left on the altars erected near its ſummit were always found as they were left, dry and unſcattered. But if on many accounts it was famous among the ancients, it is no leſs ſo among the moderns. The Greeks, ſtruck with its ſingular ſituation and the venerable appearance of its towering aſcent, erected ſo many churches, monaſteries, hermitages, &c. upon it, that it became in a manner inhabited by devotees, and from thence received the name of the *Holy Mountain*; which name it ſtill retains, though many of thoſe conſecrated works are now decayed. According to the accounts of modern travellers, this mountain advances into the Archipelago, being joined to the continent by an iſthmus about half a league in breadth. It is about 30 miles in circumference, and two in perpendicular height. It may be tavelled over in about three days, and may be ſeen 90 miles off. There is a fine proſpect from the top; but, like all other high mountains, the cold on its ſummit is exceſſive. It abounds with many different kinds of plants and trees, particularly the pine and fir. In the valleys grows a plant called *elegia*, whoſe branches ſerve to make pens for writing. In ſhort, this mountain is ſaid to be adorned with variety of herbage and evergreens, a multitude of ſprings and ſtreams, and woods growing near the ſhore, ſo as to be one of the moſt agreeable places in the world.

It is now inhabited by Caloyers, a ſort of Greek monks, of the order of St Baſil, who never marry, though others of that church do. They abſtain from fleſh, and fare very hardly, their ordinary meal being olives pickled when they are ripe. They are about 6000 in all, and inhabit ſeveral parts of the mountain, on which are 24 large old monaſteries, ſurrounded with high walls for a defence againſt banditti. They are ſo reſpected, that the Turks themſelves will often ſend them alms. Theſe monks are not idle like others; but labour with the ax, ſpade, and ſickle, dreſſing themſelves like hermits. Formerly they had fine Greek manuſcripts; but are now become ſo illiterate, that they can ſcarce read or write.

Through this mountain, or rather through the iſthmus behind it, Xerxes king of Perſia is ſaid to have cut a paſſage for his fleet when about to invade Greece. In this work he ſpent three whole years, and employed in it all the forces on board the fleet. He is alſo ſaid, before the work was begun, to have written the following inſolent and ridiculous letter to the mountain: "Athos, thou proud and aſpiring mountain, that lifteſt up thy head to the very ſkies, I adviſe thee not to be ſo audacious as to put rocks and ſtones that cannot be cut in the way of my workmen. If thou makeſt that oppoſition, I will cut thee entirely down, and throw thee headlong into the ſea." The directors of this enterpriſe are ſaid to have been Bubaris the ſon of Megabyzus, and Artacheus the ſon of Arbeus, both Perſians; but as no traces of ſuch a great work remain, the truth of the whole relation has juſtly been called in queſtion.

ATHWART, in navigation, is ſynonimous with acroſs the line of the courſe.

Athwart the Fore-foot, is a phraſe that denotes the flight of a cannon-ball from one ſhip acroſs the courſe of another, to intercept the latter, and oblige her to ſhorten ſail, that the former may come near enough to examine her.

Athwart-Hauſe, expreſſes the ſituation of a ſhip, when ſhe is driven by wind or tide, or any other accident, acroſs the fore-part of another.

Athwart-Ships, reaching acroſs ſhips from one ſide to the other.

ATHY, a town of Ireland in the county of Kildare, not far from the borders of Queen's county. W. Long. 7. 0. N. Lat. 53. 0. It is ſituated on the river Barrow; is governed by a ſovereign, two bailiffs, and a recorder, and is, alternately with Naas, the aſſizes town.

ATIBAR, the name by which the inhabitants of the kingdom of Gago in Africa call gold-duſt; from which word Europeans, and eſpecially the French, have compoſed the word *tibir*, which alſo ſignifies gold-duſt among thoſe who trade in that commodity.

ATIGNY, an ancient town of Champagne in France, where ſeveral of the kings of France had their reſidence. It is ſeated on the river Arſne, in E. Long. 4. 47. N. Lat. 49. 30.

ATKINS (Sir Robert), lord chief baron of the exchequer, was born in 1621, and educated at the univerſity of Oxford, from whence he removed to the inns of court, and became eminent in the law. He was made knight of the Bath, with many other perſons of the firſt diſtinction, at the coronation of King Charles II. In 1672, he was appointed one of the judges of Common Pleas; in which honourable ſtation he continued till 1679, when, foreſeeing the troubles that ſoon after enſued, he thought fit to reſign, and retire into the country. In 1689, he was made by King William lord chief baron of the exchequer; and about the ſame time executed the office of ſpeaker to the houſe of lords, which had been previouſly refuſed by the Marquis of Halifax. He diſtinguiſhed himſelf by an unſhaken zeal for the laws and liberties of his country. He wrote ſeveral pieces, which have been collected into one volume 8vo, under the title of *Parliamentary and Political Tracts*. The authors of the Biographia Britannica remark, that whoever inclines to be thoroughly informed of the true conſtitution of his country, of the grounds and reaſons of the revolution, and of the danger of ſuffering prerogative to joſtle law, cannot read a better or plainer book than thoſe tracts of Sir Robert Atkins. He died in 1709, aged 88.

ATKINS (Sir Robert), ſon of the preceding, was born in 1646, and was eminent for all the virtues that could adorn an Engliſh gentleman. He wrote The Ancient and Preſent State of Glouceſterſhire, in one large volume in folio; and died October 29, 1711.

ATKYNS (Richard), was deſcended from a good family, and was born at Tuffleigh in Glouceſterſhire, in the year 1615. He was educated at Oxford, from whence he removed to Lincoln's Inn, and afterwards diſtinguiſhed himſelf by his loyalty to King Charles I. for whom he raiſed a troop of horſe at his own expence. At the Reſtoration he was made one of the deputy lieutenants of Glouceſterſhire, and diſtinguiſhed himſelf by his attachment to the government. But at length being committed priſoner to the Marſhalſea in Southwark for debt, he died there on the 14th of September 1677. He wrote ſeveral pieces, particularly A Treatiſe on the Original and Growth of Printing.

ATLANTIC OCEAN, that bounded by Europe and Africa on the eaſt, and by America on the weſt.

ATLANTICA. See ATLANTIS.

ATLANTIDES, in aſtronomy, a denomination given to the Pleiades, or ſeven ſtars, ſometimes alſo called *Vergilliæ*. They are thus called, as being ſuppoſed by the poets to have been the daughters either of Atlas or his brother Heſperus, who were tranſlated into heaven.

ATLANTIS, ATALANTIS, or ATLANTICA, an iſland mentioned by Plato and ſome others of the ancients, concerning the real exiſtence of which many diſputes have been raiſed. Homer, Horace, and the other poets, make two Atlanticas, calling them *Heſperides* and *Elyſian Fields*, making them the habitations of the bleſſed. The moſt diſtinct account of this iſland we have in Plato's Timæus, of which Mr Chambers gives the following abridgment. "The Atlantis was a large iſland in the weſtern ocean, ſituated before or oppoſite to the ſtraits of Gades. Out of this iſland there was an eaſy paſſage into ſome others, which lay near a large continent exceeding in bigneſs all Europe and Aſia. Neptune ſettled in this iſland (from whoſe ſon Atlas its name was derived), and divided it among his ten ſons. To the youngeſt fell the extremity of the iſland, called *Gadir*, which in the language of the country ſignifies *fertile*, or *abundant in ſheep*. The deſcendants of Neptune reigned here from father to ſon for a great number of generations in the order of primogeniture, during the ſpace of 9000 years. They alſo poſſeſſed ſeveral other iſlands; and, paſſing into Europe and Africa, ſubdued all Lybia as far as Egypt, and all Europe to Aſia Minor. At length the iſland ſunk under water, and for a long time afterwards the ſea thereabouts was full of rocks and ſhelves."

Many of the moderns alſo are of opinion, that the exiſtence of the Atlantis is not to be looked upon as entirely fabulous. Some take it to have been America; and from thence, as well as from a paſſage in Seneca's Medea, and ſome other obſcure hints, they imagine that the new world was not unknown to the ancients. But allowing this to be the caſe, the abovementioned continent which was ſaid to lie beyond Atlantis would ſeem rather to have been the continent of America than Atlantis itſelf. The learned Rudbeck, profeſſor in the univerſity of Upſal, in a work intitled *Atlantica ſive Manheim*, endeavours to prove that Sweden and Norway are the Atlantis of the ancients; but this its ſituation will by no means allow us to believe. By Kircher it is ſuppoſed to have been an iſland extending from the Canaries quite to the Azores; that it was really ſwallowed up by the ocean as Plato aſſerts: and that theſe ſmall iſlands are the ſhattered remains of it which were left ſtanding.

ATLANTIS (New), is the name of a fictitious philoſophical commonwealth, of which a deſcription has been given by Lord Bacon.—The new Atlantis is ſuppoſed to be an iſland in the South Sea, to which the author was driven in a voyage from Peru to Japan. The compoſition is an ingenious fable, formed after the manner of the Utopia of Sir Thomas More, or Campanella's City of the Sun. Its chief deſign is to exhibit a model or deſcription of a college, inſtituted for the interpretation of nature and the production of great and marvellous works, for the benefit of men, under the name of *Solomon's Houſe*, or "the college of the ſix day's work." Thus much, at leaſt, is finiſhed; and with great beauty and magnificence. The author propoſed alſo a frame of laws, or of the beſt ſtate or mould of a commonwealth. But this part is not executed.

ATLAS, king of Mauritania, a great aſtronomer, contemporary with Moſes. From his taking obſervations of the ſtars from a mountain, the poets feigned him to have been turned into a mountain, and to ſuſtain the heavens on his ſhoulders. Being an excellent aſtronomer, and the firſt who taught the doctrine of the ſphere, they tell us that his daughters were turned into ſtars; ſeven of them forming the Pleiades, and other ſeven the Hyades.

ATLAS, a chain of mountains in Africa, lying between the 20th and 25th degree of north latitude, and ſuppoſed almoſt to divide the continent from eaſt to weſt. They are ſaid to have derived their name from Atlas king of Mauritania, who was a great aſtronomer. They are greatly celebrated by the ancients on account of their height, inſomuch that the abovementioned king, who is ſaid to have been transformed into a mountain, was feigned to bear up the heavens on his ſhoulders. We are aſſured, however, by Dr Shaw, that the part of this chain of mountains which fell under his obſervation could not ſtand in competition either with the Alps or Apennines. He tells us, that if we conceive a number of hills, uſually of the perpendicular height of 400, 500, or 600 yards, with an eaſy aſcent, and ſeveral groves of fruit or foreſt trees, riſing up in a ſucceſſion of ranges above one another; and that if to this proſpect we add now and then a rocky precipice, and on the ſummit of each imagine a miſerable mud-walled village; we ſhall then have a juſt idea of the mountains of Atlas.

According to M. Chenier*, this mountain is formed by an endleſs chain of lofty eminences, divided into different countries, inhabited by a multitude of tribes, whoſe ferocity permits no ſtranger to approach. "I have not been able (continues he) to obtain a ſufficient knowledge of theſe mountains to deſcribe them accurately: What Leo Africanus has ſaid of them is very vague; and his account is the leſs to be regarded at preſent, as it is now about three centuries ſince he wrote, and the face of the country has been in that time totally changed. Nothing perhaps would be more intereſting to the curioſity of the philoſopher, or conduce more to the improvement of our knowledge in natural hiſtory, than a journey over mount Atlas. The climate, though extremely cold in winter, is very healthy and pleaſant; the valleys are well cultivated, abound in fruits, and are diverſified by foreſts and plentiful ſprings, the ſtreams of which uniting at a little diſtance, form great rivers, and loſe themſelves in the ocean. According to the reports of the Moors, there are many quarries of marble, granite, and other valuable ſtone, in theſe mountains: It is probable there are alſo mines, but the inhabitants have no idea of theſe riches; they conſider their liberty, which their ſituation enables them to defend, as the moſt ineſtimable of all treaſures."

ATLAS, in matters of literature, denotes a book of univerſal geography, containing maps of all the known parts of the world.

ATLAS, in commerce, a ſilk-ſattin, manufactured in the Eaſt-Indies. There are ſome plain, ſome ſtriped, and ſome flowered, the flowers of which are either gold or only ſilk. There are atlaſſes of all colours; but moſt of them falſe, eſpecially the red and the crimſon. The manufacture of them is admirable; the gold and

* *Hiſt. of Morocco*, l. 13.

and ſilk being worked together after ſuch a manner as no workmen in Europe can imitate; yet they are very far from having that fine gloſs and luſtre which the French know how to give to their ſilk ſtuffs. In the Chineſe manufactures of this ſort, they gild paper on one ſide with leaf-gold; then cut it in long ſlips, and weave it into their ſilks; which makes them with very little coſt, look very rich and fine. The ſame long ſlips are twiſted or turned about ſilk threads, ſo artificially, as to look finer than gold thread, though it be of no great value.

ATMOSPHERE, a word generally uſed to ſignify the whole maſs of fluid conſiſting of air, aqueous and other vapours, electric fluid, &c. ſurrounding the earth to a conſiderable height.

1
Atmoſphere compoſed of two different fluids.

2
Phlogiſticated air poiſonous to animals, and dephlogiſticated air to vegetables.

The compoſition of that part of our atmoſphere properly called *air*, was till lately very much unknown. In former times it was ſuppoſed to be a ſimple, homogeneous, and elementary fluid. The experiments of Dr Prieſtly diſcovered, that the pureſt kind of air, which he called *dephlogiſticated*, was in reality a compound, and might be artificially produced in various ways. His firſt conjectures concerning its component parts were, that it conſiſted of earth, nitrous acid, and phlogiſton. Subſequent experiments rendered theſe conjectures dubious; and at laſt it was ſuppoſed that dephlogiſticated air is a pure elementary ſubſtance, the vivifying principle to animals, and the acidifying principle throughout all nature. This dephlogiſticated air, however, is but a ſmall part of the compoſition of our atmoſphere. According to the moſt accurate computations, the air we uſually breathe is compoſed of only one-fourth of this dephlogiſticated air, or perhaps leſs; the other three or four parts conſiſting of what Dr Prieſtley calls *phlogiſticated*, and M. Lavoiſier *mephitic air*. This by itſelf is abſolutely noxious, and exceedingly poiſonous to animals: though it ſeems only to be negatively ſo; for when mixed in a certain proportion with dephlogiſticated air, it may be breathed with ſafety, which could not be if it contained any ingredient abſolutely unfriendly to the human conſtitution. The other part, viz. the pure dephlogiſticated air, ſeems to ſtand much in the ſame relation to plants that phlogiſticated air does to animals; that is, it would prove poiſonous, and deſtroy them if they were to depend upon it entirely for their ſubſiſtence; but as they derive their nouriſhment partly from the air and partly from the ſoil, it thence happens, that the plants which are ſet to grow in dephlogiſticated air do not die inſtantly, as animals do in the phlogiſticated kind, but remain for ſome time weak and ſickly.

3
A great quantity of electric fluid contained in the atmoſphere

The other component parts of our atmoſphere are ſo various, and of ſuch heterogeneous natures, that they do not admit of any kind of definition or analyſis, one only excepted, namely, the *electric fluid*. This we know pervades the whole, but appears to be much more copious in the upper than in the lower atmoſpherical regions. See Electricity. To meaſure the abſolute quantity of this fluid, either in the atmoſphere or any other ſubſtance, is impoſſible. All that we can know on this ſubject is, that the electric fluid pervades the atmoſphere; that it appears to be more abundant in the ſuperior than the inferior regions; that it ſeems to be the immediate bond of connection between the atmoſphere and the water which is ſuſpended in it; and that by its various operations, the phenomena of hail, rain, ſnow, lightning, and various other kinds of meteors, are occaſioned. See Rain, Hail, Snow, &c.

4
Calculations of the height of the atmoſphere.

Various attempts have been made to aſcertain the height to which the atmoſphere is extended all round the earth. Theſe commenced ſoon after it was diſcovered, by means of the Torricellian tube, that air is a gravitating ſubſtance. Thus it alſo became known, that a column of air, whoſe baſe is a ſquare inch, and the height that of the whole atmoſphere, weighs 15 pounds; and that the weight of air is to that of mercury as 1 to 10,800: whence it follows, that if the weight of the atmoſphere be ſufficient to raiſe a column of mercury to the height of 30 inches, the height of the aerial column muſt be 10,800 times as much, and conſequently a little more than five miles high.

It was not, however, at any time ſuppoſed, that this calculation could be juſt: for as the air is an elaſtic fluid, the upper parts muſt expand to an immenſe bulk, and thus render the calculation above related exceedingly erroneous. By experiments made in different countries, it has been found, that the ſpaces which any portion of air takes up, are reciprocally proportional to the weights with which it is compreſſed. Allowances were therefore to be made in calculating the height of the atmoſphere. If we ſuppoſe the height of the whole divided into innumerable equal parts, the denſity of each of which is as its quantity; and the weight of the whole incumbent atmoſphere being alſo as its quantity; it is evident, that the weight of the incumbent air is every where as the quantity contained in the ſubjacent part; which makes a difference between the weights of each two contiguous parts of air. By a theorem in geometry, where the differences of magnitudes are geometrically proportional to the magnitudes themſelves, theſe magnitudes are in continual arithmetical proportion; therefore, if, according to the ſuppoſition, the altitude of the air, by the addition of new parts into which it is divided, do continually increaſe in arithmetical proportion, its denſity will be diminiſhed, or (which is the ſame thing, its gravity decreaſed) in continual geometrical proportion.

5
Height of it determined from the beginning and end of twilight.

It is now eaſy, from ſuch a ſeries, by making two or three barometrical obſervations, and determining the denſity of the atmoſphere at two or three different ſtations, to determine its abſolute height, or its rarity at any aſſignable height. Calculations accordingly were made upon this plan; but it having been found that the barometrical obſervations by no means correſponded with the denſity which, by other experiments, the air ought to have had, it was ſuſpected that the upper part of the atmoſpherical regions were not ſubject to the ſame laws with the lower ones. Philoſophers therefore had recourſe to another method for determining the altitude of the atmoſphere, viz. by a calculation of the height from which the light of the ſun is refracted, ſo as to become viſible to us before he himſelf is ſeen in the heavens. By this method it was determined, that at the height of 45 miles the atmoſphere had no power of refraction; and conſequently beyond that diſtance was either a mere vacuum, or the next thing to it, and not to be regarded.

This theory ſoon became very generally received and the height of the atmoſphere was ſpoken of as familiarly

6
Objection from the appearance of meteors.

miliarly as the height of a mountain, and reckoned to be as well aſcertained, if not more ſo, than the heights of moſt mountains are. Very great objections, however, which have never yet been removed, ariſe from the appearances of ſome *meteors*, like large globes of fire, not unfrequently to be ſeen at vaſt heights above the earth (ſee Meteor). A very remarkable one of this kind was obſerved by Dr Halley in the month of March 1719, whoſe altitude he computed to have been between 69 and 73¼ Engliſh miles; its diameter 2800 yards, or upwards of a mile and an half; and its velocity about 350 miles in a minute. Others, apparently of the ſame kind, but whoſe altitude and velocity were ſtill greater, have been obſerved: particularly that very remarkable one, Auguſt 18th 1781, whoſe diſtance from the earth could not be leſs than 90 miles, and its diameter not leſs than the former; at the ſame time that its velocity was certainly not leſs than 1000 miles in a minute. Fire-balls, in appearance ſimilar to theſe, though vaſtly inferior in ſize, have been ſometimes obſerved at the ſurface of the earth. Of this kind Dr Prieſtley mentions one ſeen on board the Montague, 4th November 1749, which appeared as big as a large millſtone, and broke with a violent exploſion.

From analogical reaſoning, it ſeems very probable, that the meteors which appear at ſuch great heights in the air are not eſſentially different from thoſe which, like the fire-ball juſt mentioned, are met with on the ſurface of the earth. The perplexing circumſtances with regard to the former are, that at the great heights abovementioned, the atmoſphere ought not to have any denſity ſufficient to ſupport flame, or to propagate ſound; yet theſe meteors are commonly ſucceeded by one or more exploſions, nay are ſometimes ſaid to be accompanied with a hiſſing noiſe as they paſs over our heads. The meteor of 1719 was not only very bright, inſomuch that for a ſhort ſpace it turned night into day, but was attended with an exploſion heard over all the iſland of Britain, occaſioning a violent concuſſion in the atmoſphere, and ſeeming to ſhake the earth itſelf. That of 1783 alſo, though much higher than the former, was ſucceeded by exploſions; and, according to the teſtimony of ſeveral people, a hiſſing noiſe was heard as it paſſed. Dr Halley acknowledged that he was unable to reconcile theſe circumſtances with the received theory of the height of the atmoſphere; as, in the regions in which this meteor moved, the air ought to have been 300,000 times more rare than what we breathe, and the next thing to a perfect vacuum.

In the meteor of 1783, the difficulty is ſtill greater, as it appears to have been 20 miles farther up in the air. Dr Halley offers a conjecture, indeed, that the vaſt magnitude of ſuch bodies might compenſate for the thinneſs of the medium in which they moved. Whether or not this was the caſe, cannot indeed be aſcertained, as we have ſo few data to go upon; but the greateſt difficulty is to account for the brightneſs of the light. Appearances of this kind are indeed with great probability attributed to electricity, but the difficulty is not thus removed. Though the electrical fire pervades with great eaſe the vacuum of a common air-pump, yet it does not in that caſe appear in bright well defined ſparks, as in the open air, but rather in long ſtreams reſembling the aurora borealis. From ſome late experiments indeed, Mr Morgan concludes, that the electrical fluid cannot penetrate a perfect vacuum*. If this is the caſe, it ſhows that the regions we ſpeak of are not ſuch a perfect vacuum as can be artificially made; but whether it is or not, the extreme brightneſs of the light ſhows that a fluid was preſent in thoſe regions, capable of confining and condenſing the electric matter as much as the air does at the ſurface of the ground; for the brightneſs of theſe meteors, conſidering their diſtance, cannot be ſuppoſed inferior to that of the brighteſt flaſhes of lightning.

7
Denſity of the air does not always keep pace with its gravity.

This being the caſe, it appears reaſonable to conclude that what is called the *denſity* of the air does not altogether keep pace with its gravity. The latter indeed muſt in a great meaſure be affected by the vapours, but above all by the quantity of the baſis of fixed or dephlogiſticated air contained in it: for Mr Kirwan has diſcovered that the baſis of fixed air, when deprived of its elaſtic principle, is not greatly inferior to gold in ſpecific gravity; and we cannot ſuppoſe that of dephlogiſticated air to be much leſs. It is poſſible, therefore, that pure air, could it be deprived of all the water it contains, might have very little gravity; and as there is great reaſon to believe that the baſis of dephlogiſticated air is only one of the conſtituent parts of water †, we ſee an evident reaſon why the air ought to become lighter, and likewiſe leſs fit for reſpiration, the higher up we go, though there is a poſſibility that its denſity, or power of ſupporting flame, may continue unaltered.

There are not yet, however, a ſufficient number of facts to enable us to determine this queſtion; though ſuch as have been diſcovered ſeem rather to favour the above conjecture. Dr Boerhaave was of opinion that the gravity of the air depended entirely on the water it contained; and, by means of alkaline ſalts, he was enabled to extract as much water from a quantity of air as was very nearly equivalent to its weight. By the calcination of metals we may extract as much of the baſis of dephlogiſticated air from a quantity of atmoſpherical air as is equivalent to the weight of air loſt. Were it poſſible, therefore, to extract the whole of this, as well as all other vapours, and to preſerve only the elaſtic principle, it is highly probable that its gravity would entirely ceaſe. It has been found by thoſe who have aſcended with aeroſtatic machines, or to the tops of high mountains, that the deplogiſticated air is found to be contained in ſmaller quantities in the atmoſphere of theſe elevated regions than on the lower grounds. It is alſo found, that in ſuch ſituations the air is much drier, and parts with water with much more difficulty, than on the ordinary ſurface. Salt of tartar, for inſtance, which at the foot of a mountain will very ſoon run into a liquid, remains for a long time expoſed to the air on the top of it, without ſhowing the leaſt tendency to deliqueſce. Nevertheleſs, it hath never been obſerved that fires did not burn as intenſely on the tops of the higheſt mountains as on the plains. The matter indeed was put to the trial in the great eruption of Veſuvius in 1779, where, though the lava ſpouted up to the height of three miles above the level of the ſea, the uppermoſt parts all the while were to appearance as much inflamed as the loweſt.

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* See *Electricity*-Index.

† See *Dephlogiſticated air*, and *Water*.

8
Gravity of the upper regions of the atmoſphere perhaps diminiſhed by electricity.

The high degree of electricity, always exiſting in the upper regions of the atmoſphere, muſt of neceſſity have a very conſiderable influence on the gravity of any heterogeneous particles floating in it. When we conſider the effects of the electric fluid upon light bodies at the ſurface of the earth, it will readily be admitted, that in thoſe regions where this fluid is very abundant, the gravity of the atmoſphere may be much diminiſhed without affecting its denſity. We know that it is the nature of any electrified ſubſtance to attract light bodies; and that, by proper management, they may even be ſuſpended in the air, without either moving up or down for a conſiderable time. If this is the caſe with light terreſtrial bodies it cannot be thought very improbable that the aerial particles themſelves, *i. e.* thoſe which we call the baſis of dephlogiſticated air, and of aqueous or other vapour diffuſed among them, ſhould be thus affected in the regions where electricity is ſo abundant. From this cauſe, therefore, alſo the gravity of the atmoſphere may be affected without any alteration at all being made in its denſity; and hence may ariſe anomalies in the barometer hitherto not taken notice of.

9
Abſolute height of the atmoſphere undetermined

It appears, therefore, that the abſolute height of the atmoſphere is not yet determined. The beginning and ending of twilight indeed ſhow, that the height at which the atmoſphere begins to refract the ſun's light is about 44 or 45 Engliſh miles. But this may not improbably be only the height to which the aqueous vapours are carried: for it cannot be thought any unreaſonable ſuppoſition, that light is refracted only by means of the aqueous vapour contained in the atmoſphere; and that where this ceaſes, it is ſtill capable of ſupporting the *electric* fire at leaſt, as bright and ſtrong as at the ſurface. That it does extend much higher, is evident from the meteors already mentioned: for all theſe are undoubtedly carried along with the atmoſphere; otherwiſe that of 1783, which was ſeen for about a minute, muſt have been left 1000 miles to the weſtward, by the earth flying out below it in its annual courſe round the ſun.

10
Of the preſſure of the atmoſphere

It has already been mentioned, that the preſſure of the atmoſphere, when in its mean ſtate, is equivalent to a weight of 15 pounds on every ſquare inch. Hence Dr Cotes computed, that the preſſure of the whole ambient fluid upon the earth's ſurface is equivalent to that of a globe of lead 60 miles in diameter. Hence alſo it appears, that the preſſure upon a human body muſt be very conſiderable; for as every ſquare inch of ſurface ſuſtains a preſſure of 15 pounds, every ſquare foot, as containing 144 inches, muſt ſuſtain a preſſure of 2160; and if we ſuppoſe a man's body to contain 15 ſquare feet of ſurface, which is pretty near the truth, he muſt ſuſtain a weight of 32,400 pounds, or 16 tun, for his ordinary load. By this enormous preſſure we ſhould undoubtedly be cruſhed in a moment, were not all parts of our bodies filled either with air or ſome other elaſtic fluid, the ſpring of which is juſt ſufficient to counterbalance the weight of the atmoſphere. But whatever this fluid may be, we are ſure that it is juſt able to counteract the atmoſpherical gravity and no more; for if any conſiderable preſſure be ſuperadded to that of the air, as by going into deep water, or the like, it is always ſeverely felt, let it be ever ſo equable. If the preſſure of the atmoſphere is taken off from any part of the human body, the hand, for inſtance, when put in an open receiver from whence the air is afterwards extracted, the weight of the atmoſphere then diſcovers itſelf, and we imagine the hand ſtrongly ſucked down into the glaſs. See PNEUMATICS.

11
Variation of the preſſure, and its effects.

In countries at ſome diſtance from the equator, the preſſure of the atmoſphere varies conſiderably, and thus produces conſiderable changes on many terreſtrial bodies. On the human body the quantity of preſſure ſometimes varies near a whole tun; and when it is thus ſo much diminiſhed, moſt people find ſomething of a liſtleſſneſs and inactivity about them. It is ſurpriſing, however, that the ſpring of the internal fluid, already mentioned, which acts as a counterpoiſe to the atmoſpherical gravity, ſhould in all caſes ſeem to keep pace with it when the preſſure is naturally diminiſhed, and even when it is artificially augmented, though not when the preſſure is artificially diminiſhed. Thus in that kind of weather when the preſſure of the air is leaſt, we never perceive our veins to ſwell, or are ſenſible of any inward expanſion in our bodies. On the contrary, the circulation is languid, and we ſeem rather to be oppreſſed by a weight.

12
Of difficulty of reſpiration on the tops of mountains.

Even in going up to the tops of mountains, where the preſſure in the atmoſphere is diminiſhed more than three times what it uſually is on the plain, no ſuch appearances are obſerved. Some travellers indeed have affirmed, that, on the tops of very high mountains, the air is ſo light as to occaſion a great difficulty of reſpiration, and even violent retching and vomiting of blood. It does not appear, however, that theſe aſſertions are well founded. Mr Brydone found no inconvenience of this kind on the top of mount Ætna; nor is any ſuch thing mentioned by Mr Houel, who alſo aſcended this mountain. Sir William Hamilton indeed ſays, that he did feel a difficulty of reſpiration, independent of any ſulphureous ſtream. But, on the top of a volcano, the reſpiration may be affected by ſo many different cauſes, that it is perhaps impoſſible to aſſign the true one. The French mathematicians, when on the top of a very high peak of the Andes, did not make any complaint of this kind, though they lived there for ſome time. On the contrary, they found the wind ſo extremely violent, that they were ſcarce able to withſtand its force; which ſeems an argument for at leaſt equal *denſity* of the atmoſphere in the ſuperior as in the inferior regions. Dr Heberden, who aſcended to the top of Teneriffe, a higher mountain than Ætna, makes no mention of any difficulty of reſpiration.

13
Mr Sauſſure's ſymptoms on the top of Mount Blanc accounted for

M. Sauſſure, however, in his journey to the top of Mount Blanc, the higheſt of the Alps, felt very great uneaſineſs in the way. His reſpiration was not only extremely difficult, but his pulſe became quick, and he was ſeized with all the ſymptoms of a fever. His ſtrength was alſo exhauſted to ſuch a degree, that he ſeemed to require four times as long a ſpace to perform ſome experiments on the top of the mountain as he would have done at the foot of it. It muſt be obſerved, however, that theſe ſymptoms did not begin to appear till he had aſcended two miles and a half perpendicular above the level of the ſea. The mountain is only about a quarter of a mile higher; and in this ſhort ſpace he was reduced to the ſituation juſt mentioned. But it is improbable that ſo ſmall a difference, even at the end of his journey, ſhould have produced ſuch violent effects, had not ſome other cauſe concurred. A cauſe of this kind he himſelf mentions, viz. that the atmoſphere at the top of the mountain was ſo much impregnated with fixed air, that lime-water, expoſed to it, quickly became covered with a pellicle occaſioned by the abſorption of that fluid. Now it is known, that fixed air is extremely pernicious to animals, and would bring on ſymptoms ſimilar to thoſe abovementioned. There is no reaſon, therefore, to have recourſe to the rarity of the atmoſphere for ſolving a phenomenon which may more naturally be accounted for otherwiſe.

When the preſſure of the atmoſphere is augmented, by deſcending, in the diving-bell, to conſiderable depths in the ſea, it does not appear that any inconvenience follows from its increaſe. Thoſe who ſit in the diving-bell are not ſenſible of any preſſure as long as they remain in the air, though they feel it very ſenſibly in going into the water: yet it is certain, that the preſſure in both caſes is the ſame; for the whole preſſure of the atmoſphere, as well as of the water, is ſuſtained by the air in the diving-bell, and conſequently communicated to thoſe who ſit in it.

But though artificial compreſſion of the air, as well as natural rarefaction, can thus be borne, it is otherwiſe with artificial rarefaction. Animals in an air-pump ſhow uneaſineſs from the very firſt, and cannot live for any time in an atmoſphere rarefied artificially even as much as it appeared to be from the barometer on the top of Mount Blanc.

14 Variation of the atmoſpherical preſſure accounted for.

It is not eaſy to aſſign the true reaſon of the variations of gravity in the atmoſphere. Certain it is, however, that they take place only in a very ſmall degree within the tropics; and ſeem there to depend on the heat of the ſun, as the barometer conſtantly ſinks near half an inch every day, and riſes again to its former ſtation in the night-time. In the temperate zones the barometer ranges from 28 to near 31 inches, by its various altitudes ſhowing the changes that are about to take place in the weather. If we could know, therefore, the latent cauſes by which the weather is influenced, we ſhould likewiſe certainly know thoſe by which the gravity of the atmoſphere is affected. Theſe are particularly explained under the articles RAIN, HAIL, SNOW, WINDS, &c. but in general they may be reduced to two, viz. an emiſſion of latent heat from the vapour contained in the atmoſphere, or of electric fluid from the ſame, or from the earth. To one or both of theſe cauſes, therefore, may we aſcribe the variations of the gravity of the atmoſphere: and we ſee that they both tend to produce the ſame effect with the ſolar heat in the tropical climates, viz. to rarefy the air, by mixing with it or ſetting looſe a non-gravitating fluid, which did not act in ſuch large proportion in any particular place before. No doubt, the action of the latent heat and electric fluid is the ſame in the torrid as in the temperate zones: but in the torrid zone the ſolar heat and exceſſive evaporation counteract them; ſo that whatever quantities may be diſcharged by the exceſſive deluges of rain, &c. which fall in thoſe countries, they are inſtantly abſorbed by the abundant fluid, and are quickly ready to be diſcharged again; while, in the temperate zones, the air becomes ſenſibly lighter, as well as warmer, by them for ſome time before they can be abſorbed again.

15 Variation of the heat and cold of the atmoſphere.

The variations of heat and cold to which the atmoſphere is ſubject, have been the ſubject of much ſpeculation. In general they ſeem to depend entirely upon the light of the ſun reflected into the atmoſphere from the earth; and where this reflection is deficient, even though the light ſhould be preſent ever ſo much, the moſt violent degrees of cold are found to take place. Hence, on the tops of mountains, the cold is generally exceſſive, though by reaſon of the clearneſs of the atmoſphere the light of the ſun falls upon them in greater quantity than it can do on an equal ſpace on the plain. In long winding paſſages alſo, ſuch as the caverns of Ætna and Veſuvius, where the air has room to circulate freely, without any acceſs of the ſun, the cold is ſcarce tolerable; whence the uſe of theſe for cooling liquors, preſerving meat, &c.

16 Lambert and De Luc's reaſons for the cold on the tops of mountains.

The coldneſs of the atmoſphere on the tops of mountains has been aſcribed by M. Lambert and De Luc, to the igneous fluid, or elementary fire, being more rare in thoſe elevated ſituations than on the plains. M. Lambert is of opinion that it is rarefied above by the action of the air, and that below it is condenſed by its own proper weight. He conſiders fire as a fluid in motion, the parts of which are ſeparable, and which is rarefied when its velocity is accelerated. He does not decide with regard to the identity of fire and light, though he ſeems inclined to believe it. M. de Luc compares elementary fire to a continuous fluid, whoſe parts are condenſed by being mutually compreſſed. He denies that fire and light are the ſame; and maintains that the latter is incapable, by itſelf, of ſetting fire to bodies, though it does ſo by putting in motion the igneous fluid they contain; and that it acts with more force near the earth than at a diſtance from its ſurface, by reaſon of this fluid, which he calls an *heavy* and *elaſtic* one, being more condenſed there than at a greater height.

17 Mr Sauſſure's account.

Mr Sauſſure, in treating of this ſubject in his account of the Alps, does not conſider fire as a fluid ſo free and detached as to be able either to aſcend with rapidity by its ſpecific levity, or to condenſe itſelf ſenſibly by its proper weight. He ſuppoſes it to be united to bodies by ſo ſtrict an affinity, that all its motions are determined, or at leaſt powerfully modified, by that affinity. As ſoon therefore as fire, diſengaged by combuſtion or by any other cauſe, endeavours to diffuſe itſelf, all the bodies that come within the ſphere of its activity endeavour to attract it; and they abſorb ſuch quantities of it as are in the direct ratio of their affinities with it, or in the inverſe ratio of what is neceſſary for their equilibrium with the ſurrounding bodies. Now it does not appear that in this diſtribution the ſituation of places, with regard to the horizon, has any other influence than what they receive from the different currents produced by the dilatation of the air, and by the levity which that dilatation produces. The aſcent of flame, ſmoke, &c. or of air heated in any way, perſuaded the ancients that fire is poſſeſſed of abſolute levity, by which it had a tendency to mount upwards. "But theſe effects (ſays he) are owing either to the levity of the fluid which conſtitutes flame, or to that of air dilated by heat; and not to the levity of the igneous fluid. I am, however, ſufficiently convinced, that this fluid is incomparably lighter than air, though I do not believe that it poſſeſſes the power of aſcending in our atmoſphere by virtue of its levity alone.

18
Mr Bouguer's reaſons for the cold on the top of the Andes.

"The celebrated Bouguer has demonſtrated, by principles the moſt ſimple, and moſt univerſally adopted, that it is not neceſſary, in order to account for the diminution of heat on mountains, to have recourſe to hypotheſes that are at beſt doubtful. The following is his explanation of what was felt on the mountains of Peru.

"It was proper, in order to explain this ſubject, to inſiſt on the ſhort duration of the ſun's rays, which cannot ſtrike the different ſides of mountains but for a few hours, and even this not always. A horizontal plain, when the ſun is clear, is expoſed at mid-day to the perpendicular and undiminiſhed action of theſe rays, while they fall but obliquely on a plain not much inclined, or on the ſides of a high pile of ſteep rocks. But let us conceive for a moment an inſulated point, half the height of the atmoſphere, at a diſtance from all mountains, as well as from the clouds which float in the air. The more a medium is tranſparent, the leſs heat it ought to receive by the immediate action of the ſun. The free paſſage which a very tranſparent body allows to the rays of light, ſhows that its ſmall particles are hardly touched by them. Indeed what impreſſion could they make on it when they paſs through almoſt without obſtruction? Light, when it conſiſts of parallel rays, does not by paſſing through a foot of free atmoſpheric air, near the earth, loſe an hundred thouſandth part of its force. From this we may judge how few rays are weakened, or can act on this fluid, in their paſſage through a ſtratum of the diameter not of an inch or a line, but of a particle. Yet the ſubtilty and tranſparency are ſtill greater at great heights, as was obvious on the Cordilleras, when we looked at diſtant objects. Laſtly, the groſſer air is heated below by the contact or neighbourhood of bodies of greater denſity than itſelf, which it ſurrounds, and on which it reſts; and the heat may be communicated by little and little to a certain diſtance. The inferior parts of the atmoſphere by this means contract daily a very conſiderable degree of heat, and may receive it in proportion to its denſity or bulk. But it is evident, that the ſame thing cannot happen at the diſtance of a league and an half or two leagues above the ſurface of the earth, although the light there may be ſomething more active. The air and the wind therefore muſt at this height be extremely cold, and colder in proportion to the elevation.

"Beſides, the heat neceſſary to life is not merely that which we receive every inſtant from the ſun. The momentary degree of this heat correſponds to a very ſmall part of that which all the bodies around us have imbibed, and by which ours is chiefly regulated. The action of the ſun only ſerves to maintain nearly in the ſame ſtate the ſum of the total heat, by repairing thro' the day the loſs it ſuſtains through the night, and at all times. If the addition be greater than the loſs, the total heat will increaſe, as it happens in ſummer, and it will continue to accumulate in a certain degree; but for the reaſons already given, this accumulation cannot be very great on the top of a mountain, where the ſummit which riſes high, is never of great bulk. The loweſt ſtate of the thermometer in every place is always in proportion to the heat acquired by the ſoil; and that heat being very ſmall on the top of a mountain, the quantity added to it by the ſun during the day muſt be comparatively greater; and the accumulated heat will be more in a condition to receive increaſe in proportion to its diſtance from the degree which it cannot paſs.

"Another particular obſervable on all the high places of the Cordilleras, and which depends on the ſame cauſe, is, that when we leave the ſhade, and expoſe ourſelves to the ſunſhine, we feel a much greater difference than we do here in our fine days when the weather is temperate. Every thing contributes at Quito to make the ſun exceedingly powerful: a ſingle ſtep from an expoſed place to the ſhade gives the ſenſation of cold: this would not be the caſe if the quantity of heat acquired by the ſoil were more conſiderable. We now alſo ſee why the ſame thermometer, put firſt into the ſhade and then in the ſun, does not undergo the ſame changes at all times and in all places. In the morning, upon Pinchincha, this inſtrument is generally a few degrees below the freezing point, which may be reckoned the natural temperature of the place; but when during the day we expoſe it to the ſun, it is eaſy to imagine that the effect muſt be great, and much more than double in whatever way it is meaſured."

19
Burning glaſſes equally powerful on the tops of mountains as on plains.

This theory is adopted by M. Sauſſure, who adds the following fact to prove that the action of the ſun's rays, conſidered abſtractedly, and independent of any extrinſic ſource of cold, is as great on mountains as on plains; viz. that the power of burning lenſes and mirrors is the ſame at all heights. To aſcertain this fact, our author procured a burning-glaſs ſo weak that at Geneva it would juſt ſet fire to tinder. This he carried with ſome of the ſame tinder, to the top of the mountain Saleve (a height of 3000 feet); where it not only produced the ſame effect, but apparently with greater facility than on the plain. Being perſuaded then, that the principal ſource of cold on the tops of high mountains is their being perpetually ſurrounded with an atmoſphere which cannot be much heated either by the rays of the ſun on account of its tranſparency, or by the reflection of them from the earth by reaſon of its diſtance, he wiſhed to know, whether the direct ſolar rays on the top of a high mountain had the ſame power as on the plain, while the body on which they acted was placed in ſuch a manner as to be unaffected by the ſurrounding air. For this purpoſe he inſtituted a ſet of experiments, from which he drew the following concluſions, viz. that a difference of 777 toiſes in height, diminiſhes the heat which the rays of the ſun are able to communicate to a body expoſed to the external air, 14° of the thermometer; that it diminiſhes the heat of a body partially expoſed, only 6°; and that it augments by 1° the heat of a third body completely defended from the air.

20
Atmoſphere every where counteracts the heat of the ſun.

Hence it appears that the atmoſphere, though ſo eſſentially neceſſary to the ſupport of fire, is ſome how or other the greateſt antagoniſt of heat, and moſt effectually counteracts the operation of the ſolar rays in producing it. This power it ſeems to exert at all diſtances, at the ſurface as well as in the higher regions. From ſome experiments made by M. Pictet, it appears,

that

21 Is colder very near the ſurface of the ground than at ſome diſtance.

that even in places expoſed to the rays of the ſun, the heat, at five feet diſtance from the ground, is greater only by one or two degrees than at 50 feet above the ſurface, though the ground was at that time 15 or 20° warmer than the air immediately in contact with it. Inconſiderable as this difference is, however, it does not hold as we go higher up: for if it did, the cold on the top of the mountain of Saleve, which is 3000 feet above the level of the lake of Geneva, would be 60° greater than at the foot it; whereas in reality it is only 10°. In the night time the caſe is reverſed; for the ſtratum of air, at five feet from the ground, was found by Mr Pictet to be colder than that at 50. Beſides this, different ſtrata of the atmoſphere are found to poſſeſs very different and variable degrees of cold, without any regard to their ſituation high up or low down. In the year 1780, Dr Wilſon of Glaſgow found a very remarkable cold exiſting cloſe to the ſurface of the ground; ſo that the thermometer, when laid on the ſurface of the ſnow, ſunk many degrees lower than one ſuſpended 24 feet above it. It has been likewiſe obſerved, that in clear weather, though the ſurface of the earth be then moſt liable to be heated by the ſun, yet after that is ſet, and during the night, the air is coldeſt near the ground, and particularly in the valleys.

22 Mr Sex's experiments on this ſubject.

Experiments on this ſubject were made for a whole year by Mr James Sex, who has given an account of them in the 78th volume of the Philoſophical Tranſactions. He ſuſpended thermometers (conſtructed in ſuch a manner as to ſhow the true maximum and minimum of heat that might take place in the obſerver's abſence) in a ſhady northern aſpect, and at different heights in the open air. One of theſe was placed at the height of 9 feet, and the other at that of 220 from the ground; and the obſervations were continued, with only a few days omiſſion, from July 1784 to July 1785. The greateſt variations of heat were in the months of October and June; in the former the thermometers generally differed moſt in the night, and in the latter moſtly in the day. From the 25th to the 28th of October, the heat below, in the night time, exceeded in a ſmall degree the heat above; at which time there was frequent rain mingled with hail. From the 11th to the 14th, and alſo on the 31ſt, there was no variation at all; during which time likewiſe the weather was rainy: all the reſt of the month proving clear, the air below was found colder than that above, ſometimes by nine or ten degrees. In the month of June, the greateſt variations took place from the 11th to the 15th, and from the 25th to the 30th; and at both theſe times there appeared to be two currents of wind, the upper from the ſouth-weſt and the lower from the north-eaſt. Sometimes theſe were rendered viſible by clouds, in different ſtrata, moving in different directions, and ſometimes by clouds moving in a contrary direction to a very ſenſible current of air below. On cloudy nights the loweſt thermometer ſometimes ſhowed the heat to be a degree or two greater than the upper one; but in the day time the heat below conſtantly exceeded that above more than in the month of October.

To determine whether the nocturnal refrigeration was augmented by a nearer approach to the earth, two thermometers were placed in the midſt of an open meadow, on the bank of the river near Canterbury. One was placed on the ground, and the other only ſix feet above it. The thermometer, at ſix feet diſtance from the ground, agreed nearly with the former at nine feet; but the nocturnal variations were found to correſpond entirely with the clearneſs or the cloudineſs of the ſky: and though they did not always happen in proportion to their reſpective altitudes, yet when the thermometers differed in any reſpect, that on the ground always indicated the greateſt degree of cold.

The difference betwixt theſe two thermometers, at the ſmall diſtance of ſix feet from each other, being found no leſs than three degrees and an half, the number of thermometers in the meadow was augmented to four. One was ſunk in the ground, another placed juſt upon it, and the third ſuſpended at three feet above it. Three others were placed on a riſing ground where the land was level with the cathedral tower, and about a mile diſtant from it. One of theſe was likewiſe ſunk in the ground, another placed juſt upon it, and a third ſuſpended ſix feet above it. With theſe ſeven thermometers, and the two firſt mentioned, which were placed in the city, he continued his obſervations for 20 days; but as the weather happened to be cloudy during the whole of that ſpace, excepting for ſeven or eight days, no conſiderable variation happened excepting on theſe days. The reſult of the experiments was, that the cold was generally greater in the valley than on the hill; but the variations between the thermometers on the ground and thoſe ſix feet above them, were often as great on the hill as in the valley.

Thus it was perceived that a difference of temperature took place at the diſtance of only three feet from the ground; but the length of the thermometers hitherto made uſe of rendered it impoſſible to make any experiment at a ſmaller diſtance. Two new ones, therefore, were formed by bending down the large tube, the body or bulb of the thermometer, to an horizontal poſition, while the ſtem remained in a vertical one; by which method the temperature might be obſerved to the diſtance of a ſingle inch. Sometimes, in clear weather, theſe two horizontal thermometers were placed in the open air, one within an inch of the ground, and the other nine inches above it. When the variation among the other thermometers was conſiderable, a difference was likewiſe perceived between theſe; the lower one ſometimes indicating more than two degrees leſs heat than the upper one, though placed ſo near each other.

23 His concluſions from theſe experiments.

From theſe experiments Mr Sex concludes, that a greater diminution of heat frequently takes place near the earth in the night-time than at any altitude in the atmoſphere within the limits of his inquiry, that is, 220 feet from the ground; and at ſuch times the greateſt degrees of cold are always met with neareſt the ſurface of the earth.

This is a conſtant and regular operation of nature, under certain circumſtances and diſpoſitions of the atmoſphere, and takes place at all ſeaſons of the year; and this difference never happens in any conſiderable degree but when the air is ſtill, and the ſky perfectly unclouded. The moiſteſt vapour, as dews and fogs, did not at all impede, but rather promote, the refrigeration. In very ſevere froſts, when the air frequently depoſites a quantity of frozen vapour, it is commonly found greateſt; but the exceſs of heat which in the day-time was found at the lower ſtation in ſummer, diminiſhed in winter almoſt to nothing.

24
Mr Darwin's experiments on cold produced by the rarefaction of air.

It has been obſerved, that a thermometer, included in a receiver, always ſinks when the air begins to be rarefied. This has been thought to ariſe, not from any degree of cold thus produced, but from the ſudden expanſion of the bulb of the thermometer in conſequence of the removal of the atmoſpherical preſſure: But from ſome late experiments related, Phil. Tranſ. vol. 78. by Mr Darwin, it appears that the atmoſphere always becomes warm by compreſſion, and cold by dilatation from a compreſſed ſtate. Theſe experiments were,

1. The blaſt from an air-gun was repeatedly thrown upon the bulb of a thermometer, and it uniformly ſunk it about two degrees. In making this experiment the thermometer was firmly fixed againſt a wall, and the air-gun, after being charged, was left for an hour in its vicinity, that it might previouſly loſe the heat it had acquired in the act of charging: the air was then diſcharged in a continued ſtream on the bulb of the thermometer, with the effect already mentioned.

2. A thermometer was fixed in a wooden tube, and ſo applied to the receiver of an air-gun, that, on diſcharging the air by means of a ſcrew preſſing on the valve of the receiver, a continued ſtream of air, at the very time of its expanſion, paſſed over the bulb of the thermometer. This experiment was four times repeated, and the thermometer uniformly ſunk from five to ſeven degrees. During the time of condenſation there was a great difference in the heat, as perceived by the hand, at the two ends of the condenſing ſyringe: that next the air-globe was almoſt painful to the touch; and the globe itſelf became hotter than could have been expected from its contact with the ſyringe. "Add to this (ſays Mr Darwin), that in exploding an air-gun the ſtream of air always becomes viſible, which is owing to the cold then produced precipitating the vapour it contained; and if this ſtream of air had been previouſly more condenſed, or in greater quantity, ſo as not inſtantly to acquire heat from the common atmoſphere in its vicinity, it would probably have fallen in ſnow."

3. A thermometer was placed in the receiver of an air-pump, and the air being haſtily exhauſted, it ſunk two or three degrees; but after ſome minutes regained its former ſtation. The experiment was repeated with a thermometer open at the top, ſo that the bulb could not be affected by any diminution of the external preſſure; but the reſult was the ſame. Both during exhauſtion and readmiſſion of the air into the receiver, a ſteam was regularly obſerved to be condenſed on the ſides of the glaſs; which, in both caſes, was in a few minutes reabſorbed, and which appeared to be precipitated by being deprived of its heat by the expanded air.

4. A hole, about the ſize of a crow-quill, was bored into a large air-veſſel placed at the commencement of the principal pipe of the water-works of Derby. There are four pumps worked by a water-wheel, the water of which is firſt thrown into the lower part of this air-veſſel, and riſes from thence to a reſervoir about 35 or 40 feet above the level; ſo that the water in this veſſel is conſtantly in a ſtate of compreſſion. Two thermometers were previouſly ſuſpended on the leaden air-veſſel, that they might aſſume the temperature of it, and as ſoon as the hole above mentioned was opened, had their bulbs applied to the ſtream of air which iſſued out; the conſequence of which was, that the mercury ſunk four degrees in each. This ſinking of the mercury could not be aſcribed to any evaporation of moiſture from their ſurfaces, as it was ſeen both in exhauſting and admitting the air into the exhauſted receiver mentioned in the laſt experiment, that the vapour which it previouſly contained was depoſited during its expanſion.

5. There is a curious phenomenon obſerved in the fountain of Hiero, conſtructed on a very large ſcale, in the Chemnicenſian mines in Hungary. In this machine the air, in a large veſſel, is compreſſed by a column of water 260 feet high; a ſtop-cock is then opened; and as the air iſſues with great vehemence, and in conſequence of its previous condenſation becomes immediately much expanded, the moiſture it contains is not only precipitated, as in the exhauſted receiver abovementioned, but falls down in a ſhower of ſnow, with iſicles adhering to the noſe of the cock. See Phil. Tranſ. vol. 52.

25
His concluſions with regard to cold on the tops of mountains.

From this phenomenon, as well as the four experiments above related, Mr Darwin thinks "there is good reaſon to conclude, that in all circumſtances where air is mechanically expanded, it becomes capable of attracting the fluid matter of heat from other bodies in contact with it.

"Now, (continues he) as the vaſt region of air which ſurrounds our globe is perpetually moving along its ſurface, climbing up the ſides of mountains, and deſcending into the valleys; as it paſſes along, it muſt be perpetually varying the degree of heat according to the elevation of the country it traverſes: for, in riſing to the ſummits of mountains, it becomes expanded, having ſo much of the preſſure of the ſuperincumbent atmoſphere taken away; and when thus expanded, it attracts or abſorbs heat from the mountains in contiguity with it; and, when it deſcends into the valleys, and is compreſſed into leſs compaſs, it again gives out the heat it has acquired to the bodies it comes in contact with. The ſame thing muſt happen to the higher regions of the atmoſphere, which are regions of perpetual froſt, as has lately been diſcovered by the aerial navigators. When large diſtricts of air, from the lower parts of the atmoſphere, are raiſed two or three miles high, they become ſo much expanded by the great diminution of the preſſure over them, and thence become ſo cold, that hail or ſnow is produced by the precipitation of the vapour: and as there is, in theſe high regions of the atmoſphere, nothing elſe for the expanded air to acquire heat from after it has parted with its vapour, the ſame degree of cold continues, till the air, on deſcending to the earth, acquires its former ſtate of condenſation and of warmth.

"The Andes, almoſt under the line, reſts its baſe on burning ſands; about its middle height is a moſt pleaſant and temperate climate covering an extenſive plain, on which is built the city of Quito; while its forehead is encircled with eternal ſnow, perhaps coeval with the mountain. Yet, according to the accounts of Don Ulloa, theſe three diſcordant climates ſeldom encroach much on each other's territories. The hot winds below, if they aſcend, become cooled by their expanſion; and hence they cannot affect the ſnow upon the ſummit; and the cold winds that ſweep the ſummit, become condenſed as they deſcend, and of temperate warmth before they reach the fertile plains of Quito."

26
Difficulties ſtill remain on the ſubject.

Notwithſtanding all theſe explanations, however, ſeveral very conſiderable difficulties remain with regard to the heat and cold of the atmoſphere. That warm air ſhould always aſcend; and thus, when the ſource of heat is taken away by the abſence of the ſun, that the ſtratum of atmoſphere lying immediately next to the earth ſhould be ſomewhat colder than that which lies a little farther up; is not at all to be wondered at. We have an example ſomewhat ſimilar to this in the potter's kiln; where, after the veſſels have been intenſely heated for ſome time, and the fire is then withdrawn, the cooling always begins at bottom, and thoſe that ſtand lowermoſt will often be quite black, while all the upper part of the furnace and the veſſels next to to it, are of a bright red. It doth not, however, appear, why ſuch degrees of cold ſhould take place at the ſurface of the earth as we ſometimes meet with. It is, beſides, no uncommon thing to meet with large ſtrata in the upper regions of the atmoſphere, remarkable for their cold, while others are warmer than thoſe at the ſurface; as we have been aſſured of by the teſtimony of ſeveral aerial navigators. It is alſo difficult to ſee why the air which has once aſcended, and become rarefied to any extreme degree, ſhould afterwards deſcend among a denſer fluid of ſuperior gravity, though indeed the atmoſpherical currents by which this fluid is continually agitated may have conſiderable effect in this way. See the article WINDS. See alſo HEAT, COLD, CONGELATION, CONDENSATION, &c.

For the quantity of water contained in the atmoſphere, ſee the articles HYGROMETER, CLOUDS, VAPOUR, &c. For the cauſe of the elaſticity of the atmoſphere, ſee ELASTICITY; and for an explanation of its various operations, ſee METEOROLOGY. See alſo HAIL, RAIN, SNOW, &c.

The uſes of the atmoſphere are ſo many and ſo various that it is impoſſible to enumerate them. One of the moſt eſſential is its power of giving life to vegetables, and ſupporting that of all animated beings. For the latter purpoſe however, it is not in all places equally proper: we ſhall therefore conclude this article with ſome remarks on

27
Of the ſalubrity of the atmoſphere.

The Salubrity of the ATMOSPHERE.——The air on the tops of mountains is generally more ſalubrious than that in pits. Denſe air indeed is always more proper for reſpiration than ſuch as is more rare; yet the air on mountains, though much more rare, is more free from phlogiſtic vapours than that of pits. Hence it has been found, that people can live very well on the tops of mountains, where the barometer ſinks to 15 or 16 inches. M. de Sauſſure, in his journey upon the Alps, having obſerved the air at the foot, on the middle, and on the ſummits of various mountains, obſerves, that the air of the very low plains ſeems to be the leſs ſalubrious; that the air of very high mountains is neither very pure, nor, upon the whole, ſeems ſo fit for the lives of men, as that of a certain height above the level of the ſea, which he eſtimates to be about 200 or 300 toiſes, that is, about 430 or 650 yards.

Dr White, in the lxviiith vol. of the Phil. Tranſ. giving an account of his experiments on air made at York, ſays, that the atmoſpherical air was in a very bad ſtate, and indeed in the worſt he had ever obſerved it, the 13th of September 1777; when the barometer ſtood at 30.30, the thermometer at 69°; the weather being calm, clear, and the air dry and ſultry, no rain having fallen for above a fortnight. A ſlight ſhock of an earthquake was perceived that day.

The air of a bed-room at various times, viz. at night, and in the morning after ſleeping in it, has been examined by various perſons; and it has been generally found, that after ſleeping in it the air is leſs pure than at any other time. The air of privies, even in calm weather has not been found to be ſo much phlogiſticated as might have been expected, notwithſtanding its diſagreeable ſmell.

From this and other obſervations, it is thought that the exhalations of human excrements are very little if at all injurious, except when they become putrid, or proceed from a diſeaſed body; in which caſe they infect the air very quickly.

28
Dr Ingenhouſz's experiments.

Dr Ingenhouſz, ſoon after he left London, ſent an account of his experiments made in the year 1779 upon the purity of the air at ſea and other parts; which account was read at the Royal Society the 24th of April 1780, and is inſerted in the lxxth vol. of the Phil. Tranſ. His firſt obſervations were made on board a veſſel in the mouth of the Thames, between Sheerneſs and Margate, where he found that the air was purer than any other ſort of common air he had met with before. He found that the ſea-air taken farther from the land, viz. between the Engliſh coaſt and Oſtend, was not ſo pure as that tried before; yet this inferior purity ſeems not to take place always. The Doctor's general obſervations, deduced from his numerous experiments, are, "That the air at ſea, and cloſe to it, is in general purer, and fitter for animal life, than the air on the land, though it ſeems to be ſubject to ſome inconſiſtency in its degree of purity with that of the land: That probably the air will be found in general much purer far from the land than near the ſhore, the former being never ſubject to be mixed with land air."

The Doctor in the ſame paper tranſcribes a journal of experiments, ſhowing the degree of purity of the atmoſphere in various places, and under different circumſtances; which we ſhall inſert here in an abridged manner.

29
His Journal of the purity of the air in different places.

The method uſed in thoſe experiments, was to introduce one meaſure of common air into the eudiometer-tube, and then one meaſure of nitrous air. The moment that theſe two ſorts of elaſtic fluids came into contact, he agitated the tube in the water-trough, and then meaſured the diminution, expreſſing it by hundredth parts of a meaſure; thus, when he ſays that ſuch air was found to be 130, it ſignifies, that after mixing one meaſure of it with one of nitrous air, the whole mixed and diminiſhed quantity was 130 hundredths of a meaſure, viz. one meaſure and 30 hundredths of a meaſure more.

" The different degrees of ſalubrity of the atmoſphere,

ſphere, as I found it in general in my country-houſe at Southal-Green, ten miles from London, from June to September, lay between 103 and 109. I was ſurpriſed when, upon my return to town to my former lodgings in Pall-Mall Court, I found the common air purer in general in October than I uſed to find it in the middle of ſummer in the country; for on the 22d of October, at nine o'clock in the morning, the weather being fair and froſty, I found that one meaſure of common air, and one of nitrous air, occupied 100 ſubdiviſions in the glaſs-tube, or exactly one meaſure. That very day, at two o'clock in the afternoon (it being then rainy weather), the air was ſomewhat altered for the worſe. It gave 102. October the 23d, it being rainy weather, the air gave 102. October the 24th, the weather being ſerene, the air at nine o'clock in the morning gave 100. October the 25th, the ſky being cloudy at 11 o'clock in the morning, the air gave 102. At 11 o'clock at night, from five different trials, it gave 105. October the 26th, the weather being very dark and rainy, the air gave 105, as before."

The air at Oſtend was found by the Doctor to be generally very good, giving between 94 and 98. At Bruges, the air taken at ſeven o'clock at night gave 103. November the 8th, the air at Ghent at three in the afternoon gave 03.

November the 12th, the air of Bruſſels at ſeven o'clock P. M. gave 105¼. The next day the air of the lower part of the ſame city gave 106; that of the higheſt appeared to be purer, as it gave 104; which agrees with the common popular obſervation. November the 14th, both the air of the higheſt and that of the loweſt part of the city appeared to be of the ſame goodneſs, giving 103. The weather was froſty.

November the 22d, the air of Antwerp in the evening gave 109¼; the weather being rainy, damp, and cold. November the 23d, the air of Breda gave 106. The next day about 11 o'clock the air gave 102; the weather being fair, cold, and inclining to froſt. At ſeven o'clock it gave 103. Next day, being the 25th, the air gave 104; the weather being cold and rainy. The 26th it gave 103; the weather being very rainy, cold, and ſtormy. November the 27th, the air at the Moordyke cloſe to the water gave 101¼; the weather being fair and cold, but not froſty. This ſpot is reckoned very healthy. November the 28th, the air of Rotterdam gave 103; the weather being rainy and cold. November the 29th, the air of Delft gave 103; the weather being ſtormy and rainy.

November the 30th, the air of the Hague gave 104; the weather being cold, and the wind northerly. The firſt of December the weather underwent a ſudden change; the wind becoming ſoutherly and ſtormy, and the atmoſphere becoming very hot. The day after, Fahrenheit's thermometer ſtood at 54°; and the common air being repeatedly and accurately tried gave 116; and that preſerved in a glaſs phial from the preceding day gave 117; and that gathered cloſe to the ſea gave 115.

December the 4th, the air of Amſterdam gave 103; the weather being rainy, windy, and cold. The day after the weather continuing nearly the ſame, the air gave 102. December the 10th, the air of Rotterdam gave 101; the weather being rainy. December the 12th, being in the middle of the water between Dort and the Moordyke, the air gave 109; the weather being remarkably dark, rainy, and windy. December the 13th, the air of Breda in the morning gave 109; the weather continuing as the day before. And in the afternoon, the air gave 106¼; the weather having cleared up. December the 16th, the air of the lower part of the city of Antwerp gave 105, that of the higher part 104; the weather being rainy and temperate. December the 17th, the air of Antwerp gave 107; the weather continuing nearly as in the preceding day. December the 19th, the air of Bruſſels gave 109; the weather being rainy, windy, and rather warm. December the 21ſt, the air of Bruſſels gave 106; the weather being dry and cold. The next day the air and weather continued the ſame. December the 23d, the air of Mons gave 104; the weather being rainy and cold. December the 24th, the air near Bouchain gave 104¼; the weather being cloudy and cold. December the 25th, the air of Peronne gave 102¼; the weather being froſty. December the 26th, the air of Cuvilli gave 103; the weather froſty. December the 27th, the air of Senlis gave 102¼; the weather froſty. December the 29th, the air of Paris gave 103; the weather froſty. 1780, January the 8th, the air of Paris gave 100; the weather froſty. January the 13th, the air of Paris gave 98; hard froſt.

30 Apparatus with which his experiments were made.

Thus far with Dr Ingenhouſz's obſervations. His apparatus was a very portable one, made by Mr Martin, which in reality is the eudiometer-tube and meaſure as uſed by Mr Fontana before he made his laſt improvement. "The whole of this apparatus (ſays Dr Ingenhouſz) was packed up in a box about ten inches long, five broad, and three and a half high. The glaſs-tube or great meaſure, which was 16 inches long, and divided in two ſeparate pieces, lay in a ſmall compaſs, and could be put together by braſs ſcrews adapted to the divided extremities. Inſtead of a water-trough, ſuch as is uſed commonly, I made uſe of a ſmall round wooden tube, &c."

31 Fontana's opinions on the ſubject.

The Abbé Fontana, who has made a great number of very accurate experiments upon this ſubject, gives his opinion in the following words: "I have not the leaſt heſitation in aſſerting, that the experiments made to aſcertain the ſalubrity of the atmoſpherical air in various places in different countries and ſituations, mentioned by ſeveral authors, are not to be depended upon; becauſe the method they uſed was far from being exact (A), the elements or ingredients for the experiment were unknown and uncertain, and the reſults very different from one another.

"When all the errors are corrected, it will be found that the difference between the air of one country and that of another, at different times, is much leſs than what is commonly believed; and that the great differences found by various obſervers are owing to the fallacious effects of uncertain methods. This I advance from experience; for I was in the ſame error. I found very

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(A) It is plain that Dr Ingenhouſz's method is not implied in this remark: ſince the Doctor's experiments were made long after, and the method uſed by him was properly that of Mr Fontana.

very great differences between the reſults of the experiments of this nature which ought to have been ſimilar; which diverſities I attributed to myſelf, rather than to the method I then uſed. At Paris I examined the air of different places at the ſame time, and eſpecially of thoſe ſituations where it was moſt probable to meet with infected air, becauſe thoſe places abounded with putrid ſubſtances and impure exhalations; but the differences I obſerved were very ſmall, and much leſs than what could have been ſuſpected, for they hardly arrived to one-fiftieth of the air in the tube. Having taken the air of the hill called *Mount Valerian*, at the height of about 500 feet above the level of Paris, and compared it with the air of Paris taken at the ſame time, and treated alike, I found the former to be hardly one-thirtieth better than the latter.

“ In London I have obſerved almoſt the ſame. The air of Iſlington and that of London ſuffered an equal diminution by the mixture of nitrous air; yet the air of Iſlington is eſteemed to be much better. I have examined the air of London taken at different heights (for inſtance, in the ſtreet, at the ſecond floor, and at the top of the adjoining houſes), and have found it to be of the ſame quality. Having taken the air at the iron gallery of St Paul's cupola, at the height of 313 feet above the ground, and likwiſe the air of the ſtone gallery, which is 202 feet below the other; and having compared theſe two quantities of air with that of the ſtreet adjoining, I found that there was ſcarce any ſenſible difference between them, although taken at ſuch different heights.

“ In this experiment a circumſtance is to be conſidered, which muſt have contributed to render the above-mentioned differences more ſenſible: this is, the agitation of the air of the cupola; for there was felt a pretty briſk wind upon it, which I obſerved to be ſtronger and ſtronger the higher I aſcended; whereas in the ſtreet, and indeed in all the ſtreets I paſſed through, there was no ſenſible wind to be felt. This experiment was made at four in the afternoon, the weather being clear. The quickſilver in the barometer at that time was 28,6 inches high, and Fahrenheit's thermometer ſtood at 54°.”

A few lines after, Mr Fontana proceeds thus:—“ From this we clearly ſee, how little the experiments hitherto publiſhed about the differences of common air are to be depended upon. In general, I find that the air changes from one time to another; ſo that the differences between them are far greater than thoſe of the airs of different countries or different heights. For inſtance, I have found that the air of London in the months of September, October, and November, 1778, when treated with the nitrous air, gave II,I, 1,90, and II,II, 2,25, which is a mean reſult of many experiments which differed very little from each other. The 26th day of November laſt, I found the air for the firſt time much better, for it gave II,I 1,80, and II,II, 2,20; but the 14th of February 1779, the air gave II,I, 1,69, and II,II, 2,21; from whence it appears, that the air of this 14th of February was better than it had been ſix months before. There can be no doubt of the accuracy of the experiments, becauſe I compared the air taken at different times with that which I had firſt uſed in the month of September, and which I had preſerved in dry glaſs-bottles accurately ſtopped.”

This difference in the purity of the air at different times, Mr Fontana farther remarks, is much greater than the difference between the air of the different places obſerved by him: notwithſtanding this great change, as he obſerved, and as he was informed by various perſons, no particular change of health in the generality of people, or facility of breathing, was perceived.

Mr Fontana laſtly concludes with obſerving, that “ Nature is not ſo partial as we commonly believe. She has not only given us an air almoſt equally good every where at every time, but has allowed us a certain latitude, or a power of living and being in health in qualities of air which differ to a certain degree. By this I do not mean to deny the exiſtence of certain kinds of noxious air in ſome particular places; but only ſay, that in general the air is good every where, and that the ſmall differences are not to be feared ſo much as ſome people would make us believe. Nor do I mean to ſpeak here of thoſe vapours and other bodies which are accidentally joined to the common air in particular places, but do not change its nature and intrinſical property. This ſtate of the air cannot be known by the teſt of nitrous air; and thoſe vapours are to be conſidered in the ſame manner as we ſhould conſider ſo many particles of arſenic ſwimming in the atmoſphere. In this caſe it is the arſenic, and not the degenerated air, that would kill the animals who ventured to breathe it.”

ATOCK, The capital of a province of the ſame name in the dominions of the Great Mogul. It is ſeated on a point of land where two large rivers meet, and is one of the beſt fortreſſes the Mogul has; but formerly nobody was permitted to enter it without a paſſport from the Mogul himſelf. E. Long. 72. 10. N. Lat. 32. 20.

ATOM, in philoſophy, a particle of matter, ſo minute, as to admit of no diviſion. Atoms are the *minima naturæ*, and are conceived as the firſt principles or component parts of all phyſical magnitude.

ATOMICAL PHILOSOPHY, or the doctrine of atoms, a ſyſtem which, from the hypotheſis that atoms are endued with gravity and motion, accounted for the origin and formation of things. This philoſophy was firſt broached by Moſchus, ſome time before the Trojan war; but was much cultivated and improved by Epicurus; whence it is denominated the *Epicurean philoſophy*. See EPICUREAN.

ATONEMENT. See EXPIATION.

ATONY, in medicine, a defect of tone or tenſion, or a laxity or debility of the ſolids of the body.

ATOOI, one of the Sandwich iſlands, ſituated in E. Long. 200. 20. N. Lat. 21. 57. Towards the north-eaſt and north-weſt, the face of the country is ragged and broken; but to the ſouthward it is more even. The hills riſe from the ſea-ſide with a gentle acclivity, and at a little diſtance back are covered with wood. Its produce is the ſame with that of the other iſlands of this cluſter; but its inhabitants greatly excel the people of all the neighbouring iſlands in the management of their plantations. In the low grounds, contiguous to the bay wherein our navigators anchored, Atooi.

ed, theſe plantations were regularly divided by deep ditches; the fences were formed with a neatneſs approaching to elegance, and the roads through them were finiſhed in ſuch a manner as would have reflected credit even on an European engineer.

The iſland is about 300 miles in circumference. The road, or anchoring-place, which our veſſels occupied, is on the ſouth-weſt ſide of the iſland, about two leagues from the weſt end, before a village named Wymoa. As far as was ſounded, the bank was free from rocks; except to the eaſtward of the village, where there projects a ſhoal on which are ſome rocks and breakers. This road is ſomewhat expoſed to the trade-wind; notwithſtanding which defect, it is far from being a bad ſtation, and greatly ſuperior to thoſe which neceſſity continually obliges ſhips to uſe, in countries where the winds are not only more variable but more boiſterous; as at Madeira, Teneriffe, the Azores, &c. The landing too is not ſo difficult as at moſt of thoſe places; and, unleſs in very bad weather, is always practicable. The water in the neighbourhood is excellent, and may be conveyed with eaſe to the boats. But no wood can be cut at any convenient diſtance, unleſs the iſlanders could be prevailed upon to part with the few etooa trees (*cordia ſebeſtina*) that grow about their villages, or a ſpecies called *dooe dooe*, which grows farther up the country. The ground, from the wooden part to the ſea, is covered with an excellent kind of graſs, about two feet in height, which ſometimes grows in tufts, and appeared capable of being converted into abundant crops of fine hay. But on this extenſive ſpace not even a ſhrub grows naturally.

Beſides taro, the ſweet potatoe, and other ſimilar vegetables uſed by our crews as refreſhments, among which were at leaſt five or ſix varieties of plantains, the iſland produces bread-fruit; which, however, ſeems to be ſcarce. There are alſo a few cocoa palms; ſome yams; the kappe of the Friendly iſlands, or Virginian arum; the etooa tree, and odoriferous gardenia or cape jaſmine. Our people alſo met with ſeveral trees of the dooe dooe, that bear the oily nuts, which are ſtuck upon a kind of ſkewer and made uſe of as candles. There is a ſpecies of ſida, or Indian mallow; alſo the morinda citrifolia, which is here called *none*; a ſpecies of convolvulus; the ava or intoxicating pepper, beſides great quantities of gourds. Theſe laſt grow to a very large ſize, and are of a remarkable variety of ſhapes, which are perhaps the effect of art.

The ſcarlet birds, which were brought for ſale, were never met with alive; but one ſmall one was ſeen, about the ſize of a canary bird, of a deep crimſon colour; alſo a large owl, two brown hawks or kites, and a wild duck. Other birds were mentioned by the natives; among which were the otoo, or blueiſh heron, and the torata, a ſort of of whimbrel. It is probable that the ſpecies of birds are numerous, if we may judge by the quantity of fine yellow, green, and ſmall, velvet-like, blackiſh feathers uſed upon the cloaks and other ornaments worn by theſe people. Fiſh, and other productions of the ſea, were to appearance not various. The only tame or domeſtic animals found here were hogs, dogs, and fowls, which were all of the ſame kind that had been met with at the iſlands of the South Pacific. There were alſo ſmall lizards, and ſome rats.

Atooi, Atra.

The inhabitants of Atooi are of the middle ſize, and in general ſtoutly made. They are neither remarkable for a beautiful ſhape nor for ſtriking features. Their viſage, particularly that of the women, is ſometimes round, but others have it long; nor can it juſtly be ſaid, that they are diſtinguiſhed as a nation by any general caſt of countenance. Their complexion is nearly of a nut brown; but ſome individuals are of a darker hue. They are far from being ugly, and have, to all appearance, few natural deformities of any kind. Their ſkin is not very ſoft nor ſhining; but their eyes and teeth are, for the moſt part, pretty good. Their hair in general is ſtraight; and though its natural colour is uſually black, they ſtain it, as at the Friendly and other iſlands. They are active, vigorous, and moſt expert ſwimmers; leaving their canoes upon the moſt frivolous occaſion, diving under them, and ſwimming to others, though at a conſiderable diſtance. Women with infants at the breaſt, when the ſurf was ſo high as to prevent their landing in the canoes, frequently leapt overboard, and ſwam to the ſhore, without endangering their little ones. They appeared to be of a frank, chearful diſpoſition; and are equally free from the fickle levity which characterizes the inhabitants of Otaheite, and the ſedate caſt which is obſervable among many of thoſe of Tongataboo. They ſeem to cultivate a ſociable intercourſe with each other; and, except the propenſity of thieving, which is as it were innate in moſt of the people in thoſe ſeas, they appeared extremely friendly. It was pleaſing to obſerve with what affection the women managed their infants, and with what alacrity the men contributed their aſſiſtance in ſuch a tender office; thus diſtinguiſhing themſelves from thoſe ſavages who conſider a wife and a child as things rather neceſſary than deſirable or worthy of their regard and eſteem. From the numbers that were ſeen aſſembled at every village in coaſting along, it was conjectured that the inhabitants of this iſland are pretty numerous. Including the ſtraggling houſes, it was computed there might perhaps be, in the whole iſland, ſixty ſuch villages as that near which our ſhips anchored; and allowing five perſons to each houſe, there would be in every village five hundred, or thirty thouſand upon the iſland. This number is by no means exaggerated; for there were ſometimes three thouſand people at leaſt collected upon the beach, when it could not be ſuppoſed that above a tenth part of the natives were preſent.

ATRA BILIS, BLACK BILE, or MELANCHOLY. According to the ancients it hath a twofold origin: 1ſt, From the groſſer parts of the blood, and this they called the *melancholy humour*. 2d, From yellow bile being highly concocted. Dr Percival, in his Eſſays Med. and Exp. ſuggeſts, that it is the gall rendered acrid by a ſtagnation in the gall-bladder, and rendered viſcid by the abſorption of its fluid parts. Bile in this ſtate diſcharged into the duodenum, occaſions univerſal diſturbance and diſorder until it is evacuated; it occaſions violent vomiting, or purging, or both; and previous to this the pulſe is quick, the head aches, a delirium comes on, a hiccough, intenſe thirſt, inward heat, and a fetid breath. Some deſcribe this kind of bile as being acid, harſh, corroding, and, when poured on the ground, bubbling up, and raiſing the earth after the manner of a ferment. Dr Percival ſays, that by the uſe of the *infuſ. ſenæ limoniet.* warmed with the *tinct. columb.* he had checked the vomitings occaſioned by this matter.

Atra dies, in antiquity, denotes a *fatal day* whereon the Romans received ſome memorable defeat. The word literally imports *a black day;* a denomination taken from the colour, which is the emblem of death and mourning. Whence the Thracians had a cuſtom of marking all their happy days with white ſtones or calculi, and their unhappy days with black ones: which they caſt, at the cloſe of each day, into an urn. At the perſon's death the ſtones were taken out; and from a compariſon of the numbers of each complection, a judgment was made of the felicity or infelicity of his courſe of life. The *dies atræ* or *artri,* were afterwards denominated *nefaſti,* and *poſteri.* Such in particular was the day when the tribunes were defeated by the Gauls, at the river Allia, and loſt the city; alſo that whereon the battle of Cannæ was fought; and ſeveral others marked in the Roman calendar as *atræ* or unfortunate.

ATRACTYLIS, distaff thistle: A genus of the polygamia æqualis order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ-capitatæ.* The corolla is radiated; and each of the little corollæ of the radius has five teeth.

Species. 1. The cancellata, or ſmall cnicus, is an annual plant riſing about eight or nine inches high, with a ſlender ſtem, garniſhed with hoary leaves, having ſpines on their edges. At the top of theſe branches are ſent out two or three ſlender ſtalks, each terminated by a head of flowers like thoſe of the thiſtle. The empalement is curiouſly netted over, and is narrow at the top, but ſwelling below; and contains many florets of a purpliſh colour. Theſe are each ſucceeded by a ſingle downy ſeed, which in cold years do not ripen in Britain. 2. The humilis, or purple prickly cnicus, riſes about a foot high, with indented leaves, having ſmall ſpines on their edges. The upper part of the ſtalk is divided into two or three ſlender branches, each ſupporting a head of purple flowers, having rays incloſed in a ſcaly empalement. The flowers appear in June; but unleſs the ſeaſon is warm, the ſeeds will not ripen in Britain. 3. The gummifera, or prickly gum-bearing cnicus, known among phyſicians by the name of *carline thiſtle.* This ſends out many narrow leaves, which are deeply ſerrated, and armed with ſpines on their edges. Theſe lie cloſe on the ground; and between them the flower is ſituated, without a ſtalk, and having many florets incloſed in a prickly empalement. Thoſe on the border are white; but ſuch as compoſe the diſk are of a yellowiſh colour. It flowers in July, but never perfects ſeeds in Britain.

Culture. All theſe plants are natives of the warm parts of Europe, as Spain, Sicily, and the Archipelago iſlands, from whence their ſeeds muſt be procured. They muſt be ſown upon an open bed of light earth, where the plants are to remain; and when the plants come up, they ſhould be thinned, ſo as to leave them three or four inches aſunder. The roots of the ſecond will laſt two or three years, and the third is a perennial plant.

Medicinal Uſes. The root of the third ſort was formerly uſed as a warm diaphoretic and alexipharmic; but it never came much into uſe in Britain, and the preſent practice has entirely rejected it. The root is about an inch thick, externally of a pale ruſty brown colour, corroded as it were in the ſurface; and perforated with numerous ſmall holes, ſo as to appear worm-eaten when cut. It has a ſtrong ſmell; and a ſubacid, bitteriſh, and weakly aromatic taſte. Frederic Hoffman the elder relates, that he has obſerved a decoction of it in broth to occaſion vomiting.

ATRÆTI, in medicine, infants having no perforation in the anus, or perſons imperforated in the vagina or urethra.

ATRAGENE, in botany; A genus of the polyandria order belonging to the polygamia claſs of plants. The calyx has four leaves; the petals are 12; and the ſeeds are candated. There are three ſpecies, all natives of the eaſt.

ATRAPHAXIS: A genus of the dygnia order, belonging to the hexandria claſs of plants; and in the natural method ranking under the 12th order, *Holoraceæ.* The calyx has two leaves; the petals are two, and ſinuated; and there is but one ſeed. There are two ſpecies, both natives of warm countries, but meriting no particular deſcription.

ATREBATII, a people of Britain, ſeated next to the Bibroci, in part of Berkſhire and part of Oxfordſhire. This was one of thoſe Belgic colonies which had come out of Gaul into Britain, and there retained their ancient name. For the Atrebatii were a tribe of the Belgæ, who inhabited that country which is now called Artois. They are mentioned by Cæſar among the nations which compoſed the Belgic confederacy againſt him; and the quota of troops which they engaged to furniſh on that occaſion was 15,000. Comius of Arras was a king or chieftain among the Atrebatii in Gaul in Cæſar's time: and he ſeems to have poſſeſſed ſome authority, or at leaſt ſome influence, over our Atrebatii in Britain; for he was ſent by Cæſar to perſuade them to ſubmiſſion. This circumſtance makes it probable that this colony of the Atrebatii had not been ſettled in Britain very long before that time. The Atrebatii were among thoſe Britiſh tribes which ſubmitted to Cæſar; nor do we hear of any remarkable reſiſtance they made againſt the Romans at their next invaſion under Claudius. It is indeed probable, that before the time of this ſecond invaſion they had been ſubdued by ſome of the neighbouring ſtates, perhaps by the powerful nation of the Cattivellauni, which may be the reaſon they are ſo little mentioned in hiſtory. Calliva Attrebatum, mentioned in the ſeventh, twelfth, thirteenth, and fourteenth itinera of Antoninus, and called by Ptolemy *Calcua,* ſeems to have been the capital of the Atrebatii; though our antiquaries differ in their ſentiments about the ſituation of this ancient city, ſome of them placing it at Wallingford, and others at Ilcheſter.

ATREUS, in fabulous hiſtory, the ſon of Pelops and Hippodamia, and the father of Agamemnon and Menelaus, is ſuppoſed to have been king of Mycenæ and Argos about 1228 years before the Chriſtian æra. He drove his brother Thyeſtes from court, for having a criminal commerce with Ærope his wife; but underſtanding that he had had two children by her, he ſent for him again, and made him eat them; at which horrid action the ſun, it is ſaid, withdrew his light.

ATRI, a town of Italy, in the farther Abruzzo in the kingdom of Naples, with the title of a duchy; it is the ſee of a biſhop, and is ſeated on a craggy mountain, four miles from the Adriatic Sea. E. Long. 13.8. N. Lat 42. 45.

ATRIENSES, in antiquity, a kind of ſervants or officers in the great families at Rome, who had the care and inſpection of the atria and the things lodged therein.

Theſe are otherwiſe called atriarii, though ſome make a diſtinction between *atrienſes* and *atriarii*; ſuggeſting that the latter were an inferior order of ſervants, perhaps aſſiſtants of the atrienſes, and employed in the more ſervile offices of the atrium, as to attend at the door, ſweep the area, &c.

The artienſes are repreſented as ſervants of authority and command over the reſt: they acted as procurators, or agents, of their maſter, in ſelling his goods, &c. To their care were committed the ſtatues and images of the maſter's anceſtors, &c. which were placed round the atrium; and which they carried in proceſſion at funerals, &c.

In the villas, or country-houſes, the atrienſes had the care of the other furniture and utenſils, particularly thoſe of metal, which they were to keep bright from ruſt. Other things they were to hang from time to time in the ſun, to keep them dry, &c. They were cloathed in a ſhort white linen habit, to diſtinguiſh them, and prevent their loitering from home.

ATRIP, in nautical language, is applied either to the anchor or ſails. The anchor is atrip, when it is drawn out of the ground in a perpendicular direction, either by the cable or buoy-rope. The top-ſails are atrip, when they are hoiſted up to the maſt-head, or to their utmoſt extent.

ATRIPLEX, ORACH, or ARACH: A genus of the monœcia order, belonging to the polygamia claſs of plants; and, in the natural method, ranking under the 12th order, *Holoraceæ*. The calyx of the hermaphrodite flower has five leaves: there is no corolla; the ſtamina are five, and the ſtylus is bifid; the ſeed is one, and depreſſed.

Species. 1. The hortenſis, or garden orach, was formerly cultivated in gardens, and uſed as a ſubſtitute for ſpinage, to which it is ſtill preferred by ſome, tho' in general it is diſliked by the Engliſh; however, it ſtill maintains its credit in France, as alſo in the northern parts of England. There are three or four varieties of this plant, whoſe only difference is their colour; one is a deep green, another a dark purple, and a third with green leaves and purple borders. 2. The halimus, or broad-leaved orach, was formerly cultivated in gardens as a ſhrub, by ſome formed into hedges, and conſtantly ſheared to keep them thick: but this is a purpoſe to which it is by no means adapted, as the ſhoots grow ſo vigorous, that it is impoſſible to keep the hedge in any tolerable order; and, what is worſe, in ſevere winters the plants are often deſtroyed. 3. The petulacoides, or ſhrubby ſea-orach, grows wild by the ſea-ſide in many places of Britain. It is a low underſhrub, ſeldom riſing above two feet and an half, or at moſt three feet high; but becomes very buſhy. This may have a place in gardens among other low ſhrubs, where it will make a pretty diverſity. Beſides theſe, nine other ſpecies are enumerated by botanical writers, but the abovementioned are the moſt remarkable.

Culture, &c. The firſt ſort is annual, ſo muſt be propagated by ſeeds. Theſe are to be ſown at Michaelmas, ſoon after the ſeeds are ripe. The plants require no other culture than to be kept free from weeds, to hoe them when they are about an inch high, and to cut them down when they are too thick, ſo as to leave them about four inches aſunder. When theſe plants are ſown in a rich ſoil, and allowed a good diſtance from each other, the leaves will grow very large, and in this their goodneſs conſiſts. This muſt be eaten whilſt it is young; for when old, the leaves become tough, and are good for nothing. This ſpecies is an article of the materia medica; a decoction of the leaves is recommended in coſtiveneſs, where the patient is of a hot bilious diſpoſition.—The ſecond ſort may be propagated by cuttings. Theſe are to be planted in any of the ſummer months, in a ſhady border; where they will ſoon take root, and be fit againſt the following Michaelmas to tranſplant into thoſe places where they are to remain.—The third ſort requires very little culture. It may be alſo propagated from cuttings, and is to be planted in a poor gravelly ſoil.

ATRIUM, in eccleſiaſtical antiquity, denotes an open place or court before a church, making part of what was called the *narthex* or *antetemple*.

The atrium in the ancient churches was a large area or ſquare plat of ground, ſurrounded with a portico or cloyſter, ſituate between the porch or veſtible of the church, and the body of the church.

Some have miſtakenly confounded the atrium with the porch or veſtible, from which it was diſtinct; others with the narthex, of which it was only a part.

The atrium was the manſion of thoſe who were not ſuffered to enter farther into the church. More particularly, it was the place where the firſt claſs of penitents ſtood to beg the prayers of the faithful as they went into the church.

ATRIUM is alſo uſed, in the cannon law, for the cemetry or church-yard. In this ſenſe we find a law prohibiting buildings to be raiſed in *atrio eccleſiæ*, except for the clergy; which the gloſſary explains thus, *id eſt in cæmeterio*, which includes the ſpace of forty paces around a large church, or thirty round a little church or chapel.

ATROPA, DEADLY NIGHT-SHADE: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 25th order, *Luridæ*. The corolla is campanulated; the ſtamina are diſtant; the berry is globular, and conſiſts of two cells. The ſpecies are five; of which the three following are the moſt remarkable: 1. The belladonna grows wild in many parts of Britain. It hath a perennial root, which ſends out ſtrong herbaceous ſtalks of a purpliſh colour, which riſe to the height of four or five feet, garniſhed with entire oblong leaves, which towards autumn change to a purpliſh colour. The flowers are large, and come out ſingly between the leaves, upon long foot-ſtalks; bell-ſhaped, and of a duſky colour on the out-ſide, but purpliſh within. After the flower is paſt, the germen turns to a large round berry a little flatted at the top. It is firſt green; but when ripe, turns to a ſhining black, ſits cloſe upon the empalement, and contains a purple juice of a nauſeous ſweet taſte, and full of ſmall kidney-ſhaped ſeeds. 2. The fruteſcens is a native of Spain, and riſes with a ſhrubby ſtem to the height of ſix or eight feet; dividing into many branches garniſhed with round leaves, in ſhape like thoſe of the ſtorax tree: theſe are placed alternately on the branches. The flowers come out between the leaves on ſhort footſtalks, ſhaped like thoſe of the former, but much leſs; of a dirty yellowiſh colour, with a few brown ſtripes: but theſe are never ſucceeded by berries in Britain. 3. The herbacea, with an herbaceous ſtalk, is a native of Campeachy. This hath a perennial root, which puts forth ſeveral channelled herbaceous ſtalks riſing about two feet; and towards the top they divide into two or three ſmall branches garniſhed with oval leaves four inches long and three broad, having ſeveral prominent tranſverſe ribs on the under ſide. The flowers come out from between the leaves on ſhort foot-ſtalks; they are white, and ſhaped like thoſe of the common ſort, but ſmaller. It flowers in July and Auguſt, but ſeldom ripens its fruit in Britain. 4. The mandragora, or mandrake, which has been diſtinguiſhed into the male and female. The male mandrake has a very large, long, and thick root; it is largeſt at the top or head, and from thence gradually grows ſmaller. Sometimes it is ſingle and undivided to the bottom; but more frequently it is divided into two or more parts. When only parted into two, it is pretended that it reſembles the body and thighs of a man. From this root there ariſe a number of very long leaves, broadeſt in the middle, narrow towards the baſe, and obtuſely pointed at the end; they are of a foot or more in length, and five inches or thereabouts in breadth; they are of a duſky and diſagreeable green colour, and of a very fœtid ſmell. The female mandrake perfectly reſembles the other in its manner of growth; but the leaves are longer and narrower, and of a darker colour, as are alſo the ſeeds and roots. It grows naturally in Spain, Portugal, Italy, and the Levant.

Culture. The firſt ſpecies, which is remarkable for its poiſonous qualities, is very ſeldom admitted in gardens, nor ſhould it ever be cultivated or allowed to grow in thoſe places to which children have acceſs. The other kinds are propagated by ſeeds, and placed in a ſtove, as is requiſite for the more tender plants.

Qualities, &c. The firſt ſpecies, as we have already obſerved, is a ſtrong poiſon. Mr Ray gives a good account of the ſymptoms that follow the taking of it inwardly, by what happened to a mendicant friar upon his drinking a glaſs of mallow wine in which the herb was infuſed. In a ſhort time he became delirious, and ſoon after was ſeized with a grining laughter; then with ſeveral irregular motions, and at laſt with a real madneſs, and ſuch a ſtupidity as thoſe have who are ſottiſhly drunk: but after all he was cured by a draught of vinegar. Buchannan alſo gives an account of the deſtruction of the army of Sweno the Dane, when he invaded Scotland, by mixing a quantity of the belladonna berries with the drink which the Scots were, according to a treaty of truce, to ſupply them with. This ſo intoxicated the Danes, that the Scots fell upon them in their ſleep, and killed the greateſt part of them, ſo that there were ſcarcely men enough left to carry off their king. There have alſo been many inſtances in Britain of children being killed by eating berries of a fine black colour, and about the ſize of a ſmall cherry, which are no other than thoſe of belladonna. When an accident of this kind is diſcovered in time, a glaſs of warm vinegar will prevent the bad effects.

The third ſpecies has been recommended in caſes of barrenneſs, but without foundation. Its freſh root is a violent purge, the doſe being from ten grains to twenty in ſubſtance, and from half a dram to a dram in infuſion. It has been found to do ſervice in hyſteric complaints; but muſt be uſed with great caution, otherwiſe it will bring on convulſions, and many other miſchievous ſymptoms. It has alſo a narcotic quality. At preſent only the freſh leaves are ſometimes uſed in anodyne and emollient cataplaſms and fomentations. It uſed to be an ingredient in one of the old officinal unguents; but both that and the plant itſelf are now rejected from our pharmacopœias. It ſtill however retains a place in the foreign ones, and may perhaps be conſidered as deſerving farther attention.

Naturaliſts tell ſtrange ſtories of this plant: but ſetting aſide its ſoporiferous virtue, the modern botaniſts will ſcarce warrant any of them, nor even that human figure ordinarily aſcribed to its roots, eſpecially ſince the diſcovery of the artifice of the Charletans in faſhioning it, to ſurpriſe the credulity of the people. The figure given in Plate XCI. however, was taken from a genuine root.

Moſes informs us, (Gen. xxx. 14.) that Reuben, the ſon of Leah, being in the field, happened to find mandrakes, which he brought home to his mother. Rachel had a mind to them, and obtained them from Leah, upon condition that ſhe ſhould conſent that Jacob ſhould be Leah's bedfellow the night following. The term דודאים *dudaim,* here made uſe of by Moſes, is one of thoſe words of which the Jews at this day do not underſtand the true ſignification. Some tranſlate it *violets,* others *lillies,* or *jeſſamine.* Junius calls it *agreeable flowers;* Codurquus makes it *truffle,* or *muſhroom;* and Calmet will have it to be the *citron.* Thoſe that would ſupport the tranſlation of *mandrakes* plead, that Rachel being barren, and having a great deſire to conceive, coveted Leah's mandrakes, it may be preſumed, with a view to its prolific virtues. The ancients have given to mandrakes the name of the *apples of love,* and to Venus the name of *Mandragoritis;* and the Emperor Julian, in his epiſtle to Calixenes, ſays, that he drinks the juice of mandrakes to excite amorous inclinations.

ATROPHY, in medicine, a diſeaſe, wherein the body, or ſome of its parts, does not receive the neceſſary nutriment, but waſte and decay inceſſantly. See MEDICINE-*Index.*

ATROPOS, in fabulous hiſtory, the name of the third of the Parcæ, or Fates, whoſe buſineſs it was to cut the thread of life.

ATTACHMENT, in the law of England, implies the taking or apprehending a perſon by virtue of a writ or precept. It is diſtinguiſhed from an *arreſt,* by proceeding out of a higher court by precept or writ; whereas the latter proceeds out of an inferior court by precept only. An arreſt lies only to the body of a man; whereas an attachment lies often on the goods only, and ſometimes on the body and goods. An attachment by writ differs from *diſtreſs*, in not extending to lands, as the latter does; nor does a diſtreſs touch the body, as an attachment does.

Attachment out of the Chancery, is obtained upon an affidavit made, that the defendant was ſerved with a ſubpoena, and made no appearance; or it iſſues upon not performing ſome order or decree. Upon the return of this attachment by the ſheriff, *qod non eſt inventus in balliva ſua*, another attachment, with a proclamation, iſſues; and if he ſtill refuſes to appear, a commiſſion of rebellion.

Attachment of the Foreſt, is one of the three courts held in the foreſt. The loweſt court is called the *court of attachment*, or *wood-mote court*; the mean, *ſwan-mote*; and the higheſt, the *juſtice in eyre's ſeat*. The court of attachments has its name from the verdurers of the foreſt having no other authority in it, but to receive the attachments of offenders againſt vert and veniſon taken by the foreſters, and to enroll them, that they may be preſented or puniſhed at the next juſtice in eyre's ſeat. This attachment is by three means: by goods and chattels; by body, pledges, or mainprize; or by the body only. This court is held every 40 days throughout the year; and is thence called *forty day's court*.

Foreign Attachment is an attachment of money or goods found within a liberty or city, to ſatisfy ſome creditor within ſuch liberty or city. By the cuſtom of London, and ſeveral other places, a man can attach money or goods in the hands of a ſtranger, to ſatisfy himſelf.

ATTACK, a violent attempt upon any perſon or thing, an aſſault, or the act of beginning a combat or diſpute.

Attack, in the military art, is an effort made to force a poſt, break a body of troops, &c.

Attack of a Seige, is a furious aſſault made by the beſiegers with trenches, covers, mines, &c. in order to make themſelves maſters of a fortreſs, by ſtorming one of its ſides. If there are two or three attacks made at the ſame time, there ſhould be a communication betwixt them. See War.

ATTACOTTI, an ancient people of Britain, mentioned by Ammianus, Marcellinus and St Jerome, as well as in the *Notitia Imperii*. They are repreſented as allies and confederates of the Scots and Picts, and therefore, probably their neighbours: though their preciſe ſituation has not been determined by antiquaries.

ATTAINDER, in law. When ſentence of death, the moſt terrible and higheſt judgment in our laws, is pronounced, the immediate inſeparable conſequence by the common law is attainder. For when it is now clear beyond all diſpute, that the criminal is no longer fit to live upon the earth, but is to be exterminated as a monſter and a bane to human ſociety, the law ſets a note of infamy upon him, puts him out of its protection, and takes no farther care of him than barely to ſee him executed. He is then called *attaint*, *attinctus*, *ſtained*, or *blackened*. He is no longer of any credit or reputation; he cannot be a witneſs in any court; neither is he capable of performing the functions of another man: for, by an anticipation of his puniſhment, he is already dead in law. This is after judgment: for there is great difference between a man *convicted*, and *attainted*; though they are frequently through inaccuracy counfounded together. After conviction only, a man is liable to none of theſe diſabilities: for there is ſtill in contemplation of law a poſſibility of his innocence. Something may be offered in arreſt of judgment: the indictment may be erroneous, which will render his guilt uncertain, and thereupon the preſent conviction may be quaſhed: he may obtain a pardon, or be allowed the benefit of clergy; both which ſuppoſe ſome latent ſparks of merit, which plead in extenuation of his fault. But when judgment is once pronounced, both law and fact conſpire to prove him completely guilty; and there is not the remoteſt poſſibility left of any thing to be ſaid in his favour. Upon judgment, therefore, of death, and not before, the attainder of a criminal commences: or upon ſuch circumſtances as are equivalent to judgment of death; as judgment of outlawry on a capital crime, pronounced for abſconding or fleeing from juſtice, which tacitly confeſſes the guilt: And therefore, upon judgment either of outlawry, or of death, for treaſon or felony, a man ſhall be ſaid to be attainted.

A perſon attainted of high treaſon forfeits all his lands, tenements, and heriditaments; his blood is corrupted, and he and his poſterity rendered baſe; and this corruption of blood cannot be taken off but by act of parliament.*

Attainders may be reverſed or falſified, (i. e. proved to be falſe) by writ or error, or by plea. If by writ of error, it muſt be by the king's leave, &c.; and when by plea, it may be by denying the treaſon, pleading a pardon by act of parliament, &c.

Perſons may be attainted by act of parliament.—Acts of attainder of criminals have been paſſed in ſeveral reigns, on the diſcovery of plots and rebellions, from the reign of king Charles II. when an act was made for the attainder of ſeveral perſons guilty of the murder of king Charles I. Among acts of this nature, that for attainting Sir John Fenwick, for conſpiring againſt king William, is the moſt remarkable; it being made to attaint and convict him of high treaſon on the oath of one witneſs, juſt after a law had been enacted, "That no perſon ſhould be tried or attainted of high treaſon where corruption of blood is incurred, but by the oath of two lawful witneſſes, unleſs the party confeſs, ſtand mute, &c." Stat. 7 and 8 W. III. cap. 3. But in the caſe of Sir John Fenwick, there was ſomething extraordinary; for he was indicted of treaſon on the oaths of two witneſſes, tho' but only one could be produced againſt him on his trial.

ATTAINT, is a writ that lies after judgment againſt a jury of twelve men that have given falſe verdict in any court of record, in an action real or perſonal, where the debt or damages amount to above 40s. Stat. 5 and 34 Ed. III. c. 7. It is called *attaint*, becauſe the party that obtains it endeavours thereby to ſtain or taint the credit of the jury with perjury, by whoſe verdict he is grieved.

The jury who are to try this falſe verdict muſt be twenty-four, and are called *the grand jury*; for the law

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* See the articles *Forfeiture* and *Corruption of Blood*.

wills not that the oath of one jury of twelve men ſhould be attainted or ſet aſide by an equal number, nor by leſs indeed than double the former. And he that brings the attaint can give no other evidence to the grand jury, than what was originally given to the petit. For as their verdict is now trying, and the queſtion is whether or no they did right upon the evidence that appeared to them, the law adjudged it the higheſt abſurdity to produce any ſubſequent proof upon ſuch trial, and to condemn the prior juriſdiction for not believing evidence which they never knew. But thoſe againſt whom it is brought are allowed, in the affirmance of the firſt verdict, to produce new matter: becauſe the petit jury may have formed their verdict upon evidence of their own knowledge, which never appeared in court; and becauſe very terrible was the judgment which the common law inflicted upon them, if the grand jury found their verdict a falſe one. The judgment was, 1. That they ſhould loſe their *liberam legem*, and become for ever infamous. 2. That they ſhould forfeit all their goods and chattels. 3. That their lands and tenements ſhould be ſeized into the king's hands. 4. That their wives and children ſhould be thrown out of doors. 5. That their houſes ſhould be raſed and thrown down. 6. That their trees ſhould be rooted up. 7. That their meadows ſhould be ploughed. 8. That their bodies ſhould be caſt into jail. 9. That the party ſhould be reſtored to all that he loſt by reaſon of the unjuſt verdict. But as the ſeverity of this puniſhment had its uſual effect, in preventing the law from being executed, therefore by the ſtatute 11 Hen. VII. c. 24. revived by 23 Hen. VIII. c. 3. and made perpetual by 13 Eliz. c. 25. it is allowed to be brought after the death of the party, and a more moderate puniſhment was inflicted upon attainted jurors; viz. perpetual infamy, and if the cauſe of action were above L.40 value, a forfeiture of L.20 a-piece by the jurors; or, if under L.40, then L.5 a-piece; to be divided between the king and the party injured. So that a man may now bring an attaint either upon the ſtatute or at common law, at his election; and in both of them may reverſe the former judgment. But the practice of ſetting aſide verdicts upon motion, and granting new trials, has ſo ſuperſeded the uſe of both ſorts of attaints, that there is hardly any inſtance of an attaint later than the 16th century.

Attaint, among farriers, a knock or hurt in a horſe's leg, proceeding either from a blow with another horſe's foot, or from an over-reach in froſty weather, when a horſe, being rough-ſhod, or having ſhoes with long caulkers, ſtrikes his hinder feet againſt his fore-leg.

ATTAINTED, in law, is applied to a perſon's being under attainder. See Attainder.

ATTALICÆ vestes, in antiquity, garments made of a kind of cloth of gold. They took the denomination from Attalus, ſurnamed Philometer, a wealthy king of Pergamus, who was the firſt, according to Pliny, who procured gold to be woven into cloth.

ATTALUS, the name of ſeveral kings of Pergamus. See Pergamus.

ATTELABUS, in zoology, a genus of inſects belonging to the order of coleoptera or beetle-kind. It has four wings, of which the ſuperior are cruſtaceous, and ſerve as a ſheath or cover to the inferior, which are membranous. The head tapers behind, and is inclined; the feelers turn thicker towards the apex. The ſpecies are 13; viz. 1. The coryli is black, with red elytra or cruſtaceous wings. 2. The avellana is black, with the breaſt, feet, and elytra red. 3. The curculionoides is black, with red elytra and breaſt. The above three ſpecies frequent the leaves of the hazel and filbert nut-trees. 4. The ſurinamenſis has a double indentation (or two teeth) in the top of the elytra. It is a native of Surinam. 5. The penſilvanicus is black, with red elytra, a black belt round the middle, and another towards the apex of the elytra. It is a native of Philadelphia. 6. The melanurus is black, with teſtaceous elytra, black at the apex. It is a native of Sweden. 7. The betula has ſaltatory or ſpringy legs, and the whole body is of a dark-red colour. It frequents the leaves of the birch-tree. 8. The formicarius is black, with red elytra, and a double white belt towards the baſe. It is a native of Europe. 9. The ſipylus is green, with a hairy breaſt, and a double yellow belt upon the elytra. 10. The apiarius is bluiſh, with red elytra, and three black belts. It is a native of Germany. 11. The mollis is yellowiſh and hairy, with pale elytra, and three belts. It is a native of Europe. 12. The ceramboides is of a blackiſh red colour, and the elytra is furrowed. It frequents the ſpongy beletus, a ſpecies of muſhroom. 13. The bupreſtoides is of a dark-red colour, with a globular breaſt, and nervous elytra. It is a native of Europe.

ATTENTION, a due application of the ear, or the mind, to any thing ſaid or done, in order to acquire a knowledge thereof. The word is compounded of *ad*, "to," and *tendo*, "I ſtretch."

Attention of mind is not properly an act of the underſtanding; but rather of the will, by which it calls the underſtanding from the conſideration of other objects, and directs it to the thing in hand. Nevertheleſs, our attention is not always voluntary: an intereſting object ſeizes and fixes it beyond the power of controul.

Attention, in reſpect of hearing, is the ſtretching or ſtraining of the *membrana tympani*, ſo as to make it more ſuſceptible of ſounds, and better prepared to catch even a feeble agitation of the air. Or it is the adjuſting the tenſion of that membrance to the degree of loudneſs or lowneſs of the ſound to which we are attentive.

According to the degree of attention, objects make a ſtronger or weaker impreſſion (A). Attention is requiſite

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(A) Bacon, in his natural hiſtory, makes the following obſervations. "Sounds are meliorated by the intenſion of the ſenſe, where the common ſenſe is collected moſt to the particular ſenſe of hearing, and the ſight ſuſpended. Therefore ſounds are ſweeter, as well as greater, in the night than in the day; and I ſuppoſe they are ſweeter to blind men than to others; and it is manifeſt, that between ſleeping and waking, when all the ſenſes are bound and ſuſpended, muſic is far ſweeter than when one is fully waking."

quiſite even to the ſimple act of ſeeing: the eye can take in a conſiderable field at one look; but no object in the field is ſeen diſtinctly but that ſingly which fixes the attention: in a profound reverie that totally occupies the attention, we ſcarce ſee what is directly before us. In a train of perceptions, no particular object makes ſuch a figure as it would do ſingly and apart; for when the attention is divided among many objects, no particular object is intitled to a large ſhare. Hence, the ſtillneſs of night contributes to terror, there being nothing to divert the attention:

Horror ubique animos, ſimul ipſa ſilentia terrent. *Æn.* ii.

Zara. Silence and ſolitude are ev'ry where!
Through all the gloomy ways and iron doors
That hither lead, nor human face nor vice
Is ſeen or heard. A dreadful din was wont
To grate the ſenſe, when enter'd here, from groans
And howls of ſlaves condemn'd, from clink of chains,
And craſh of ruſty bars and creaking hinges;
And ever and anon the ſight was daſh'd
With frightful faces, and the meagre looks
Of grim and ghaſtly executioners.
Yet more this ſtillneſs terrifies my ſoul
Than did that ſcene of complicated horrors.
Mourning Bride, act 5. ſc. 3.

In matters of ſlight importance, attention is moſtly directed by will; and for that reaſon, it is our own fault if trifling objects make any deep impreſſion. Had we power equally to with-hold our attention from matters of importance, we might be proof againſt any deep impreſſion. But our power fails us here: an intereſting object ſeizes and fixes the attention beyond the poſſibility of controul; and while our attention is thus forcibly attached to one object, others may ſolicit for admittance; but in vain, for they will not be regarded. Thus a ſmall misfortune is ſcarce felt in preſence of a greater:

Lear. Thus think'ſt 'tis much, that this contentious ſtorm
Invades us to the ſkin: ſo 'tis to thee:
But where the greater malady is fix'd,
The leſſer is ſcarce felt. Thou'dſt ſhun a bear;
But if thy flight lay tow'rd the roaring ſea,
Thou'dſt meet the bear i' th' mouth. When the mind's free,
The body's delicate: the tempeſt in my mind
Doth from my ſenſes take all feeling elſe,
Save what beats there. *King Lear, act* 3. *ſc.* 5.

ATTENUANTS, or **ATTENUATING** *Medicines*, are ſuch as ſubtilize and break the humours into finer parts; and thus diſpoſe them for motion, circulation, excretion, &c.

Attenuating and inciding medicines are of very extenſive uſe in phyſic, and come under different denominations, according to the different effects they produce. Thus, when tenacious and viſcid juices not only ſtagnate in the cavities of the veſſels, but obſtruct the minute ducts of the viſcera and emunctories, theſe medicines, by the inciding and attenuating quality, diſcharge the humours, and remove the obſtructions; for which reaſon they are not improperly called *aperients.*

Attenuants produce ſo great a variety of effects, that it is proper we ſhould be well acquainted with their ſeveral kinds, as appropriated to the ſeveral diſorders, and know which will prove moſt ſerviceable in each. According to Hoffman, the diſſolving and attenuating of viſcid crudities in the ſtomach and *primæ viæ*, is well anſwered by the roots of arum, acorus, pepper, ginger, and the like; as alſo by ſal ammoniac, vitriolated tartar, the fixed alkaline ſalts, and the ſimple or dulcified ſpirit of ſalt. When crude and unconcocted humours are to be evacuated by ſtool, this intention is very well anſwered by the neutral ſalts, as the ſalts of the purging waters, and the *ſal polycreſtum*, with a ſufficient quantity of watery vehicle.

When viſcid humours, occaſioning diſorders of the breaſt, are to be attenuated and expectorated, the intention is moſt effectually anſwered by elecampane and orice roots; and by gum ammoniacum, myrrh, or benjamin, and balſam of Peru; or by regenerated tartar, oxymel of ſquills, a ſolution of crabs eyes in diſtilled vinegar, and the ſyrups of tabacco, and the like.

When the maſs of blood is tainted by thick and tenacious ſordes, and the emunctories are by that means obſtructed, and the humours contaminated by a ſaline ſulphureous and ſcorbutic dyſcracy, the moſt efficacious of the attenuants are the horſe-radiſh, ſcurvy-graſs, water and garden creſſes, muſtard, gum ammoniacum, benjamin, myrrh, the oil of fixed nitre, oil of tartar *per deliquium*, ſolutions of nitre, ſpirit of ſal ammoniac, ſalt of wormwood with lemon juice, and the ſalts of the medicinal waters.

When grumous or coagulated blood, occaſioned by contuſions or blows, is to be attenuated, and again diſſolved, the intention is ſure to be anſwered by the roots of Solomon's ſeal, vinegar, and crabs eyes, the regenerated tartar, and nitre prepared with antimony.

And in caſes where the lymph has acquired a preternatural thickneſs and viſcidity, eſpecially if from a venereal taint, the curative intention is moſt effectually anſwered by guaiacum, the acrid tincture of antimony, calomel æthiops mineral, and the like; which, when ſkilfully uſed, are of ſingular efficacy in diſſolving and attenuating the viſcid juices impacted in the glands of the liver.

ATTENUATION, the act of attenuating; that is, of making any fluid thinner, and leſs conſiſtent, than it was before. The word is compounded of *ad* 'to,' and *tenuis* 'thin.' Attenuation is defined more generally by Chauvin, the dividing or ſeparating of the minute parts of any body, which before, by their mutual *nexus* or implication, formed a more continuous maſs. Accordingly, among alchemiſts, we ſometimes find the word uſed for pulverization, or the act of reducing a body into an impalpable powder, by grinding, pounding, or the like.

ATTERBURY (Dr Francis), ſon of Dr Lewis Atterbury, was born at Milton in Buckinghamſhire, 1662; educated at Weſtminſter; and from thence elected to Chriſt-Church in Oxford, where he ſoon diſtinguiſhed himſelf by his fine genius and turn for polite literature. The year he was made M. A. 1687, he exerted himſelf in the controverſy with the Papiſts, vindicated Luther in the ſtrongeſt manner, and ſhowed an uncommon fund of learning, enlivened with great vivacity. In 1690 he married Miſs Oſborn, a diſtant relation of the Duke of Leeds; a lady of great beauty, but with little or no fortune, who lived at or in the neigbourhood of Oxford.

In Feb. 1690-1, we find him reſolved "to beſtir himſelf in his office in the houſe;" that of cenſor probably, an officer (peculiar to Chriſt-church) who preſides over the claſſical exerciſes; he then alſo held the catechetical lecture founded by Dr Buſby.

About this period it muſt have been that he took orders, and entered into another ſcene, and another ſort of converſation; for in 1691 he was elected lecturer of St Bride's church in London, and preacher at Bridewell chapel. An academic life, indeed, muſt have been irkſome and inſipid to a perſon of his active and aſpiring temper. It was hardly poſſible that a clergyman of his fine genius, improved by ſtudy, with a ſpirit to exert his talents, ſhould remain long unnoticed; and we find that he was ſoon after appointed chaplain to King William and Queen Mary.

The ſhare he took in the controverſy againſt Bentley (about the genuineneſs of the Phalaris Epiſtles) is now very clearly aſcertained. In one of the letters to his noble pupil, dated "Chelſea 1698, (he ſays), the matter had coſt him ſome time and trouble. In laying the deſign of the book, in writing above half of it, in reviewing a good part of the reſt, in tranſcribing the whole, and attending the preſs (he adds), half a year of my life went away."

In 1700, a ſtill larger field of activity opened, in which Atterbury was engaged four years with Dr Wake (afterwards Archbiſhop of Canterbury) and others, concerning the Rights, Powers, and Privileges of Convocations;" in which, however, the truth of the queſton may be ſuppoſed to lie, he diſplayed ſo much learning and ingenuity, as well as zeal for the intereſts of his order, that the Lower Houſe of Convocation returned him their thanks, and the univerſity of Oxford complimented him with the degree of D. D. January 29, 1700, he was inſtalled archdeacon of Totneſs, being promoted to that dignity by Sir Jonathan Trelawny, then Biſhop of Exeter. The ſame year he was engaged, with ſome other learned divines, in reviſing an intended edition of the "Greek Teſtament," with Greek "Scholia," collected chiefly from the fathers, by Mr Archdeacon Gregory. At this period he was popular as preacher at the Rolls Chapel; an office which had been conferred on him by Sir John Trevor, a great diſcerner of abilities, in 1698, when he reſigned Bridewell, which he had obtained in 1693. Upon the acceſſion of Queen Anne in 1702, Dr Atterbury was appointed one of her Majeſty's chaplains in ordinary; and, in October 1704, was advanced to the deanery of Carliſle. About two years after this, he was engaged in a diſpute with Mr Hoadly, concerning the advantages of virtue with regard to the preſent life; occaſioned by his ſermon, preached Auguſt 30, 1706, at the funeral of Mr Thomas Bennet, a bookſeller. In 1707, Sir Jonathan Trelawny, then biſhop of Exeter, appointed him one of the canons reſidentiaries of that church. In 1709, he was engaged in a freſh diſpute with Mr Hoadly, concerning "Paſſive Obedience;" occaſioned by his Latin Sermon, intitled "Concio ad Clerum Londinenſem, habita in Eccleſia S. Elphegi." In 1710, came on the famous trial of Dr Sacheverell, whoſe remarkable ſpeech on that occaſion was generally ſuppoſed to have been drawn up by our author, in conjunction with Dr Smalridge and Dr Freind. The ſame year Dr Atterbury was unanimouſly choſen prolocutor of the Lower Houſe of Convocation, and had the chief management of affairs in that Houſe. May 11, 1711, he was appointed by the Convocation, one of the committee, for comparing Mr Whiſton's doctrines with thoſe of the church of England; and in June following, he had the chief hand in drawing up "A Repreſentation of the Preſent State of Religion." In 1712, Dr Atterbury was made dean of Chriſt-Church, notwithſtanding the ſtrong intereſt and warm applications of ſeveral great men in behalf of his competitor Dr Smalridge. The next year ſaw him at the top of his preferment, as well as of his reputation: for, in the beginning of June 1713, the Queen, at the recommendation of Lord Chancellor Harcourt, advanced him to the biſhopric of Rocheſter, with the deanery of Weſtminſter in commendam; he was confirmed July 4, and conſecrated at Lambeth next day.

At the beginning of the ſucceeding reign, his tide of proſperity began to turn; and he received a ſenſible mortification preſently after the coronation of King George I. when, upon his offering to preſent his Majeſty (with a view, no doubt, of ſtanding better in his favour) with the chair of State and royal canopy, his own perquiſites as dean of Weſtminſter, the offer was rejected, not without ſome evident marks of diſlike to his perſon.

During the rebellion in Scotland, when the Pretender's declaration was diſperſed, the archbiſhop of Canterbury, and the biſhops in and near London, had publiſhed a *Declaration of their Abhorrence of the preſent Rebellion, and an Exhortation to the Clergy and People to be zealous in the diſcharge of their duties to his Majeſty King George:* but the Biſhop of Rocheſter refuſed to ſign it; and engaged biſhop Smalridge in the ſame refuſal, on account of ſome reflections it contained againſt the high-church party. He appeared generally among the proteſtors againſt the meaſures of the miniſtry under the king, and drew up the reaſons of the proteſts with his own hand.

In 1716, we find him adviſing Dean Swift in the management of a refractory chapter. April 26, 1722, he ſuſtained a ſevere trial in the loſs of his lady; by whom he had four children; Francis, who died an infant; Oſborn, ſtudent of Chriſt-Church; Elizabeth, who died September 29, 1716. aged 17; and Mary, who had been then ſeven years married to Mr Morrice.

In this memorable year, on a ſuſpicion of his being concerned in a plot in favour of the Pretender, he was apprehended, Auguſt 24, and committed priſoner to the tower.

Two officers, the under-ſecretary, and a meſſenger, went about two o'clock in the afternoon to the Biſhop's houſe in Weſtminſter, where he then was, with orders to bring him and his papers, before the council. He happened to be in his night-gown when they came in: and being made acquainted with their buſineſs, he deſired time to dreſs himſelf. In the mean time his ſecretary came in; and the officers went to ſearch for his papers; in the ſealing of which the meſſenger brought a paper, which he pretended to have found in his cloſe-ſtool, and deſired it might be ſealed up with the reſt. His Lordſhip obſerving it, and believing it to be a forged one of his own, deſired the officers not to do it, and to bear witneſs that the paper was not found with him. Nevertheleſs they did it; and though they behaved themſelves with ſome reſpect to him, they ſuffered the meſſengers to treat him in a very rough manner, threatening him, if he did not make haſte to dreſs himſelf, they would carry him away undreſſed as he was. Upon which he ordered his ſecretary to ſee his papers all ſealed up, and went himſelf directly to the Cock-pit, where the council waited for him. The behaviour of the meſſengers, upon this occaſion, ſeems to have been very unwarrantable, if what the author of "a Letter to the Clergy of the Church of England," &c. tell us be be true, that the perſons, directed by order of the King and council, to ſeize his Lordſhip and his papers, received a ſtrict command to treat him with great reſpect and reverence. However this was, when he came before the council, he behaved with a great deal of calmneſs, and they with much civility towards him. He had liberty to ſpeak for himſelf as much as he pleaſed, and they liſtened to his defence with a great deal of attention; and, what is more unuſual, after he was withdrawn, he had twice liberty to re-enter the council-chamber, to make for himſelf ſuch repreſentations and requeſts as he thought proper. It is ſaid, that, while he was under examination, he made uſe of our Saviour's anſwer to the Jewiſh council, while he ſtood before them; "If I tell you, ye will not believe me; and if I alſo aſk you you, ye will not anſwer me, nor let me go." After three quarters of an hour's ſtay at the Cock-pit, he was ſent to the Tower, privately, in his own coach, without any manner of noiſe or obſervation.

This commitment of a biſhop, upon a ſuſpicion of high treaſon, as it was a thing rarely practiſed ſince the Reformation, ſo it occaſioned various ſpeculations among the people. Thoſe who were the Biſhop's friends, and pretended to the greateſt intimacy with him, laid the whole odium of the matter on the miniſtry. They knew the Biſhop ſo well, they ſaid, his love to our conſtitution, and attachment to the Proteſtant ſucceſſion, his profeſſed abhorence of Popery and ſettled contempt of the Pretender, and his caution, prudence, and circumſpection, to be ſuch as would never allow him to engage in an attempt of ſubverting the government, ſo hazardous in itſelf, and ſo repugnant to his principles; and therefore they imputed all to the malice and management of a great miniſter of ſtate or two, who were reſolved to remove him, on account of ſome perſonal prejudices, as well as the conſtant moleſtation he gave them in parliament, and the particular influence and activity he had ſhown in the late election. The friends to the miniſtry, on the other hand, were ſtrongly of opinion, that the Biſhop was ſecretly a favourer of the Pretender's cauſe, and had formerly been tampering with things of that nature, even in the Queen's time, and while his party was excluded from power; but upon their re-admiſſion, had relinquiſhed that purſuit, and his confederates therein, and became a good ſubject again. They urged, that the influence which the late Duke of Ormond had over him, aſſiſted by his own private ambition and revenge, might prompt him to many things contrary to his declared ſentiments, and inconſiſtent with that cunning and caution which in other caſes he was maſter of. And to obviate the difficulty, ariſing from the Biſhop's averſion to Popery, and the Pretender's bigotry to that religion, they talked of a new-invented ſcheme of his, not to receive the Pretender, whoſe principles were not to be changed, but his ſon only, who was to be educated a Proteſtant in the church of England, and the biſhop to be his guardian, and Lord Protector of the kingdom, during his minority. Theſe, and many more ſpeculations, amuſed the nation at that time; and men, as uſual, judged of things by the meaſure of their own affections and prejudices.

March 23. 1722-3 a bill was brought into the Houſe commons, for "inflicting certain pains and penalties on Francis Lord biſhop of Rocheſter;" a copy of which was ſent to him, with notice that he had liberty of council and ſolicitors for making his defence. Under theſe circumſtances the Biſhop applied, by petition, to the Houſe of Lords, for their direction and advice, as to his conduct in this conjuncture; and April 4, he acquainted the Speaker of the Houſe of Commons, by a letter, that he was determined to give that houſe no trouble, in relation to the bill depending therein; but ſhould be ready to make his defence againſt it when it ſhould be argued in another Houſe, of which he had the honour to be a member. On the 9th the bill paſſed the Houſe of Commons, and was the ſame day ſent up to the Houſe of Lords for their concurrence.

May 6th, being the day appointed by the Lords for the firſt reading of the bill, Biſhop Atterbury was brought to Weſtminſter to make his defence. The counſel for the Biſhop were, Sir Conſtantine Phipps, and William Wynne, Eſq. for the King, Mr Reeve, and Mr Wearg. The proceedings continued above a week: and on Saturday May 11th, the Biſhop was permitted to plead for himſelf. This he did in a very eloquent ſpeech; which he feelingly opens by complaining of the uncommon ſeverity he had experienced in the Tower; which was carried to ſo great a length, that not even his ſon-in-law Mr Morrice was permitted to ſpeak to him in any nearer mode than ſtanding in an open area, while the Biſhop looked out of a two-pair-of-ſtairs window. In the courſe of his defence he obſerves, "Here is a plot of a year or two ſtanding, to ſubvert the government with an armed force; an invaſion from abroad, an inſurrection at home: juſt when ripe for execution, it is diſcovered; and twelve months after the contrivance of this ſcheme, no conſultation appears, no men correſponding together, no proviſion made, no arm, no officers provided, not a man in arms; and yet the poor biſhop has done all this. What could tempt me to ſtep thus out of my way? Was it ambition, and a deſire of climbing into a higher ſtation in the church? There is not a man in my office farther removed from this than I am. Was money my aim? I always deſpiſed it too much, conſidering what occaſion I am now like to have for it: for out of a poor biſhopric of L. 500 *per annum*, I have laid out no leſs than L. 1000 towards the repairs of the church and epiſcopal palace; nor did I take one ſhilling for dilapidations. The reſt of my little income has been ſpent, as is neceſſary, as I am a biſhop. Was I influenced by any diſlike of the eſtabliſhed religion, and ſecretly inclined towards a church of greater pomp and power? I have, my lords, ever ſince I knew what Popery was, oppoſed it; and the better I knew it, the more I oppoſed it. I began my ſtudy in divinity, when the Popiſh controverſy grew hot, with that immortal book of Tillotſon's, when he undertook the Proteſtant cauſe in general; and as ſuch, I eſteemed him above all. You will pardon me, my lords, if I mention one thing: Thirty years ago, I writ in defence of Martin Luther; and have preached, expreſſed, and wrote to that purpoſe from my infancy; and whatever happens to me, I will ſuffer any thing, and, by God's grace, burn at the ſtake, rather than depart from any material point of the Proteſtant religion as profeſſed in the church of England. Once more: Can I be ſuppoſed to favour arbitrary power? The whole tenor of my life has been otherwiſe: I was always a friend to the liberty of the ſubject; and, to the beſt of my power, conſtantly maintained it. I may have been thought miſtaken in the meaſures I took to ſupport it; but it matters not by what party I was called, ſo my actions are uniform." Afterwards, ſpeaking of the method of proceeding againſt him as unconſtitutional, he ſays: "My ruin is not of that moment to any number of men, to make it worth their while to violate, or even to ſeem to violate, the conſtitution in any degree, which they ought to preſerve againſt any attempts whatſoever. Though I am worthy of no regard, though whatſoever is done to me may for that reaſon be looked upon to be juſt; yet your lordſhips will have ſome regard to your own laſting intereſt and that of poſterity. This is a proceeding with which the conſtitution is unacquainted; which, under the pretence of ſupporting it, will at laſt effectually deſtroy it. For God's ſake, lay aſide theſe extraordinary proceedings; ſet not up theſe new and dangerous precedents. I, for my part, will voluntarily and cheerfully go into perpetual baniſhment, and pleaſe myſelf that I am in ſome meaſure the occaſion of putting a ſtop to ſuch precedents, and doing ſome good to my country: I will live, wherever I am, praying for its proſperity; and do, in the words of Father Paul to the ſtate of Venice, ſay, *Eſto perpetua*. It is not my departing from it I am concerned for. Let me depart, and let my country be fixed upon the immoveable foundation of law and juſtice, and ſtand for ever."—After a ſolemn proteſtation of his innocence, and an appeal to the Searcher of Hearts for the truth of what he had ſaid, he concludes thus: "If, on any account, there ſhall ſtill be thought by your lordſhips to be any ſeeming ſtrength in the proofs againſt me; if, by your lordſhips judgments, ſpringing from unknown motives, I ſhall be thought to be guilty; if, for any reaſons or neceſſity of ſtate, of the wiſdom and juſtice of which I am no competent judge, your lordſhips ſhall proceed to paſs this bill againſt me; I ſhall diſpoſe myſelf quietly and tacitly to ſubmit to what you do; God's will be done: Naked came I out of my mother's womb, and naked ſhall I return; and whether he gives or takes away, bleſſed be the name of the Lord!"

On Monday the 13th he was carried for the laſt time from the Tower to hear the reply of the King's counſel to his defence. Theſe were both men of great knowledge and ſagacity in law, but of different talents in point of eloquence. Their ſpeeches on this occaſion were made public; and they ſeem to have formed their "Replies," deſignedly, in a different way. The former ſticks cloſe to the matter in evidence, and enforces the charge againſt the Biſhop with great ſtrength and perſpicuity: The latter anſwers all his objections, and refutes the arguments brought in his defence, in an eaſy ſoft manner, and with great ſimplicity of reaſoning. Mr. Reeve is wholly employed in facts, in comparing and uniting together circumſtances, in order to corroborate the proofs of the Biſhop's guilt: Mr Wearg is chiefly taken up in ſilencing the complaints of the Biſhop and his counſel, and replying to every thing they advance, in order to invalidate the allegations of his innocence. The one, in ſhort, poſſeſſes the minds of the Lords with ſtrong convictions againſt the Biſhop: The other diſpoſſeſſes them of any favourable impreſſion that might poſſibly be made upon them by the artifice of his defence. And accordingly Mr Reeve is ſtrong, nervous, and enforcing; but Mr Wearg, ſmooth, eaſy, and inſinuating, both in the manner of his expreſſion and the turn of his periods. Mr Wearg pays the higheſt compliments to the Biſhop's eloquence: but, at the ſame time, repreſents it as employed to impoſe upon the reaſon, and miſguide the judgment of his hearers, in proportion as it affected their paſſions; and he endeavours to ſtrip the Biſhop's defence of all its ornaments and colours of rhetoric.

On the 15th the bill was read the third time; and, after a long and warm debate, paſſed on the 16th, by a majority of 83 to 43. On the 27th the King came to the Houſe, and confirmed it by his royal aſſent. June 18. 1723, this eminent Prelate, having the day before taken leave of his friends, who, from the time of paſſing the bill againſt him to the day of his departure, had free acceſs to him in the Tower (B), embarked on board the Aldborough man of war, and

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(B) The following anecdote was firſt communicated to the public by the late Dr Maty, on the credit of Lord Cheſterfield: "I went (ſaid Lord Cheſterfield) to Mr Pope, one morning, at Twickenham, and found a large folio Bible, with gilt claſps, lying before him upon his table; and, as I knew his way of thinking upon that book, I aſked him, jocoſely, if he was going to write an anſwer to it? It is a preſent, ſaid he, or rather a legacy, from my old friend the Biſhop of Rocheſter. I went to take my leave of him yeſterday in the Tower, where I ſaw this Bible upon his table. After the firſt compliments, the Biſhop ſaid to me, 'My friend Pope, conſidering your infirmities, and my age and exile, it is not likely that we ſhould ever meet again; and therefore I give you this legacy to remember me by it. Take it home with you; and let me adviſe you to abide by it.'—'Does your Lordſhip abide by it yourſelf?'—'I do.'—'If you do, my Lord, it is but lately. May landed the Friday following at Calais. When he went on ſhore, having been informed that Lord Bolingbroke, who had after the riſing of the parliament, received the King's pardon, was arrived at the ſame place on his return to England, he ſaid, with an air of pleaſantry, “Then I am exchanged!” and it was, in the opinion of Mr Pope, on the ſame occaſion, “a ſign of the nation's being curſedly afraid of being over-run with too much politeneſs, when it could not regain one great man, but at the expence of another.” But the ſeverity of his treatment did not ceaſe even with his baniſhment. The ſame vindictive ſpirit purſued him in foreign climes. No Britiſh ſubject was even permitted to viſit him without the king's ſign manual, which Mr Morice was always obliged to ſolicit, not only for himſelf, but for every one of his family whom he carried abroad with him, for which the fees of office were very high.

When biſhop Atterbury firſt entered upon his baniſhment, Bruſſels was the place deſtined for his reſidence; but, by the arts and inſtigations of the Britiſh miniſters, he was compelled to leave that place, and retire to Paris. There being ſolicited by the friends of the Pretender to enter into their negociations, he changed his abode for Montpelier in 1728; and, after reſiding there about two years, returned to Paris, where he died Feb. 15. 1731-2. The affliction which he ſuſtained by the death of his daughter in 1729, was thought to have haſtened his own diſſolution. The former event he hath himſelf related in a very affecting manner, in a letter to Mr. Pope: “The earneſt deſire of meeting one I dearly loved, called me abruptly to Montpelier; where, after continuing two months under the cruel torture of a ſad and fruitleſs expectation, I was forced at laſt to take a long journey to Toulouſe; and even there I had miſſed the perſon I ſought, had ſhe not, with great ſpirit and courage, ventured all night up the Garonne to ſee me, which ſhe above all things deſired to do before ſhe died. By that means ſhe was brought where I was, between ſeven and eight in

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I beg to know what new light or arguments have prevailed with you now, to entertain an opinion ſo contrary to that which you entertained of that book all the former part of your life?'—The Biſhop replied, ‘We have not time to talk of theſe things; but take home the book; I will abide by it, and I recommend you to do ſo too; and ſo God bleſs you.'

Theſe anecdotes Mr Nichols has inſerted in the “Epiſtolary Correſpondence,” Vol. II. p. 79. with the profeſſed view of vindicating Atterbury, in the following words of an ingenius correſpondent:

“Dr Warton hath revived this ſtory, which he juſtly calls an ‘uncommon' one, in his laſt ‘Eſſay on the Genius and Writings of Pope.' It was indeed very uncommon; and I have my reaſons for thinking it equally groundleſs and invidious. Dr Warton, though he retails the ſtory from ‘Maty's Memoirs,' yet candidly acknowledges, that it ought not to be implicitly relied on. That this caution was not unneceſſary, will, I apprehend, be ſufficiently obvious, from the following compariſon between the date of the ſtory itſelf and Mr Pope's letters to the Biſhop.

“According to Lord Cheſterfield's account, this remarkable piece of converſation took place but a few days before the Biſhop went into exile: and it is inſinuated that Mr Pope, till that period, had not even entertained the ſlighteſt ſuſpicion of his friend's reverence for the Bible: Nay, it is aſſerted, that the very recommendation of it from a quarter ſo unexpected, ſtaggered Mr Pope to ſuch a degree, that in a mingled vein of raillery and ſerioufneſs, he was very eager to know the grounds and reaſons of the Biſhop's change of ſentiment.

“Unfortunately for the credit of Lord Cheſterfield and his ſtory, there is a letter on record, that was written nine months before this pretended dialogue took place, in which Mr Pope ſeriouſly acknowledged the Biſhop's piety and generoſity, in intereſting himſelf ſo zealouſly and affectionately in matters which immediately related to his improvement in the knowledge of the holy ſcriptures. The paſſage I refer to is a very remarkable one: and you will find it in a letter, dated July 27. 1722. It appears undeniably from this letter, that the Biſhop had earneſtly recommended to Mr Pope the ſtudy of the Bible; and had ſoftened his zeal with an unuſual urbanity and courteſy, in order to avoid the imputation of ill-breeding, and remove all occaſion of diſguſt from a mind ſo ‘trembling alive' as Mr Pope's. I will tranſcribe the paſſage at large. ‘I ought firſt to prepare my mind for a better knowledge even of good profane writers, eſpecially the moraliſts, &c. before I can be worthy of taſting the Supreme of books, and Sublime of all writings, in which, as in all the intermediate ones, you may (if your friendſhip and charity towards me continue ſo far) be the beſt guide to, Yours, A. Pope.'

“The laſt letter of Mr Pope to the Biſhop, previous to his going into exile, was written very early in June 1723. It muſt have been about this time that Pope paid his farewel viſit to the Biſhop in the Tower. But whether ſuch a converſation as that which hath been pretended actually took place, may be left to the determination of every man of common ſenſe, after comparing Lord Cheſterfield's anecdote with Mr. Pope's letter.

“There muſt have been a miſtake, or a wilful miſrepreſentation ſomewhere. To determine its origin, or to mark minutely the various degrees of its progreſs, till it iſſued forth into calumny and falſehood, is impoſſible. I have ſimply ſtated matters of fact as they are recorded; and leave it to your readers to ſettle other points not quite ſo obvious and indiſputable, as they may think fit. My motives in this very plain relation aroſe from an honeſt wiſh to remove unmerited obloquy from the dead. I ſhould ſincerely rejoice if the cloud which in other reſpects ſtill ſhades the character of this ingenious Prelate could be removed with equal facility and ſucceſs. I am, dear Sir, your faithful humble ſervant.

Samuel Badcock.”

in the morning, and lived 20 hours afterwards; which time was not loſt on either ſide, but paſſed in ſuch a manner as gave great ſatisfaction to both, and ſuch as, on her part, every way became her circumſtances and character: For ſhe had her ſenſes to the very laſt gaſp, and exerted them to give me, in thoſe few hours, greater marks of duty and love than ſhe had done in all her lifetime, though ſhe had never been wanting in either. The laſt words ſhe ſaid to me were the kindeſt of all; a reflection on the goodneſs of God, which had allowed us in this manner to meet once more, before we parted for ever. Not many minutes after that, ſhe laid herſelf on her pillow, in a ſleeping poſture.

Placidaque ibi demum morte quievit.

Judge you, Sir, what I felt, and ſtill feel on this occaſion, and ſpare me the trouble of deſcribing it. At my age, under my infirmities, among utter ſtrangers, how ſhall I find out proper reliefs and ſupports? I can have none, but thoſe with which reaſon and religion furniſh me; and thoſe I lay hold on, and graſp as faſt as I can. I hope that he who laid the burden upon me (for wiſe and good purpoſes no doubt) will enable me to bear it in like manner as I have borne others, with ſome degree of fortitude and firmneſs."

How far the Biſhop might have been attached in his inclinations to the Stuart family, to which he might be led by early prejudices of education, and the divided opinions of the times, it is not neceſſary here to enquire: But that he ſhould have been weak enough to engage in a plot ſo inconſiſtent with his ſtation, and ſo clumſily deviſed (to ſay the leaſt of it, and without entering into his ſolemn aſſeveration of innocence), is utterly inconſiſtent with that cunning which his enemies allowed him. The Duke of Wharton, it is well known, was violent againſt him, till convinced by his unanſwerable reaſoning.

It has been ſaid that Atterbury's wiſhes reached to the biſhopric of London, or even to York or Canterbury. But thoſe who were better acquainted with his views, knew that Wincheſter would have been much more deſirable to him than either of the others. And there are thoſe now living, who have been told from reſpectable authority, that that biſhopric was offered to him whenever it ſhould become vacant (and till that event ſhould happen a penſion of L.5000 a-year, beſides an ample proviſion for Mr Morice), if he would ceaſe to give the oppoſition he did to Sir Robert Walpole's adminiſtration, by his ſpeeches and proteſts in the Houſe of Lords. When that offer was rejected by the Biſhop, then the contrivance for his ruin was determined on.

In his ſpeech in the Houſe of Lords, the Biſhop mentions his being "engaged in a correſpondence with two learned men (Biſhop Potter and Dr Wall), on ſettling the times of writing the four goſpels." Part of this correſpondence is ſtill in being, and will ſoon be publiſhed. The ſame ſubject the Biſhop purſued during his exile, having conſulted the learned of all nations, and had nearly brought the whole to a concluſion when he died. Theſe laudable labours are an ample confutation of Biſhop Newton's aſſertion, that Atterbury "wrote little whilſt in exile but a few criticiſms on French authors."

His body was brought over to England, and interred on the 12th of May following in Weſtminſter abbey, in a vault which in the year 1722 had been prepared by his directions. There is no memorial over his grave: nor could there well be any, unleſs his friends would have conſented (which it is moſt probable they refuſed to do) that the words implying him to have died biſhop of Rocheſter ſhould have been omitted on his tomb.

Some time before his death, he publiſhed a vindication of himſelf, Biſhop Smalridge, and Dr Aldrich, from a charge brought againſt them by Mr Oldmixon, of having altered and interpolated the copy of Lord Clarendon's "Hiſtory of the Rebellion." Biſhop Atterbury's "Sermons" are extant in four volumes in octavo: thoſe contained in the two firſt were publiſhed by himſelf, and dedicated to his great patron Sir Jonathan Trelawny biſhop of Wincheſter; thoſe in the two laſt were publiſhed after his death by Dr Thomas Moore his Lordſhip's chaplain. Four admirable "Viſitation Charges" accompany his "Epiſtolary Correſpondence."

As to Biſhop Atterbury's character, however the moral and political part of it may have been differently repreſented by the oppoſite parties, it is univerſally agreed, that he was a man of great learning and uncommon abilities, a fine writer, and a moſt excellent preacher. His learned friend Smalridge, in the ſpeech he made when he preſented him to the Upper Houſe of Convocation, as prolocutor, ſtyles him *Vir in nullo literarum genere hoſpes, in pleriſque artibus et ſtudiis diu et feliciter exercitatus, in maxime perfectis literarum diſciplinis perfectiſſimus.* In his controverſial writings, he was ſometimes too ſevere upon his adverſary, and dealt rather too much in ſatire and invective: but this his panegyriſt imputes more to the natural fervour of his wit than to any bitterneſs of temper or prepenſe malice. In his ſermons, however, he is not only every way unexceptionable, but highly to be commended. The truth is, his talent as a preacher was ſo excellent and remarkable, that it may not improperly be ſaid, that he owed his preferment to the pulpit; nor any hard matter to trace him, through his writings, to his ſeveral promotions in the church. We ſhall conclude Biſhop Atterbury's character, as a preacher, with the encomium beſtowed on him by the author of "the Tatler;" who, having obſerved that the Engliſh clergy too much neglect the art of ſpeaking, makes a particular exception with regard to our prelate; who, ſays he, "has ſo particular a regard to his congregation, that he commits to his memory what he has to ſay to them; and has ſo ſoft and graceful a behaviour, that it muſt attract your attention. His perſon (continues this author), it is to be confeſſed, is no ſmall recommendation; but he is to be highly commended for not loſing that advantage, and adding to propriety of ſpeech (which might paſs the criticiſm of Longinus) an action which would have been approved by Demoſthenes. He has a peculiar force in his way, and has many of his audience, who could not be intelligent hearers of his diſcourſe were there no explanation as well as grace in his action. This art of his is uſed with the moſt exact and honeſt ſkill. He never attempts your paſſions, till he has convinced your reaſon. All the objections which you can form are laid open and diſperſed before he uſes the leaſt vehemence in his ſermon ; but when he thinks he has your head, he very ſoon wins your heart, and never pretends to ſhow the beauty of holineſs, till he has convinced you of the truth of it."—In his letters to Pope, &c. Biſhop Atterbury appears in a pleaſing light, both as a writer and as a man. In eaſe and elegance they are ſuperior to thoſe of Pope, which are more ſtudied. There are in them ſeveral beautiful references to the claſſics. The Biſhop excelled in his alluſions to ſacred as well as profane authors.

ATTESTATION, the act of affirming or witneſſing the truth of ſomething, more eſpecially in writing.

ATTIC, any thing relating to Attica, or to the city of Athens : thus Attic ſalt, in philology, is a delicate poignant ſort of wit and humour peculiar to the Athenian writers ; Attic witneſs, a witneſs incapable of corruption, &c.

Attic Order. See ARCHITECTURE.

Attic Baſe, a peculiar kind of baſe uſed by the ancient architects in the Ionic order ; and by Palladio, and ſome others, in the Doric.

Attic Story, in architecture ; a ſtory in the upper part of a houſe, where the windows are uſually ſquare.

1 Boundaries extent, &c.

ATTICA, an ancient kingdom of Greece, ſituated along the north coaſt of the gulph of Saron, bounded on the weſt by Megara, mount Cithæron, and part of Bœotia ; on the north by the gulph of Euripus, now *Stretto di negro ponte*, and the reſt of Bœotia ; and on the eaſt by the Europius. It extended in length from north-weſt to ſouth-eaſt about 60 miles ; its breadth from north to ſouth was 56, decreaſing as it approached the ſea.

2 Inhabitants thought to be produced from the ſoil.

The ſoil of this country was naturally barren and craggy, though by the induſtry of its inhabitants it produced all the neceſſaries of life. On this account Attica was leſs expoſed to invaſions than other more fertile countries ; and hence it preſerved its ancient inhabitants beyond all the other kingdoms in its neighbourhood ; ſo that they were reputed to be the ſpontaneous productions of the ſoil ; and as a badge of this, Thucydides tells us, they wore golden graſshoppers in their hair.

3 Cities.

The chief cities in the kingdom of Attica were Athens the capital ; next to it Eleuſis, ſituated on the ſame gulph, near the coaſts of Megara ; and next to that Rhamnus, famed for the temple of Amphiaraus and the ſtatue of the goddeſs Nemeſis.

4 Cecrops the firſt king.

The firſt king of this country, of whom we have any diſtinct account, was Cecrops. Others indeed are ſaid to have reigned before him, particularly one Actæus, whoſe daughter Cecrops married, and in her right laid the foundation of his new monarchy. Cecrops is ſaid to have been the firſt who deified Jupiter, ſet up altars and idols, and inſtituted marriage among the Greeks. He is likewiſe affirmed to have taught his ſubjects navigation ; and for the better adminiſtration of juſtice, and promoting intercourſe among them, to have divided them into the firſt four tribes, called *Cecropis*, *Autochton*, *Actea*, and *Paralia* ; and he is alſo by ſome ſaid to be the founder of the Areopagus. From this monarch the Athenians affected to call themſelves *Cecropidæ* till the reign of Erectheus their ſixth king, after whom they took the name of *Erecthydæ*.

5 Cranaus.

6 Whence the country was called Attica.

Cecrops dying after the reign of 50 years, left three daughters ; by marrying one of which, probably, Cranaus a wealthy citizen aſcended the throne. He enjoyed his crown peaceably for ten years ; till, having married one of his daughters, named *Attis*, to Amphictyon the ſon of Deucalion, he was by him dethroned, and forced to lead a private life to the laſt. From this daughter, the country, which before had been called *Actea*, took the name of *Attica*.

7 Ericthonius.

8 Pandion.

After a reign of 10 or 12 years, Amphictyon was himſelf depoſed by Ericthonius, ſaid to be the ſon of Vulcan and Tethys. Being lame of both his feet, he is ſaid to have invented coaches, or, as others will have it, inſtituted horſe and chariot races in honour of Minerva. He is alſo reported to have been the firſt who ſtamped ſilver coin. He reigned 50 years, and was ſucceeded by his ſon Pandion the father of Progne and Philomela ; whoſe hard fate, ſo famous among the poets, is ſuppoſed to have broke his heart, after a reign of about 40 years. In his time Triptolemus taught the Athenians agriculture, which he had learned from Ceres.

9 Erectheus.

10 Cecrops II.

Pandion was ſucceeded by his ſon Erectheus, who being reckoned the moſt powerful prince of his time, Boreas king of Thrace demanded his daughter Orithia in marriage, and on being refuſed carried her off by force. After a reign of 50 years, Erectheus being killed in a battle with the Eleuſians, was ſucceeded by his ſon Cecrops II. who is generally allowed to have been the firſt who gathered the people into towns ; they having till then lived in houſes and cottages ſcattered here and there, without order or regular diſtance. After a reign of 40 years he was driven out by his brethren Metion and Pandorus, who forced him to fly into Ægialea, where he died.

11 Pandion II.

Cecrops II. was ſucceeded by his ſon Pandion II. and he was likewiſe driven out by Metion, who aſſumed the government. Pandion in the mean time fled into Megara, where he married Pelia the daughter of Pylas king of that place, and was appointed ſucceſſor to the kingdom. Here he had four ſons, who returning to Athens, whether with or without their father is uncertain, expelled the ſons of Metion, and after the deceaſe of Pandion their father, divided the government among themſelves ; notwithſtanding which the royal dignity did in effect remain with Ægeus the eldeſt.

12 Ægeus.

Ægeus, when he aſcended the throne, finding himſelf deſpiſed by his ſubjects becauſe he had no ſons, and ſometimes inſulted by his brother Pallas, who had no leſs than fifty, conſulted the oracle of Apollo at Delphi. Receiving here, as was commonly the caſe, an anſwer which could not be underſtood without a commentator, he applied to Pittheus king of Troezen, famous for his ſkill in expounding oracles. This prince eaſily prevailed with him to lie with his daughter Æthra, who proved with child ; and as none but theſe three were privy to the ſecret, Ægeus, before his return to Athens, hid a ſword and a pair of ſhoes under a ſtone, leaving orders with the princeſs, that if the child proved a boy, ſhe ſhould ſend him to Athens with theſe tokens as ſoon as he was able to lift up that ſtone. He charged her moreover to uſe all imaginable ſecrecy, leſt the ſons of his brother Pallas ſhould way-lay and murder him.

13 Theſeus born.

Æthra being delivered of a ſon, Pittheus gave out that Neptune was the father of it. This child was named *Theſeus*, and proved one of the moſt famous heroes of antiquity. Being arrived at the age of 16, his mother brought him to the ſtone abovementioned; and he having lifted it with eaſe, was deſired to take up the ſword and ſhoes and prepare himſelf to go to his father. He was adviſed to go by ſea rather than by land, as, ever ſince the departure of Hercules, the roads had been exceedingly infeſted by banditti. Theſeus, however, who had already begun to diſcover marks of uncommon ſtrength and courage, no ſooner heard the name of Hercules mentioned, than he became deſirous of imitating ſo great a pattern; and after performing a number of glorious exploits, for which ſee the article Theseus, he arrived ſafe at his father's capital.

14
Is made known to his father.

The great atchievements of our young hero procured him a welcome reception at the court of Ægeus, though his birth was unknown to all except Medea, to whom the king had lately been married. This queen being a ſorcereſs, it is not to be ſuppoſed any thing could be concealed from her: ſhe therefore, by her diabolical penetration, quickly found out that Theſeus was the king's ſon; after which ſhe became ſo jealous of him on account of his valour, that ſhe perſuaded her old huſband to invite the young ſtranger to a banquet, and poiſon him in a glaſs of wine. The poiſon was accordingly prepared, and Theſeus invited; but the prince ſuddenly drawing his ſword, it was immediately recognized by Ægeus to be the ſame he had formerly buried below the ſtone. Upon this he ſtepped forward to Theſeus, throwing down the poiſoned draught in his way; and, embracing him with much tenderneſs, owned him for his ſon before all the court.

At this time the king of Athens had great occaſion for ſuch a champion as Theſeus. The ſons of Pallas, who had all along behaved with great inſolence, upon Theſeus being diſcovered to be the king's ſon, and heir apparent to the crown, broke out in open rebellion. They were ſoon diſcomfited; but Ægeus and the whole country of Attica were ſtill in great diſtreſs on the following account. Some years before, Androgeus, the ſon of Minos king of Crete, came to Athens to be preſent at one of their feaſts. During this viſit he contracted ſuch an intimacy with the fifty ſons of Pallas, that Ægeus fearing ſome fatal conſequences, cauſed him to be privately murdered. According to others, Androgeus having undertaken to encounter the Marathonian bull, was killed by it. Be this as it will, Minos having received news of his ſon's death, imputed it to the people of Attica; and therefore, after ſeveral unſucceſsful attempts to revenge his own quarrel, prayed to the gods to do it for him. The Athenians, in conſequence of this prayer, were viſited with earthquakes, famine, and peſtilence; on account of which they applied to the oracle. Here they were informed, that no relief was to be had till they were reconciled to the Cretan king. Minos reſolving to make them pay dear for their deliverance, impoſed upon them a tribute of ſeven young men and as many virgins, whom he condemned to be devoured by the Minotaur, a monſter feigned by the poets to have been half man and half bull. This bloody tribute had been twice paid, and Minos had already ſent his meſſengers the third time, when Theſeus willingly offered himſelf to be one of the unhappy victims; and embarking with them in one ſhip, he gave the pilot two ſails, the one black to ſail with, and the other white to be hoiſted up at his return in caſe he came off victorious. Our hero had all the ſucceſs he could wiſh: he killed the Minotaur, prevailed with Minos to remit the tribute, and his daughter Ariadne to run away with him; but her he left with child in the iſle of Naxos. Unfortunately, however, for Ægeus, the joy of Theſeus and his company was ſo great, that at their return they forgot to hoiſt the white flag in token of their victory: upon which the old king, taking for granted that his ſon was killed, threw himſelf into the ſea, which ever ſince has from him been called the *Ægean Sea*.

15
He kills the Minotaur.

16
Death of Ægeus.

17
Theſeus king of Attica.

18
New models the government.

Theſeus being thus left in poſſeſſion of the kingdom of Attica, began immediately to think of indulging his warlike genius, and rendering the civil affairs of his kingdom as little troubleſome as poſſible. To accompliſh this purpoſe, he began with gathering moſt of the people of Attica into the old and new town, which he incorporated into one city. After this he diveſted himſelf of all his regal power, except the title of king, the command of the army, and the guardianſhip of the laws. The reſt he committed to proper magiſtrates choſen out of three different orders of the people, whom he divided into nobles, huſbandmen, and artificers. The firſt he inveſted with the power of interpreting and executing the laws, and regulating whatever related to religion. The other two choſe their inferior magiſtrates from among themſelves, to take care of whatever related to their ſeparate orders: ſo that the kingdom was in ſome meaſure reduced to a commonwealth, in which the king had the greateſt poſt, the nobles were next to him in honour and authority, the huſbandmen had the greateſt profit, and the artiſts exceeded them in number. He likewiſe aboliſhed all their diſtinct courts of judicature, and built one common council-hall called *Prytaneum*, which ſtood for many ages afterwards.

19
Defeats the Amazons, kills the Centaurs, and carries off Helena.

Having thus new-modelled the government, his next care was to join to his dominions the kingdom of Megara, in right of his grandfather Pandion II. who had married the daughter of Pylas, as abovementioned. On this occaſion he erected the famous pillar in the iſthmus, which ſhowed the limits of the two countries that met there. On the one ſide of this pillar was inſcribed, "This is not Peloponneſus, but Ionia;" and on the other, "This is Peloponneſus, not Ionia." After this he undertook an expedition againſt the Amazons, whom he overcame, took their queen Hippolita, and afterwards married her. Soon after this, Theſeus contracted an intimacy with Perithous the ſon of Ixion; and being invited to his nuptials, aſſiſted him in killing a number of Centaurs, or rather Theſſalian horſemen (who in their cups had offered violence to their female gueſts), and drove the reſt out of the country. Our two aſſociates then proceeded to Sparta, where Theſeus fell in love with the famed Helena, at that time not above nine years old, while he himſelf was upwards of fifty. Her they carried off: and of the rape there are various accounts; but the following one, which is given by Plutarch, is generally allowed to be the moſt authentic.

According to that hiſtorian, they ſtole this beauty, the greateſt in the world at this time, out of the temple of Diana Ortia, where Helena happened to be dancing. They were purſued as far as Tegea, but made their eſcape out of Peloponneſus; and thinking themſelves now ſecure of their prey, they agreed to caſt lots for her, upon condition that he to whoſe lot ſhe fell ſhould aſſiſt the other in procuring ſome celebrated beauty. Fortune having declared for Theſeus, he aſſiſted his companions in the like attempt upon Proſerpina daughter of Aidonius king of the Moloſſi in Epirus; who, being the next beauty to Helena, was guarded by the dog Cerberus, which had three heads, and was conſequently a very formidable enemy. Her father, however, underſtanding that they deſigned to ſteal away his daughter, threw Perithous to be torn in pieces by Cerberus, and put Theſeus in priſon, from whence he was afterwards relieved at the interceſſion of Hercules.

20 Impriſoned by the king of Epirus.

21 Driven out of Athens.

After this misfortune, Theſeus at length returned to Athens, but found himſelf very coolly received by his ſubjects. Mneſtheus, the ſon of Peteus, and great-grandſon of Erectheus, had made uſe of the king's abſence to ingratiate himſelf with the people; and upon the commencement of a war with Caſtor and Pollux, the two brothers of Helena, he perſuaded the people of Athens to open their gates to the two brothers. Upon this, Theſeus was under the neceſſity of conveying away himſelf and family with all poſſible privacy. This he luckily accompliſhed; and deſigned to have ſailed to Crete, to have obtained aſſiſtance from Deucalion ſon of Minos, and now brother-in-law to Theſeus himſelf, he having lately married Phædra ſiſter to Deucalion. Unfortunately, however, our hero was ſhipwrecked on the iſland of Scyros. Here he he was at firſt kindly received by Lycomedes the king of that iſland, but was ſoon after killed by a fall from a high rock, over which ſome ſay he was puſhed by Lycomedes himſelf, who had been prevailed upon to deſtroy Theſeus in that manner by Mneſtheus, that he might with the more ſecurity enjoy the kingdom of Athens.

22 His death.

23 Mneſtheus, Demophon, &c.

Mneſtheus reigned 24 years, but loſt his life at the ſiege of Troy; and was ſucceeded by Demophon one of the ſons of Theſeus by Phædra, who was likewiſe at the ſiege of Troy, but had the good fortune to return in ſafety. In his reign was erected the famous court of the Ephetæ; conſiſting originally of 50 Athenians and as many Argives, for trying of wilful murders. By this court the king himſelf afterwards ſubmitted to be tried for having accidentally killed one of his ſubjects. He reigned 33 years, and was ſucceeded by his ſon, according to ſome, or according to others his brother, Oxyntes, who reigned 12 years. Oxyntes was ſucceeded by his ſon Aphydas, who was murdered by Thymætes the baſtard ſon of Oxyntes.

24 Thymætes depoſed.

This king diſcovered many baſe qualities unworthy of his dignity; and at laſt was depoſed by his ſubjects on the following occaſion. Xanthus king of Bœotia had a conteſt with the Athenians about one of their frontier towns. He offered to decide the matter by ſingle combat with the king; but this was declined by Thymætes. It happened, that at that time one Melanthus a Meſſenian, who had been driven out of his country by the Heraclidæ, was come to Athens; who accepted the king of Bœotia's challenge. At the firſt onſet, Melanthus aſked his adverſary, why he had, contrary to the articles, brought a ſecond into the field with him? and as Xanthus immediately looked about to ſee who was behind him, Melanthus run him through with his lance. The victory, though it did little honour to him who gained it, was ſo agreeable to the Athenians, that they depoſed their cowardly king Thymætas, after he had reigned 8 years; and appointed Melanthus in his ſtead, who after a reign of 37 years left the kingdom to his ſon Codrus.

25 Melanthus

26 Codrus the laſt king ſacrifices himſelf for his country

This prince reigned about 21 years; during which time the Dores and Heraclidæ had regained all Peloponneſus, and were upon the point of entering into Attica. Codrus, being informed that the oracle had promiſed them victory provided they did not kill the king of the Athenians, came immediately to a reſolution of dying for his country. Diſguiſing himſelf, therefore, like a peaſant, he went into the enemy's camp, and, quarrelling with ſome of the ſoldiers, was killed by them. On the morrow, the Athenians knowing what was done, ſent to demand the body of their king; at which the invaders were ſo terrified, that they decamped without ſtriking a blow.

27 Republican government introduced.

Upon the death of Codrus, a diſpute which happened among his ſons concerning the ſucceſſion, furniſhed the Athenians with a pretence for ridding themſelves of their kings altogether, and changing the monarchial form of government into a republican one. It was improbable, they ſaid, that they ſhould ever have ſo good a king as Codrus; and to prevent their having a worſe, they reſolved to have no king but Jupiter. That they might not, however, ſeem ungrateful to the family of Codrus, they made his ſon Medon their ſupreme magiſtrate, with the title of *archon*. They aftetwards rendered that office decennial, but continued it ſtill in the family of Codrus. The extinction of the Medontidæ at laſt left them without reſtraint; upon which they not only made this office annual, but created nine archons. By the latter invention they provided againſt the too great power of a ſingle perſon, as by the former they took away all apprehenſion of the archons having time to eſtabliſh themſelves, ſo as to change the conſtitution. In a word, they now attained what they had long ſought, viz. the making the ſupreme magiſtrates dependent on the people.

28 Draco legiſlator of Athens.

We have a liſt of theſe archons for upwards of 600 years, beginning with Creon, who lived about 684 years before Chriſt, to Herodes, who lived only 60 years before that time. The firſt archon of whom we hear any thing worth notice, is named *Draco*. He reigned in the ſecond, or, as others ſay, in the laſt year of the 39th Olympiad, when, it is ſuppoſed, he publiſhed his laws: but though his name is very frequently mentioned in hiſtory, yet no connected account can be found either of him or his inſtitutions; only, in general, his laws were exceedingly ſevere, inflicting death for the ſmalleſt faults; which gave occaſion to one Demades an orator to obſerve, that the laws of Draco were written with blood, and not with ink. For this extraordinary ſeverity he gave no other reaſon, than that ſmall faults ſeemed to him to be worthy of death, and he could find no higher puniſhment for the greateſt. He was far advanced in years when he gave laws to Athens; and to give his inſtitutions the greater weight, he would not ſuffer them to be called *nomoi*, or laws, but *theſmoi*, or ſanctions proceeding from more than human wiſdom. The extreme ſeverity of theſe laws, however, ſoon made the Athenians weary both of them and the author of them; upon which Draco was obliged

29 Expelled the city.

30 His death.

obliged to retire to Ægina. Here he was received with the higheſt honours: but the favour of the inhabitants of this place proved more fatal to him than the hatred of the Athenians; for coming one day into the theatre, the audience, to ſhow their regard, threw, as the cuſtom then was, their cloaks upon him; and the multitude of theſe being very great, they ſtifled the old man, who was too weak to diſengage himſelf from their load.

31 Mitylenian war.

After the expulſion of Draco, nothing remarkable happened at Athens till the year before Chriſt 606, when we find the republic engaged in a war with the Mitylenians about the city Sigæum, ſituated near the mouth of the river Scamander. The Athenian army was commanded by Phrynon, a perſon equally remarkable for the comelineſs of his perſon and the generoſity of his mind. The Mitylenians were commanded by Pittacus, one of the celebrated ſages of Greece. As the commanders looked upon the honour of their reſpective countries to be concerned, they exerted themſelves to the utmoſt. At laſt they met in ſingle combat: wherein Phrynon depended on his valour only; but Pittacus concealed behind his ſhield a net, wherewith he ſuddenly entangled his antagoniſt, and eaſily ſlew him. This, however, not putting an end to the war, Periander tyrant of Corinth interpoſed; and both parties having ſubmitted to his arbiration, he decreed that Sigæum ſhould belong to the Athenians.

32 Cylon's conſpiracy.

About ſeven years after this war, a conſpiracy was formed by Cylon ſon-in-law to Theagenes tyrant of Megara, who, having by his affable behaviour procured many friends, formed a deſign of ſeizing the ſovereignty of Athens. Having conſulted the oracle as to the moſt proper time, he was directed to make the attempt when the citizens of Athens were employed in celebrating the higheſt feaſt to Jupiter. When many of the citizens therefore were gone to the Olympic games, Cylon and his aſſociates made themſelves maſters of the citadel. Here they were inſtantly beſieged by Megacles at that time archon, and ſoon reduced to great diſtreſs for want of water. The chief together with his brother found means to make their eſcape, but the meaner ſort were left to ſhift for themſelves. In this extremity they fled to the temple of Minerva; from whence Megacles with much ado prevailed upon them to come down and ſubmit themſelves to the mercy of their country. Having at laſt aſſented to this, they tied a cord to the image of the goddeſs, and carried the clue with them, to demonſtrate, that though they were out of the temple they were ſtill under Minerva's protection.

33 Conſpirators maſſacred by Megacles.

Unfortunately for them, however, as they paſſed the temple of the furies, the line ſnapt of itſelf; which Megacles conſtruing into a renunciation by the goddeſs, cauſed his men fall upon them and diſpatch as many as they could find. Such as were without the temple were immediately maſſacred, and thoſe who fled thither again were murdered in their ſanctuary. In ſhort, none eſcaped but ſuch as bribed the wives of the officers of juſtice. This carnage, however, did not put an end to the ſedition. The remains of Cylon's faction created great diſturbances, by inſinuating that the violation of Minerva's ſanctuary had drawn down the anger of the gods; and theſe diſcourſes had ſuch an effect, that Megacles and his officers were ſtyled *execrable*, and held to be perſons under the diſpleaſure of heaven.

34 Who is execrated by the people.

35 Unſucceſsful war with Megara.

During the time of this confuſion, the Megarenſians attacked Niſea, which they took, as well as Salamis; and ſo completely routed the Athenians in every attempt to recover the latter, that a law was at laſt paſſed by which it ſhould be capital for any one to propoſe the recovery of Salamis. About the ſame time the city was diſturbed by reports of frightful appearances, and filled with ſuperſtitious fears; the oracle at Delphi was therefore conſulted, and an anſwer returned that the city behoved to be expiated. Upon this, Epimenides the Pheſtian was ſent for from Crete, to perform the neceſſary ceremonies, he being reputed an holy man, and one that was deeply ſkilled in all the myſteries of religion.

36 Epimenides's expiation and prophecy.

His expiation conſiſted in taking ſome black, and ſome white ſheep, turning them all looſe, and directing ſome perſons to follow them to thoſe places where they couched, and there to ſacrifice them to the local deity. He cauſed alſo many temples and chapels to be erected, two of which have been particularly noted, viz. the chapel of *Contumely* and that of *Impudence*. This man is ſaid to have looked wiſtfully on the port of Munychia for a long time, and then to have ſpoke as follows to thoſe that were near him. "How blind is man to future things? for did the Athenians know what miſchief will one day be derived to them from this place, they would eat it with their teeth." This prediction was thought to be accompliſhed 270 years after, when Antipater conſtrained the Athenians to admit a Macedonian garriſon into that place.

37 Solon the wiſe legiſlator.

About 597 years before Chriſt, Solon the famed Athenian legiſlator began to ſhow himſelf to his countrymen. He is ſaid to have been lineally deſcended from Codrus; but left by his father in circumſtances rather neceſſitous, which obliged him to apply to merchandize; it is plain, however, both from his words and writings, that he was a diſintereſted patriot. The ſhameful decree, that none under pain of death ſhould propoſe the recovery of Salamis, grieved him ſo much, that having compoſed an elegy of 100 verſes, ſuch as he thought would be moſt proper to inflame the minds of the people, he ran into the market-place as if he had been mad, with his night-cap on his head, repeating his elegy.

38 Salamis recovered by his means.

A crowd being gathered round the pretended madman, his kinſman Piſiſtratus mingled among the reſt, and obſerving the people moved with Solon's words, he alſo ſeconded him with all the eloquence he was maſter of, and between them they prevailed ſo far as to have the law repealed, and a war was immediately commenced againſt the people of Megara. Who was commander in this expedition is not certain; but the city was recovered, according to the moſt general account, by the following ſtratagem. Solon coming with Piſiſtratus to Colias, and finding there the women buſy in celebrating, according to cuſtom, the feaſt of Ceres, ſent a confident of his to Salamis, who pretended to be no friend to the people of Attica, telling the inhabitants of Salamis, that if they had a mind to ſeize the faireſt of the Athenian ladies, they might now do it by paſſing over to Colias. The Megarenſians giving eaſy credit to what the man ſaid, immediately fitted out a ſhip; which Solon perceiving from the oppoſite ſhore, diſmiſſed the women, and having dreſſed a number of beardleſs youths in female habits, under which they concealed every one a dagger, he ſent them to the ſea-ſide to dance and divert themſelves as the women are wont to do. When thoſe who came from Salamis ſaw theſe young perſons ſkipping up and down, they ſtrove who ſhould be firſt on ſhore; but were every one of them killed, and their veſſel ſeized; aboard which the Athenians embarking, ſailed immediately to Salamis and took it.

39
Cirrha likewiſe reduced by Solon's wiſdom.

On the return of Solon to Athens, he was greatly honoured by the people, to whom another occaſion of admiring his wiſdom was quickly afforded. The inhabitants of Cirrha, a town ſituated in the bay of Corinth, after having by repeated incurſions waſted the territory of Delphi, at laſt beſieged the capital itſelf, with a view of making themſelves maſters of the treaſures contained in the temple of Apollo. Advice of this intended ſacrilege being ſent to the Amphictyons, who were the ſtates-general of Greece, Solon adviſed that the matter ſhould be univerſally reſented, and that all the ſtates ſhould join in puniſhing the Cirrhæans, and ſaving the Delphic oracle. This advice was complied with, and a general war againſt Cirrha declared. Clyſthenes, tyrant of Sicyon, commanded in chief, and Alcmæon was general of the Athenian quota. Solon went as aſſiſtant or counſellor to Clyſthenes, and by following his advice the war was conducted to a proſperous iſſue. For when the Greek army had beſieged Cirrha for ſome time without any appearance of ſucceſs, the oracle at Delphi was conſulted, from whence the following anſwer was returned:

"In vain you hope to take the place before
"The ſea's blue waves roll o'er the hallow'd ſhore."

This anſwer ſtruck the whole army with ſurpriſe, till Solon adviſed Clyſthenes to conſecrate ſolemnly the whole territory of Cirrha to the Delphic Apollo; ſo as that was a maritime country, the ſea muſt then waſh the ſacred coaſt. According to Pauſanius, the city was reduced by the following ſtratagem, likewiſe invented by Solon. He cauſed the river Pliſtus, which run through Cirrha, to be turned into another channel, hoping thereby to have diſtreſſed the inhabitants for want of water: but finding they had many wells within the city, and were not to be reduced by that means, he cauſed a vaſt quantity of roots of hellebore to be thrown into the river, which was then ſuffered to return into its former bed. The inhabitants, overjoyed at the ſight of running water, came in troops to drink of it; whereupon an epidemic flux enſued, and the citizens being no longer able to defend the walls, the town was eaſily taken.

40
Athens in great confuſion.

On the return of Solon to Athens he found things again in the utmoſt confuſion. The remnant of Cylon's faction gave out, that all ſorts of misfortunes had befallen the republic on account of the impiety of Megacles and his followers; which clamour was heightened by the retaking of Salamis about this time by the Megarenſians. Solon interpoſed, and perſuaded thoſe who were ſtyled *execrable* to abide a trial, and 300 perſons were choſen to judge them. The event was, that 300 of Megacle's party who were alive were ſent into perpetual baniſhment, and the bones of ſuch as were dead were dug up and ſent without the limits of their country.

41
Megacle's party baniſhed.

42
Three factions ſtart up.

Though this deciſion reſtored the public quiet for the preſent, it was not long before the people were divided into three factions, contending about the proper form of government. Theſe were called the *Diacrii*, *Pediæi*, and *Parali*: the firſt of theſe were the inhabitants of the hilly country, who declared poſitively for democracy; the ſecond, dwelling in the lower parts, and who were far more opulent than the former, declared for an oligarchy, as ſuppoſing the government would fall moſtly into their hands; the third party, who lived on the ſea-coaſt, were people of moderate principles, and therefore were for a mixed government. Beſides the diſturbances raiſed on this account, others were occaſioned by the rich oppreſſing the poor. According to Plutarch, the poor being indebted to the rich, either tilled their grounds and paid them the ſixth part of the produce, or engaged their bodies for their debts, ſo that many were made ſlaves at home, and many ſold into other countries; nay, ſome were obliged to ſell their children to pay their debts, and others in deſpair quitted Attica altogether. The greateſt part, however, were for throwing off the yoke, and began to look about for a leader, openly declaring that they intended to change the form of government, and make a repartition of lands. In this extremity, the eyes of all the citizens were caſt upon Solon. The moſt prudent were for offering him the ſovereignty; but he perceiving their intentions, behaved in ſuch a manner as to cheat both parties, and ſhewed a ſpirit of patriotiſm perhaps never equalled. He refuſed the ſovereignty as far as it might have benefited himſelf; and yet took upon himſelf all the care and trouble of a prince, for the ſake of his people.

43
Solon choſen archon.

He was choſen archon without having recourſe to lots, and after his election diſappointed the hopes of both parties. It was Solon's fundamental maxim, That thoſe laws will be beſt obſerved which power and juſtice equally ſupport. Wherever, therefore, he found the old conſtitution conſonant to juſtice in any tolerable degree, he refuſed to make any alteration at all, and was at extraordinary pains to ſhow the reaſon of the changes he did make. In ſhort, being a perfect judge of human nature, he ſought to rule only by ſhowing his ſubjects that it was their intereſt to obey, and not by forcing upon them what he himſelf eſteemed beſt. Therefore, to a perſon who aſked whether he had given the Athenians the beſt laws in his power, he replied, "I have eſtabliſhed the beſt they could receive."

44
Settles all diſorders.

As to the main cauſe of ſedition, viz. the oppreſſed ſtate of the meaner ſort Solon removed it by a contrivance which he called *ſiſachthia*, i. e. *diſcharge*; but what this was, authors are not agreed upon. Some ſay that he releaſed all debts then in being, and prohibited the taking any man's perſon for payment of a debt for the future. According to others the poor were eaſed, not by cancelling the debts, but by lowering the intereſt, and increaſing the value of money; a mina, which before was made equal to 73 drachms only, being by him made equal to 100; which was of great advantage to the debtor, and did the creditor no hurt. It is, however, moſt probable that the ſiſachthia was a general remittance of all debts whatever, otherwiſe Solon could not have boaſted in his verſes that he had removed ſo many marks of mortgages (B) as were every where frequent; that he had freed from apprehenſion ſuch as were driven to deſpair, &c.

45 Infamous behaviour of his three friends.

But in the midſt of all Solon's glory, an accident befel him, which, for a time, hurt his reputation, and had almoſt entirely ruined his ſchemes. He had conſulted Conon, Clinias, and Hipponicus, his three friends, on an oration prepared with a view to engage the people's conſent to the diſcharge; and theſe three men, thus knowing there was to be a general diſcharge of debts, baſely took the opportunity of borrowing vaſt ſums before the law was promulgated, in conſequence of which they were never obliged to return them.

This was thought at firſt to have been done with Solon's conſent, and that he had ſhared in the money; but this aſperſion was quickly wiped off when it appeared that the lawgiver himſelf was a very conſiderable loſer by his own law. His friends, however, could never recover their credit, but were ever afterwards ſtigmatized with the opprobrious appellation of *chreocopidæ*, or *debt-ſinkers*.

46 Solon blamed at firſt, but afterwards applauded and choſen legiſlator.

The Athenians were as little pleaſed with Solon's management as with their former condition; the rich thinking he had done too much in cancelling the money-debts due to them, and the poor that he had done too little, becauſe he had not divided the lands of Attica equally. In a ſhort time, however, they acquieſced in the new inſtitutions, and gave a more public token of their repentance than they had before ſhown of their diſpleaſure, inſtituting a ſolemn ſacrifice under the name of *Siſacthia*, at the ſame time that Solon was unanimouſly elected legiſlator of Athens, with full power to make laws, and alter or new model the conſtitution as he thought fit.

47 Compiles a new body of laws.

Solon being now inveſted with unlimited authority, ſet about the arduous taſk of compiling new laws for the turbulent people of Attica; which having at laſt completed in the beſt manner he was able, or in the beſt manner the nature of the people would admit, he procured them to be ratified for 100 years. Such as related to private actions were preſerved on parallelograms of wood, with caſes which reached from the ground, and turned about upon a pin like a wheel. Theſe were thence called *Axones*; and were placed firſt in the citadel, and afterwards in the prytaneum, that all the ſubjects might have acceſs to them when they pleaſed. Such as concerned public inſtitutions and ſacrifices were contained in triangular tables of ſtone called *cyrbes*. The Athenian magiſtrates were ſworn to obſerve both; and in proceſs of time theſe monuments of Solon's wiſdom became ſo famous, that all public acts were from them named *Axones* and *Cyrbes*.

48 He goes abroad for ten years.

After the promulgation of the laws, Solon found himſelf obliged to leave Athens, to prevent his being continually teazed for explanations and alterations of them. He therefore pretended an inclination to merchandize, and obtained leave to abſent himſelf for 10 years, during which time he hoped the laws would be grown familiar. From Athens Solon travelled into Egypt, where he converſed with Pſenophis the Heliopolitan, and Sonchis the Saite, the moſt learned prieſts of that age. From theſe he learned the ſituation of the iſland Atlantis, of which he wrote an account in verſe, which Plato afterwards continued*. From Egypt he went to Cyprus, where he was extremely well received by one of the petty kings. This prince lived in a city called *Apeia*, built by Demophon the ſon of Theſeus, on an eminence near the river Clarius, but in a ſoil craggy and barren. Solon obſerving a very pleaſant plain below, engaged the king to remove thither; aſſiſted in executing the ſcheme he had formed; and ſucceeded ſo well, that a new city was formed, which ſoon became populous, and out of gratitude to the Athenian legiſlator was called *Solos*.

* See *Atlantis*.

49 Things fall into diſorder in his abſence.

But while Solon was thus travelling in queſt of wiſdom, and with a view to benefit thoſe among whom he came, his countrymen, who ſeem to have reſolved on being diſſatisfied at all events, had again divided themſelves into three factions. Lycurgus put himſelf at the head of the country people; Megacles the ſon of Alcmæon was at the head of thoſe who lived on the ſea-coaſt; and Piſiſtratus put himſelf at the head of the poorer ſort, to protect them, as he pretended, from tyranny, but in reality to ſeize on the ſovereignty for himſelf. All the factions pretended to have a vaſt regard for Solon and his laws, at the ſame time that they were very deſirous of a change; but how they were to be bettered, none of them knew, or pretended to know.

50 He returns to Athens, but refuſes to reſume his office.

In the midſt of this confuſion the legiſlator returned. Each of the factions paid their court to him, and affected to receive him with the deepeſt reverence and reſpect; beſeeching him to reaſſume his authority, and compoſe the diſorders which they themſelves kept up. This Solon declined on account of his age, which, he ſaid, rendered him unable to ſpeak and act for the good of his country as formerly: however, he ſent for the chiefs of each party, beſeeching them in the moſt pathetic manner not to ruin their common parent, but to prefer the public good to their own private intereſt.

Piſiſtratus, who of all the three had perhaps the leaſt intention to follow Solon's advice, ſeemed to be the moſt affected with his diſcourſes; but as Solon perceived he affected popularity by all poſſible methods, he eaſily penetrated into his deſigns of aſſuming the ſovereign power. This he ſpoke of to Piſiſtratus himſelf, at firſt privately; but as he ſaw that his admonitions in this way had no effect, he then ſaid the ſame things to others, that the public might be on their guard againſt him.

51 Piſiſtratus aſſumes the ſovereignty

All the wiſe diſcourſes of Solon, however, were loſt upon the Athenians. Piſiſtratus had got the meaner ſort entirely at his devotion, and therefore reſolved to cheat them out of the liberty which they certainly deſerved to loſe. With this view he wounded himſelf, and, as Herodotus ſays, the mules that drew his chariot; then he drove into the market-place, and there ſhowed his bleeding body, imploring the protection of the people from thoſe whom his kindneſs to them had ren-

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(B) The Athenians had a cuſtom of hanging up billets to ſhow that houſes were engaged for ſuch and ſuch ſums of money.

rendered his implacable enemies. A concourſe of people being inſtantly formed, Solon came among the reſt, and, ſuſpecting the deceit, openly taxed Piſiſtratus with his perfidious conduct; but to no purpoſe. A general aſſembly of the people was called, wherein it was moved by one Ariſton, that Piſiſtratus ſhould have a guard. Solon was the only perſon preſent who had reſolution enough to oppoſe this meaſure; the richer Athenians, perceiving that the multitude implicitly followed Piſiſtratus, and applauded every thing he ſaid, remaining ſilent through fear. Solon himſelf, when he ſaw he could prevail nothing, left the aſſembly, ſaying he was *wiſer* than ſome, and *ſtouter* than others. A guard of 400 men was now unanimouſly decreed to Piſiſtratus, as we are told by Solon himſelf. This inconſiderable body he made uſe of to enſlave the people, but in what manner he accompliſhed his purpoſe is not agreed. Certain it is, that with his guard he ſeized the citadel; but Polyænus hath given an account of a very ſingular method which he took to put it out of the power of the Athenians to defend themſelves even againſt ſuch a ſmall number. He ſummoned an aſſembly to be held at the Anacium, and directed that the people ſhould come thither armed. They accordingly came; and Piſiſtratus harangued them, but in a voice ſo low that they could not tell what he ſaid. The people complaining of this, Piſiſtratus told them that they were hindered from hearing him by the clangour of their arms; but if they would lay them down in the portico, he would then be heard diſtinctly. This they did; and while they liſtened very attentively to a long and eloquent oration, Piſiſtratus's guard conveyed away their arms, ſo that they found themſelves deprived of all power of reſiſtance.

52
Solon leaves Athens.

During the confuſion which followed this event, another aſſembly was held, wherein Solon enveighed bitterly againſt the meanneſs of his countrymen, inviting them to take up arms in defence of their liberty. When he ſaw that nothing would do, he laid down his own arms, ſaying, that he had done his utmoſt for his country and his laws. According to Plutarch, he refuſed to quit the city; but the moſt probable opinion is, that he immediately retired from the dominions of Athens, and refuſed to return, even at the ſolicitation of Piſiſtratus himſelf.

53
Piſiſtratus governs with great moderation

Piſiſtratus having thus obtained the ſovereignty, did not overturn the laws of Solon, but uſed his power with the greateſt moderation. It is not to be expected, however, that ſo turbulent a people as the Athenians could be ſatisfied by any method of government he could lay down. At the beginning of his adminiſtration, Megacles and his family retired out of Athens to ſave their own lives, yet without deſpairing of being able ſome time or other to return. With this view Megacles and his aſſociates entered into a treaty with Lycurgus; and having brought him and his party into a ſcheme for depoſing Piſiſtratus, they concerted matters ſo well, that Piſiſtratus was ſoon obliged to ſeek for ſhelter ſomewhere elſe, and, on his departure, the Athenians ordered his goods to be ſold. Nobody, however, except one perſon *(Callias)*, would venture to buy any of them, from an apprehenſion, no doubt, that they would ſoon be reſtored to their proper owner, which accordingly happened in a very ſhort time.

54
Driven out by Megacles.

As Megacles and his party had negociated with Lycurgus to turn out Piſiſtratus, ſo they now entered into a treaty with Piſiſtratus to reinſtate him in his principality, as ſoon as they found Lycurgus would not be implicitly governed by them.

55
Who ſoon after reinſtates him.

To accompliſh this, they fell upon a very ridiculous project; which, however, was attended with the deſired ſucceſs. They found out a woman whoſe name was *Phya*, of a mean family and fortune, but of a great ſtature, and very handſome. Her they dreſſed in armour, placed her in a chariot, and having diſpoſed things ſo as to make her appear with all poſſible advantage, they conducted her towards the city, ſending heralds before, with orders to ſpeak to the people in the following terms: "Give a kind reception, O Athenians, to Piſiſtratus, who is ſo much honoured by Minerva above all other men, that ſhe herſelf condeſcends to bring him back to the citadel." The report being univerſally ſpread that Minerva was bringing home Piſiſtratus, and the ignorant multitude believing this woman to be the goddeſs, addreſſed their prayers to her, and received Piſiſtratus with the utmoſt joy. When he had recovered the ſovereignty, Piſiſtratus married the daughter of Megacles as he had promiſed, and gave the pretended goddeſs to his ſon Hipparchus.

56
Driven out a ſecond time.

Piſiſtratus did not long enjoy the kingdom to which he had been reſtored in ſo ſtrange a manner. He had married the daughter of Megacles, as already obſerved; but having children by a former wife, and remembering that the whole family of Megacles was reprobated by the Athenians, he thought proper to let his new ſpouſe remain in a ſtate of perpetual widowhood. This ſhe patiently bore for ſome time, but at laſt acquainted her mother. An affront ſo grievous could not fail to be highly reſented. Megacles inſtantly entered into a treaty with the malcontents, of whom there were always great plenty at Athens whatever was the form of government. This Piſiſtratus being apprized of, and perceiving a new ſtorm gathering, he voluntarily quitted Athens, and retired to Eretria. Here having conſulted with his ſons, it was reſolved to reduce Athens by force. With this view he applied to ſeveral of the Greek ſtates, who furniſhed him with the troops he deſired, but the Thebans exceeded all the reſt in their liberality; and with this army he returned to Attica, according to Herodotus, in the 11th year of his baniſhment.

57
But returns with an army.

They firſt reduced Marathon, the inhabitants of which had taken no meaſures for their defence, tho' they knew that Piſiſtratus was preparing to attack them. The republican forces in the mean time marched out of Athens to attack him; but behaving in a ſecure and careleſs manner, they were ſupriſed by Piſiſtratus, and totally routed. While they were endeavouring to make their eſcape, he cauſed his two ſons ride before him with all ſpeed, and tell thoſe they came up with that nobody had any thing to fear, but that they might every one return to his own home. This ſtratagem ſo effectually diſperſed the republican army, that it was impoſſible to rally them, and Piſiſtratus became a third time abſolute maſter of Attica.

58
He takes poſſeſſion of the city.

59
His ſubjects ſtill diſcontented notwithſtanding his moderation.

Piſiſtratus being once more in poſſeſſion of the ſovereignty, took a method of eſtabliſhing himſelf on the throne directly oppoſite to what Theſeus had done. Inſtead of collecting the inhabitants from the country into cities, Piſiſtratus made them retire from the cities into the country, in order to apply themſelves

ſelves to agriculture. This prevented their meeting together, and caballing againſt him in ſuch bodies as they had been accuſtomed to do. By this means alſo the territory of Athens was greatly meliorated, and great plantations of olives were made over all Attica, which had before not only been deſtitute of corn, but alſo bare of trees. He alſo commanded, that, in the city men ſhould wear a kind of ſheep-ſkin veſt, reaching to the knees; but ſo intolerable were the laws of Piſiſtratus to his ſubjects, that this kind of garment in ſucceeding times became proverbially the habit of ſlavery.

As prince of Athens, Piſiſtratus received the tenth part of every man's revenues, and even of the fruits of the earth; and this alſo, though for the ſervice of the ſtate, ſeemed to the Athenians a moſt grievous burden. In ſhort, though Piſiſtratus behaved in all reſpects as a moſt excellent prince, his ſubjects fancied themſelves oppreſſed by tyranny, and were perpetually grumbling from the time he firſt aſcended the throne to the day of his death, which happened about 33 years after he had firſt aſſumed the ſovereignty, of which time, according to Ariſtotle, he reigned 17 years.

60 Hipparchus and Hippias.

Piſiſtratus left behind him two ſons named *Hipparchus* and *Hippias*, both men of great abilities, who ſhared the government between them, and behaved with lenity and moderation. But though by the mildneſs of their government the family of the Piſiſtratidæ ſeemed to be fully eſtabliſhed on the throne of Athens, a conſpiracy was unexpectedly formed againſt both the brothers, by which Hipparchus was taken off, and Hippias narrowly eſcaped. The moſt material facts relating to this conſpiracy are what follow.

61 Conſpiracy of Harmodius and Ariſtogiton.

There were at that time in Athens two young men called *Harmodius* and *Ariſtogiton*; the former of theſe was exquiſitely beautiful in his perſon, and on that account, according to the infamous cuſtom of the Greeks, violently beloved of the other. This Harmodius was alſo beloved of Hipparchus; who, if we may believe Thucydides, forced him. This was grievouſly reſented, and revenge determined on; to haſten which, another accident concurred. Hipparchus finding that Harmodius endeavoured to avoid him, publicly affronted him, by not ſuffering his ſiſter to carry the offering of Minerva, as if ſhe was a perſon unworthy of that office. The two young men, not daring to ſhow any public ſigns of reſentment, conſulted privately with their friends; among whom it was reſolved, that at the approaching feſtival of Panathenæa, when the citizens were allowed to appear in arms, they ſhould attempt to reſtore Athens to its former liberty. In this they imagined that they ſhould find themſelves ſeconded by the whole body of the people. But when the day appointed was come, they perceived one of their number talking very familiarly with Hippias; and fearing that they were diſcovered, they immediately fell upon Hipparchus, and diſpatched him with a multitude of wounds. In this exploit the people were ſo far from ſeconding them, as they expected, that they ſuffered Harmodius to be killed by Hipparchus's guards, and ſeizing Ariſtogiton themſelves, delivered him up to Hippias. Some time afterwards, however, the reſpect they paid to theſe two young men exceeded all bounds. They cauſed their praiſes to be ſung at the Panathenæa, forbid any citizen to call a ſlave by either of their names, and erected brazen ſtatues to them in the forum; which ſtatues were afterwards carried into Perſia by Xerxes, and ſent back from thence by Alexander the Great, Antiochus, or Seleucus, for authors are not agreed by which. Several immunities and privileges were alſo granted to the deſcendants of theſe two patriots, and all poſſible means were taken to render their memory venerable and reſpected by poſterity.

62 Hipparchus killed.

63 The conſpirators extravagantly honoured.

64 Cruelty of Hippias.

Hippias being now ſole maſter of Athens, and probably exaſperated by the murder of his brother, began to alter his conduct greatly, and treat his ſubjects in an oppreſſive and cruel manner. He began with torturing Ariſtogiton, in order to make him confeſs his accomplices: but this proved fatal to his own friends; for Ariſtogiton impeaching ſuch as he knew to be beſt affected to Hippias, they were immediately put to death; and when he had deſtroyed all thoſe he knew, at laſt told Hippias, that now he knew of none that deſerved to ſuffer death except the tyrant himſelf. Hippias now vented his rage on a woman named *Leæna*, who was kept by Ariſtogiton. She endured the torture as long as ſhe could; but finding herſelf unable to bear it any longer, ſhe at laſt bit off her tongue, that ſhe might not have it in her power to make any diſcovery. To her the Athenians erected the ſtatue of a lioneſs, alluding to her name, without a tongue, on which was engraved a ſuitable inſcription.

After the conſpiracy was, as Hippias thought, thoroughly quaſhed, he ſet himſelf about ſtrengthening his government by all the means he could think of. He contracted leagues with foreign princes, increaſed his revenues by various methods, &c. But theſe precautions were of little avail: the lenity of Piſiſtratus's government had alone ſupported it; and Hippias purſuing contrary methods, was deprived of the ſovereignty in leſs than four years after the death of his brother.

65 He is driven out of Athens.

This revolution was likewiſe owing to the family of Megacles, who were ſtyled *Alcmæonidæ*, and had ſettled at Lipſydrum. In times of diſcontent, which at Athens were very frequent, this family was the common refuge of all who fled from that city; and at laſt they thought of a method of expelling the Piſiſtratidæ altogether. The method they took to accompliſh their purpoſe was as follow. They agreed with the Amphictyons to rebuild the temple at Delphi; and being poſſeſſed of immenſe riches, they performed their engagements in a much more magnificent manner than they were bound to do; for having agreed only to build the front of common ſtone, they built it of Parian marble. At the ſame time they corrupted the propheteſs Pythia, engaging her to exhort all the Lacedemonians that came to conſult the oracle either in behalf of the ſtate, or their own private affairs, to attempt the delivery of Athens. This had the deſired effect: The Lacedemonians ſupriſed at hearing this admonition inceſſantly repeated, at laſt reſolved to obey the divine command, as they imagined it to be; and ſent Anchimolius, a man of great quality, at the head of an army into Attica, though they were at that time in league with Hippias, and accounted by him his good friends and allies. Hippias demanding aſſiſtance from the Theſſalians, they readily ſent him 1000 horſe, under

under the command of one of their princes named *Cineas*. The Lacedemonians being landed, Hippias fell upon them ſo ſuddenly, that he defeated them with geat ſlaughter, killed their general, and forced the ſhattered remains of their army to fly to their ſhips. The Spartans, incenſed at this unfortunate expedition, determined to ſend another army into Attica; which they accordingly did ſoon after under their king Cleomenes: and he having, at his entrance into the Athenian territories, defeated the Theſſalian horſe, obliged Hippias to ſhut himſelf up in the city of Athens, which he was ſoon after forced to abandon altogether. He was, however, in no want of a place of refuge; the Theſſalian princes inviting him into their country, and the king of Macedon offering his family a city and territory, if they choſe to retire into his dominions. But Hippias choſe rather to go to the city of Sigeum, which Piſiſtratus had conquered, and left to his own family.

66 **And retires to Sigeum.**

67 **Two factions in Athens.**

After the expulſion of the Piſiſtratidæ, the Athenians did not long enjoy the quiet they had propoſed to themſelves. They were quickly divided into two factions; at the head of one was Clyſthenes, one of the chiefs of the Alcmæonidæ; and the other, Iſagoras, a man of great quality, and highly in favour with the Athenian nobility. Clyſthenes applied himſelf to the people, and endeavoured to gain their affections by increaſing their power as much as poſſible. Iſagoras perceiving that by this means his rival would get the better, applied to the Lacedemonians for aſſiſtance, reviving at the ſame time the old ſtory of Megacles's ſacrilege, and inſiſting that Clyſthenes ought to be baniſhed as being of the family of Megacles.

68 **The Spartans ſupport Iſagoras.**

Cleomenes king of Sparta readily came into his meaſures, and ſuddenly diſpatched an herald to Athens with a declaration of war in caſe all the Alcmæonidæ were not immediately baniſhed. The Athenians did not heſitate to baniſh their benefactor Clyſthenes, and all his relations; but this piece of ingratitude did not anſwer their purpoſe. Cleomenes entered Attica at the head of a Spartan army; and, arriving at Athens, condemned to baniſhment 700 families more than what had been ſent into exile before. Not content with this, he would have diſſolved the ſenate, and veſted the government in 300 of the chief of Iſagoras's faction. This the Athenians would by no means ſubmit to; and therefore took up arms, and drove Cleomenes and his troops into the citadel, where they were beſieged for two days. On the third day Cleomenes ſurrendered, on condition that all thoſe who were in the citadel ſhould retire unmoleſted. This, though agreed to, was not performed by the Athenians. They fell upon ſuch as were ſeparated from the army, and put them to death without mercy. Among the number of thoſe ſlain on this occaſion was Timeſitheus the brother of Cleomenes himſelf.

69 **But without ſucceſs.**

The Spartan king was no ſooner withdrawn from Athens, than he formed a ſtrong combination in favour of Iſagoras. He engaged the Bœotians to attack Attica on the one ſide, and the Chalcidians on the other, while he at the head of a powerful Spartan army entered the territories of Eleuſina. In this diſtreſs, the Athenians, not being able to cope with ſo many enemies at once, reſolved to ſuffer their territories to be ravaged by the Chalcidians and Bœotians, contenting themſelves with oppoſing the army commanded by Cleomenes in perſon. But this powerful confederacy was quickly diſſolved: the Corinthians, who were allied with Cleomenes, doubting the juſtice of their cauſe, returned home; his other allies likewiſe beginning to waver, and his colleague Ariſton, the other king of Sparta, differing in ſentiments, Cleomenes was obliged to abandon the enterpriſe. The Spartans and their allies being withdrawn, the Athenians took a ſevere revenge of the Bœotians and Chalcidians, totally routing their forces, and carrying off a great number of priſoners. The priſoners taken in this war were put in irons, but afterwards ſet at liberty on paying a ranſom of two minæ per head. Their fetters were, however, hung up in the citadel; and the Athenians conſecrated the tenth of what they had received for ranſom, purchaſed a ſtatue, repreſenting a chariot and four horſes, which they ſet up in the portico of the citadel, with a triumphant inſcription in token of their victory.

70 **Bœotians and Chalcidians defeated.**

Theſe indignities rouſing the Bœotians, they immediately vowed revenge, and engaged on their ſide the people of Ægina, who had an hereditary hatred at the Athenians; and while the latter bent all their attention to the Bœotian war, the Ægenitans landing a conſiderable army, ravaged the coaſts of Attica.

71 **Attempt of the Spartans to reſtore Hippias.**

But while the Athenians were thus employed againſt the Bœotians and Æginetans, a jealouſy ſprung up on the part of Lacedæmon, which was never afterwards eradicated. Cleomenes, after his unſucceſsful expedition againſt Attica, produced at Sparta certain oracles which he ſaid he had found in the citadel of Athens while he was beſieged therein: the purport of theſe oracles was, that Athens would in time become a rival to Sparta. At the ſame time it was diſcovered, that Clyſthenes had bribed the prieſteſs of Apollo to cauſe the Lacedæmonians expel the Piſiſtratidæ from Athens; which was ſacrificing their beſt friends to thoſe whom intereſt obliged to be their enemies. This had ſuch an effect, that the Spartans, repenting their folly in expelling Hippias, ſent for him from Sigeum, in order to reſtore him to his principality: but this not being agreed to by the reſt of the ſtates, they were forced to abandon the enterpriſe, and Hippias returned to Sigeum as he came.

72 **Cauſe of the war with Perſia.**

About this time too, Ariſtagoras the Mileſian having ſet on foot a revolt in Ionia againſt the Perſian king, applied to the Spartans for aſſiſtance; but they declining to have any hand in the matter, he next applied to the Athenians, and was by them furniſhed with 20 ſhips under the command of Melanthus, a nobleman univerſally eſteemed. This raſh action coſt the Greeks very dear, as it brought upon them the whole power of the Perſian empire; for no ſooner did the king of Perſia hear of the aſſiſtance ſent from Athens to his rebellious ſubjects, than he declared himſelf the ſworn enemy of that city, and ſolemnly beſought God that he might one day have it in his power to be revenged on them.

The Ionian war being ended, by the reduction of that country again under the Perſian government, the king of Perſia ſent to demand earth and water as tokens of ſubmiſſion from the Greeks. Moſt of the iſlanders yielded to this command out of fear, and among the reſt the people of Ægina; upon which the Athenians accuſed the inhabitants of this iſland of treachery towards Greece, and a war was carried on with them for a long time. How it ended we are not informed; but its continuance was fortunate for Greece in general, as, by inuring them to war, and ſea-affairs in particular, it prevented the whole of the Grecian ſtates from being ſwallowed up by the Perſians who were now about to invade them.

73 Hippias applies to the Perſians.

Beſides the diſpleaſure which Darius had conceived againſt the Athenians on account of the aſſiſtance they had afforded the Ionians, he was further engaged to an expedition againſt Greece by the intrigues of Hippias. Immediately on his returning unſucceſsfully from Lacedemon, as above related, Hippias paſſed over into Aſia, went to Artaphernes governor of the adjacent provinces belonging to the Perſian king, and excited him to make war upon his country, promiſing to be obedient to the Perſian monarch provided he was reſtored to the principality of Athens. Of this the Athenians being apprized, ſent ambaſſadors to Artaphernes, deſiring leave to enjoy their liberty in quiet: but that nobleman returned for anſwer, that if they would have peace with the great king, they muſt immediately receive Hippias; upon which anſwer the Athenians reſolved to aſſiſt the enemies of Darius as much as poſſible. The conſequence of this reſolution was, that Darius commiſſioned Mardonius to revenge him of the inſults he thought the Greeks had offered him. But Mardonius having met with a ſtorm at ſea, and other accidents, which rendered him unable to do any thing, Datis and Artaphernes the ſon of Artaphernes abovementioned, were commiſſioned to do what he was to have done.

74 They invade Greece.

75 Eretria deſtroyed.

The Perſian commanders, fearing again to attempt to double the promontory of Athos, where their fleet had formerly ſuffered, drew their forces into the plains of Celicia; and paſſing from thence through the Cyclades to Eubœa, directed their courſe to Athens. Their charge from Darius was to deſtroy both Eretria and Athens; and to bring away the inhabitants, that they might be at his diſpoſal. Their firſt attempt was on Eretria, the inhabitants of which ſent to Athens for aſſiſtance on the firſt approach of the Perſian fleet. The Athenians, with a magnanimity almoſt unparalleled at ſuch a juncture, ſent 4000 men to their aſſiſtance; but the Eretrians were ſo much divided among themſelves, that nothing could be reſolved on. One party among them was for receiving the Athenian ſuccours into the city; another, for abandoning the city and retiring into the mountains of Eubœa; while a third ſought to betray their country to the Perſians for their own private intereſt. Seeing things in this ſituation, therefore, and that no good could poſſibly be done, one Æſchines, a man of great authority among the Eretrians, generouſly informed the Athenians commanders that they might return home. They accordingly retired to Oropus, by which means they eſcaped deſtruction: for Eretria being ſoon after betrayed to the Perſians, was pillaged, burnt, and its inhabitants ſold for ſlaves.

76 Perſians defeated at Marathon.

On the news of this diſaſter the Athenians immediately drew together all the forces they were able, which after all amounted to no more than 9000 men. Theſe, with 1000 Platæans who afterwards joined them, were commanded by ten general officers, who had equal power; among whom were Miltiades, Ariſtides, and Themiſtocles, men of diſtinguiſhed valour and great abilities. But it being generally imagined that ſo ſmall a body of troops would be unable to reſiſt the formidable power of the Perſians, a meſſenger was diſpatched to Sparta to intreat the immediate aſſiſtance of that ſtate. He communicated his buſineſs to the ſenate in the following terms: "Men of Lacedæmon, the Athenians deſire you to aſſiſt them, and not to ſuffer the moſt ancient of all the Grecian cities to be enſlaved by the barbarians. Eretria is already deſtroyed, and Greece conſequently weakened by the loſs of ſo conſiderable a place." The aſſiſtance was readily granted; but at the ſame time the ſuccours arrived ſo ſlowly, that the Athenians were forced to fight without them. In this memorable engagement in the plains of Marathon, whither Hippias had conducted the Perſians, the latter were defeated with the loſs of 6300 men; while the Greeks loſt only 192. The Perſians being thus driven to their ſhips, endeavoured to double Cape Sunium, in order to ſurprize Athens itſelf before the army could return: but in this they were prevented by Miltiades; who leaving Ariſtides with 1000 men to guard the priſoners, returned ſo expeditiouſly with the other 9000, that he was at the temple of Hercules, which was but a ſmall way diſtant, before the barbarians could attack the city.

77 Integrity of Ariſtides.

After the battle, Ariſtides diſcharged the truſt repoſed in him with the greateſt integrity. Though there was much gold and ſilver in the Perſian camp, and the tents and ſhips they had taken were filled with all ſorts of riches, he not only forbore touching any thing himſelf, but to the utmoſt of his power prevented others from doing it. Some, however, found means to enrich themſelves; among the reſt, one Callias, couſin-german to Ariſtides himſelf. This man being a torch-bearer, and, in virtue of his office, having a fillet on his head, one of the Perſians took him for a king, and, falling down at his feet, diſcovered to him a vaſt quantity of gold hid in a well. Callias not only ſeized, and applied it to his own uſe, but had the cruelty to kill the poor man who diſcovered it to him, that he might not mention it to others; by which infamous action he entailed on his poſterity the name of *Laccopluti*, or *enriched by the well*.

78 Miltiades ungratefully treated by the Athenians.

After the battle of Marathon, all the inhabitants of Platæa were declared free citizens of Athens, and Miltiades, Themiſtocles, and Ariſtides, were treated with all poſſible marks of gratitude and reſpect. This, however, was but very ſhort-lived; Miltiades propoſed an expedition againſt the iſland of Paros, in which having been unſucceſsful, through what cauſe is not well known, he was, on his return, accuſed, and condemned to pay 50 talents, the whole expence of the ſcheme; and being unable to pay the debt was thrown into priſon, where he ſoon died of a wound received at Paros.

79 As likewiſe Ariſtides.

If any thing can exceed the enormity of ſuch a proceeding as this, it was the treatment Ariſtides next received. Miltiades had propoſed an expedition which had not proved ſucceſsful, and in which he might poſſibly have had bad deſigns; but againſt Ariſtides not ſo much as a ſhadow of guilt was pretended. On the contrary, his extraordinary virtue had procured him the title of *Juſt*, and he had never been found to ſwerve from the maxims of equity. His downfal was occaſioned by the intrigues of Themiſtocles: who being a man of great abilities, and hating Ariſtides on account of the character he deſervedly bore among his countrymen, took all opportunities of inſinuating that his rival had in fact made himſelf maſter of Athens without the parade of guards and royalty. "He gives laws to the people (ſaid he); and what conſtitutes a tyrant, but giving laws?" In conſequence of this ſtrange argument, a ſtrong party was formed againſt the virtuous Ariſtides, and it was reſolved to baniſh him for 10 years by the oſtraciſm. In this caſe, the name of the perſon to be baniſhed was written upon a ſhell by every one who deſired his exile, and carried to a certain place within the forum incloſed with rails. If the number of ſhells ſo collected exceeded 6000, the ſentence was inflicted; if not, it was otherwiſe. When the agents of Themiſtocles had ſufficiently accompliſhed their purpoſe, on a ſudden the people flocked to the forum deſiring the oſtraciſm. One of the clowns who had come from a borough in the country, bringing a ſhell to Ariſtides, ſaid to him, "Write me Ariſtides upon this." Ariſtides, ſurpriſed, aſked him if he knew any ill of that Athenian, or if he had ever done him any hurt? "Me hurt! (ſaid the fellow), no, I don't ſo much as know him; but I am weary and ſick at heart on hearing him every where called *the juſt*." Ariſtides therefore took the ſhell, and wrote his own name upon it; and when informed that the oſtraciſm fell upon him, modeſtly retired out of the forum, ſaying, "I beſeech the gods that the Athenians may never ſee that day which ſhall force them to remember Ariſtides."

80
Themiſtocles adviſes the building of a fleet.

After the battle of Marathon, the war with Ægina was revived with great vigour; but the Æginetans generally had the ſuperiority, on account of their great naval power. Themiſtocles obſerving this, was continually exhorting his countrymen to build a fleet, not only to make them an equal match for the Æginetans, but alſo becauſe he was of opinion that the Perſians would ſoon pay them another viſit. At laſt, he had the boldneſs to propoſe, that the money produced by the ſilver mines, which the Athenians had hitherto divided among themſelves, ſhould be applied to the building of a fleet: which propoſal being complied with, 100 galleys were immediately put upon the ſtocks; and this ſudden increaſe of the maritime power proved the means of ſaving all Greece from ſlavery.

81
Xerxes invades Greece.

About three years after the baniſhment of Ariſtides, Xerxes king of Perſia ſent to demand earth and water: but Themiſtocles deſiring to make the breach with that monarch ſtill wider, put to death the interpreter for publiſhing the decree of the king of Perſia in the language of the Greeks; and having prevailed upon the ſeveral ſtates to lay aſide their animoſities, and provide for their common ſafety, got himſelf elected general of the Athenian army.

When the news arrived that the Perſians were advancing to invade Greece by the ſtraits of Thermopylæ, and that they were for this purpoſe tranſporting their forces by ſea, Themiſtocles adviſed his countrymen to quit the city, embark on board their galleys, and meet their enemies while yet at a diſtance. This they would by no means comply with; for which reaſon Themiſtocles put himſelf at the head of the army, and having joined the Lacedemonians, marched towards Tempe. Here, having received advice that the ſtraits of Thermopylæ were forced, and that both Bœotia and Theſſaly had ſubmitted to the Perſians, the army returned without doing any thing.

82
Athens abandoned by its inhabitants.

In this diſtreſs the Athenians applied to the oracle at Delphi: from whence they received at firſt a very ſevere anſwer, threatening them with total deſtruction; but after much humiliation, a more favourable one was delivered, in which, probably by the direction of Themiſtocles, they were promiſed ſafety in *walls of wood*. This was by Themiſtocles and the greateſt part of the citizens interpreted as a command to abandon Athens, and put all their hopes of ſafety in their fleet. Upon this, the opinion of Themiſtocles prevailing, the greateſt part began to prepare for this embarkation; and had money diſtributed among them by the council of the Areopagus, to the amount of eight drachms per man; but this not proving ſufficient, Themiſtocles gave out that ſomebody had ſtolen the ſhield of Minerva; under pretence of ſearching for which, he ſeized on all the money he could find. Some, however, there were who refuſed to embark with the reſt, but raiſed to themſelves fortifications of wood; underſtanding the oracle in its literal ſenſe, and reſolving to wait the arrival of the Perſians, and defend themſelves to the laſt. In the mean time Ariſtides was recalled, when the Athenians ſaw it their intereſt, leſt he ſhould have gone over to the Perſians and aſſiſted them with his advice.

83
And deſtroyed by the Perſians.

84
They are totally defeated at Salamis.

The Perſians having advanced to Athens ſoon after the inhabitants had deſerted it, met with no oppoſition except from the few juſt now mentioned; who, as they would hearken to no terms of accommodation, were all cut in pieces, and the city utterly deſtroyed. Xerxes, however, being defeated in a ſea-fight at Salamis, was forced to fly with prodigious loſs. See SALAMIS. Themiſtocles was for purſuing him, and breaking down the bridge he had caſt over the Helleſpont; but this advice being rejected, he ſent a truſty meſſenger to Xerxes, acquainting him that the Greeks intended to break down his bridge, and therefore deſired him to make all the haſte he could, leſt by that means he ſhould be ſhut up in Europe. According to Herodotus, he alſo adviſed the Athenians to quit the purſuit and return home, in order to build their ruined houſes. This advice, though miſinterpreted by ſome, was certainly a very prudent one, as Xerxes, though once defeated, was ſtill at the head of an army capable of deſtroying all Greece; and had he been driven to deſpair by finding himſelf ſhut up, or warmly purſued, it was impoſſible to ſay what might have been the event. After this, Themiſtocles formed a ſcheme, for the aggrandiſement of Athens indeed, but a moſt unjuſt and infamous one. It was, in ſhort, to make Athens miſtreſs of the ſea by burning all the ſhips except thoſe belonging to that republic. He told his countrymen that he had ſomething to propoſe of great conſequence, but which could not be ſpoken publicly: whereupon he was deſired to communicate it to Ariſtides, by whom the propoſal was rejected; and Ariſtides having informed the Athenians that what Themiſtocles had ſaid was very advantageous but very unjuſt, they deſired him to think no more of it.

85
Themiſtocles honoured by the Lacedemonians.

When the fleet returned to Salamis, extraordinary honours were paid to Themiſtocles by the Lacedemonians. On his entering that city, they decreed him a wreath of olive as the prize of prudence; preſented him with the moſt magnificent chariot in Sparta; and when he returned to Athens, he was eſcorted by 500 horſe, an honour never paid to any ſtranger but himſelf. On his arrival at Athens, however, there were not wanting ſome who inſinuated that the receiving ſuch honours from the Lacedemonians was injurious to the republic; but Themiſtocles confiding in his innocence, treated theſe clamours with contempt, and exhorted his countrymen to entertain no doubts of their allies, but rather endeavour to preſerve the great reputation they had acquired throughout all Greece.

86
Athens a ſecond time deſtroyed.

87
The Perſians defeated at Platæa and Mycale.

The defeat of Xerxes at Salamis made Mardonius, who was left to carry on the war by land, more ready to treat with the Athenians than to fight them; and with this view he ſent Alexander king of Macedon to Athens to make propoſals of alliance with that republic, excluſively of all the other Grecian ſtates. This propoſal, however, was rejected; and the conſequence was, that Athens was a ſecond time deſtroyed, the Spartans ſending aſſiſtance ſo ſlowly, that the Athenians were forced to retire to Salamis: but they were ſoon freed from all apprehenſions by the total defeat and death of Mardonius at Platæa; where Ariſtides, and the body of troops under his command, diſtinguiſhed themſelves in a moſt extraordinary manner.

88
Seſtos taken by the Athenians.

The ſame day that the battle of Platæa was fought, the Perſians were defeated in a ſea-fight at Mycale in Ionia, wherein it was allowed that the Athenians who were there behaved better than any of the other Greeks; but when it was propoſed to tranſport the Ionians into Europe, that they might be in perfect ſafety, and give them the territories of ſuch Grecian ſtates as had ſided with the Perſians, the Athenians refuſed to comply, fearing the Ionians would rival them in trade, or refuſe the obedience they uſed to pay them: beſides which, they would then loſe the opportunity of plundering the Perſians in caſe of any quarrel with Ionia. Before they returned home, however, the Athenians croſſed over to the Cherſoneſus, and beſieged Seſtos. The ſiege was long and troubleſome: but at laſt the garriſon, being preſſed with hunger, and having no hopes of relief, divided themſelves into two bodies, and endeavoured to make their eſcape; but were purſued, and all either killed or taken. *Oibazus*, one of their commanders, was ſacrificed to a Thracian god; and the other, called *Artyactes*, impaled alive, and his ſon ſtoned before his face, becauſe he had rifled the ſepulchre of Proteſilaus.

89
They rebuild their city.

After the victories at Platæa and Mycale, the Athenians returned without any apprehenſion, and began to rebuild their city in a more magnificent manner than before. Here they were no ſooner arrived than a diſpute was ready to be commenced about the form of government. The commons, with Themiſtocles at their head, were for a democracy; to which Ariſtides, rather than hazard the raiſing diſturbances, conſented. It was therefore propoſed, that every citizen ſhould have an equal right to the government; and that the archons ſhould be choſen out of the body of the people, without preference or diſtinction: and this propoſal being agreed to, put an end to all diſcontents for the preſent.

90
Themiſtocles adviſes to fortify Athens, and deceives the Spartans who oppoſe it.

At this time alſo Themiſtocles propoſed that the city of Athens ſhould be fortified in the beſt manner poſſible, that it might not be liable to be again deſtroyed, when the Perſians ſhould take it into their heads to invade Greece. At this propoſal the Lacedemonians were exceedingly alarmed; and therefore remonſtrated, that ſhould Athens once be ſtrongly fortified, and the Perſians become poſſeſſed of it, it would be impoſſible to get them out of it again. At laſt, ſeeing theſe arguments had no effect, they abſolutely forbid the Athenians to carry their walls any higher. This command gave great offence; but Themiſtocles, conſidering the power of Sparta at that time, adviſed the Athenians to temporize; and to aſſure the ambaſſadors, that they ſhould proceed no farther in their work, till by an embaſſy of their own, ſatisfaction ſhould be given to their allies. Being named ambaſſador at his own deſire to Sparta, with ſome other Athenians, Themiſtocles ſet out alone, telling the ſenate that it would be for the intereſt of the ſtate to delay ſending the other ambaſſadors as long as poſſible. When arrived at Sparta, he put off from time to time receiving an audience, on account of his colleagues not being arrived: but in the mean time the walls of Athens were building with the utmoſt expedition; neither houſes nor ſepulchres being ſpared for materials; and men, women, children, ſtrangers, citizens and ſervants, working without intermiſſion. Of this the Lacedemonians having notice, and the reſt of the Athenian ambaſſadors being arrived, Themiſtocles and his colleagues being ſummoned before the ephori, who immediately began to exclaim againſt the Athenians for their breach of promiſe. Themiſtocles denied the charge: he ſaid his colleagues aſſured him of the contrary: that it did not become a great ſtate to give heed to vague reports, but that deputies ought to be ſent from Sparta to inquire into the truth of the matter, and that he himſelf would remain as a hoſtage, to be anſwerable for the event. This being agreed to, he engaged his aſſociates to adviſe the Athenians to commit the Spartan ambaſſadors to ſafe cuſtody till he ſhould be releaſed; after which he publicly avowed the whole tranſaction, took the ſcheme upon himſelf, and told the Lacedemonians that "all things are lawful for our country." The Spartans ſeeing no remedy, concealed their reſentment, and ſent Themiſtocles home in ſafety.

91
Makes the Pyræum the port of Athens.

The next year, being the laſt of the 75th Olympiad, Themiſtocles obſerving the inconvenience of the port Phalerum, thought of making the *Pyræum* the port of Athens. This he did not at firſt think proper to mention publicly; but having ſignified to the people that he had ſomething of importance to communicate, they appointed Xantippus and Ariſtides to judge of his propoſal. They readily came into his meaſures, and told the people that what Themiſtocles propoſed would be of the utmoſt advantage to the ſtate, at the ſame time that it might be performed with eaſe. Upon this they were deſired to lay the matter before the ſenate; who coming unanimouſly into their meaſure, ambaſſadors were diſpatched to Sparta to inſinuate there how proper it would be for the Greeks to have ſome great port, where a fleet might always watch the deſigns of the Perſians; and thus having prevented any umbrage from their firſt undertakings, the work was ſet about with ſuch expedition, that it was finiſhed before the Lacedemonians knew well what they were about.

At this time alſo the ſovereignty of the ſea was trans-

92 Sovereignty of the ſea transferred to Athens.

transferred from Sparta to Athens, through the haughty behaviour of Pauſanius the Lacedemonian. He had commanded at Platæa, and ſtill enjoyed the ſupreme authority in the war which was all this time carrying on againſt the Perſians; but being elated with his ſucceſs at Platæa, and having entered into a treaſonable correſpondence with the enemy, he treated the captains under his command with the greateſt haughtineſs, giving the preference to the Spartans in ſuch a manner that the reſt of the Greeks could no longer bear his inſolence. On the contrary, Ariſtides, and Cimon the ſon of Miltiades, who commanded the Athenians, by their obliging behaviour gained the favour of every body; ſo that the allies, having publicly affronted Pauſanias, put themſelves under the protection of the Athenian republic; and thenceforward the Athenians, and not the Lacedemonians, had the ſupreme command.

93 Ariſtides taxes Greece with extraordinary applauſe.

The Greeks being now ſenſible that they would always have occaſion to be on their guard againſt the Perſians, and that it was neceſſary to eſtabliſh a fund by a common taxation of all the ſtates, Ariſtides was pitched upon as the only perſon that could be truſted with the power of allotting to each of the ſtates its proper quota. This difficult taſk he undertook, and executed in a manner unparalleled in the annals of hiſtory. All parties were pleaſed, and his taxation was ſtyled *the happy lot of Greece*. The groſs amount of it was 450 talents.

94 Themiſtocles baniſhed.

It now came to the turn of Themiſtocles to experience the ingratitude of his countrymen. His ſervices had been ſo eſſential, that the treatment he received may perhaps be a ſufficient excuſe for modern patriots when they connect their own intereſt with the ſervice of their country. Themiſtocles had plainly ſaved the ſtate from ruin by his advice; he had diſtinguiſhed himſelf by his valour; had rendered Athens, by his policy, ſuperior to the other ſtates of Greece; and entirely ſubverted the Lacedemonian ſcheme of power. Yet notwithſtanding all this he was baniſhed by the oſtraciſm, without the ſmalleſt crime pretended, unleſs that he was hated by the Lacdemonians, and that he had erected a temple, near his own houſe, dedicated to *Diana, the giver of the beſt counſel;* intimating that he himſelf had given the beſt council for the ſafety both of Athens and of all Greece, which was no more than the truth. Nay, he was not only driven out of Athens, but out of all Greece; ſo that he was forced to ſeek ſhelter from the king of Perſia, againſt whom he had fought with ſo much valour. That monarch gave him a gracious reception; and he was never recalled, becauſe the Greeks had no occaſion for his ſervices.

95 Succeſs of Cimon againſt the Perſians.

The war with Perſia was not yet diſcontinued; the Greeks found their advantage in plundering and enriching themſelves with the ſpoils of the king of Perſia's ſubjects. For this reaſon, in the end of the 77th Olympiad, they equipped a navy, under a pretence of relieving ſuch of the Greek cities in Aſia as were ſubject to the Perſians. Of this fleet Cimon, the ſon of Miltiades by the daughter of the king of Thrace, was appointed commander in chief. He had already taſted the juſtice and generoſity of his countrymen, having been thrown into priſon for his father's fine, from which he was releaſed by *Callias*, whom his ſiſter Elpinice married on account of his great wealth procured by no very honourable means. He accepted of the command, however; and gained ſuch immenſe booty in this expedition, that the Athenians were thereby enabled to lay the foundation of thoſe long extended walls which united the port to the city. The foundation was laid in a mooriſh ground; ſo that they were forced to ſink it very deep, and at a great expence; but to this Cimon himſelf contributed out of his own ſhare of the ſpoils, which was very conſiderable. He alſo adorned the forum with palm trees, and beautified the academy with delightful walks and fountains.

96 He ſubdues the Cherſoneſus.

The Perſians having ſoon after this expedition invaded Cherſoneſus, and with the aſſiſtance of the Thracians made themſelves maſters of it, Cimon was ſent againſt them in a great hurry. He had only four ſhips; but nevertheleſs with theſe he took 13 of the Perſian galleys, and reduced the whole of the Cherſoneſus. After this he marched againſt the Thracians, who revolting againſt the Athenians, had made themſelves maſters of the gold mines lying between the rivers Nyſſus and Strymon. The Thracians were quickly obliged to yield; after which the Athenians ſent a great colony to Amphipolis a city of Thrace, which for ſome time made a conſiderable figure, but afterwards attempting to penetrate into the country of the *Edones*, great part of them were deſtroyed.

97 Makes Athens irreſiſtable at ſea.

Cimon alſo fell upon the following expedient to make Athens irreſiſtable at ſea by the other ſtates of Greece. Many of the Greek ſtates, by virtue of Ariſtides's taxation, were bound to furniſh men and galleys, as well as to pay the tax for their ſupport. But when they ſaw themſelves out of danger from the Perſians, moſt of them were very unwilling to furniſh their quota of men. This the Athenian generals being offended with, were for having recourſe to force; but Cimon permitted ſuch as were deſirous of ſtaying at home to do ſo, and accepted a ſum of money in lieu of a galley completely manned. By this means he inured the Athenians, whom he took on board his galleys, to hardſhip and diſcipline; while the allies who remained at home became enervated through idleneſs, and from being confederates, dwindled into tributaries, and almoſt ſlaves. In the laſt year of the 77th Olympiad, Cimon was ſent to aſſiſt the Lacedemonians againſt the Helotes, who had revolted from them. In this he was attended with his uſual ſucceſs; but, ſome time after, the Lacedemonians being engaged in the ſiege of Ithome, ſent again to the Athenians for ſuccour, and Cimon a ſecond time ſent to their relief; but the Spartans having received a ſufficient ſupply of troops from other quarters before the arrival of the Athenian general, he and his men were diſmiſſed without doing any thing. This grievouſly offended the people of Athens, who thenceforward hated not only the Lacedemonians, but all their own citizens who were thought to be friends to that ſtate.

98 He is baniſhed.

It was not poſſible, however, that any perſon who had ſerved the ſtate ſhould eſcape baniſhment at Athens. Cimon had gained great wealth both to the public and to himſelf. In his public character he had behaved with unimpeached honeſty, and as a private citizen he dedicated his wealth to the moſt excellent purpoſes. He demoliſhed the incloſures about his grounds and gardens, permitting every one to enter and take what fruits they pleaſed; he kept an open table, where both rich and poor were plentifully entertained. If he met a citizen in a tattered ſuit of clothes, he made ſome of his attendants exchange with him; or if the quality of the perſon rendered that kindneſs unſuitable, he cauſed a ſum of money to be privately given him. All this, however, was not ſufficient: he did not concur with every meaſure of the commonalty; and therefore the popular party determined not to baniſh him, but to put him to death. The crime laid to his charge was, that by preſents from the Macedonians he was prevailed upon to let ſlip a manifeſt opportunity of enlarging his conqueſts, after taking from the Perſians the gold mines of Thrace. To this accuſation Cimon replied, that to the utmoſt of his power he had proſecuted the war againſt the Thracians and other enemies of the ſtate of Athens; but that it was true he had not made any inroads into Macedonia, becauſe he did not imagine he was to act as a public enemy of mankind, and becauſe he was ſtruck with reſpect for a nation modeſt in their carriage, juſt in their dealings, and ſtrictly honourable in their behaviour towards him and the Athenians: that if his countrymen looked upon this as a crime, he muſt abide their judgment; but, for his part, he could never be brought to think ſuch conduct amiſs. Elpinice, Cimon's ſiſter, uſed all her intereſt in his behalf, and amongſt others ſpoke to Pericles the celebrated ſtateſman and orator. He was indeed Cimon's rival, and had no doubt aſſiſted in ſtirring up the proſecution againſt him; but he did not deſire his death: and therefore, though appointed to accuſe him, Pericles ſpoke in ſuch a manner that it plainly appeared he did not think him guilty; and, in conſequence of this lenity, Cimon was only baniſhed by the oſtraciſm.

99
War between Athens and Sparta.

The Athenian power was now riſen to ſuch an height, that all the other ſtates of Peloponneſus looked upon this republic with a jealous eye, and were continually watching every opportunity of making war upon it when the ſtate was engaged in troubleſome affairs, and ſeemed to be leſs able to reſiſt. Theſe attempts, however, ſo far from leſſening, generally contributed to increaſe the power of the Athenians; but in the year before Chriſt 458, the republic entered into a war with Sparta, which was ſcarce put an end to but by the deſtruction of the city of Athens. For this war, there was no recent provocation on the part of the Spartans. They had ſent a great army to aſſiſt the Dorians againſt the Phocians, and the Athenians took this opportunity to revenge themſelves of former quarrels. Having therefore drawn in the Argives and Theſſalians to be their confederates, they poſted themſelves on the Iſthmus, ſo that the Spartan army could not return without engaging them. The Athenians and their confederates amounted to 14,000, and the Spartans to 11,500. The Spartan general, however, not very willing to hazard a battle, turned aſide to Tanagra, a city in Bœotia, where ſome of the Athenians who inclined to ariſtocracy entered into a correſpondence with him. But before their deſigns were ripe for execution, the Athenian army marched with great expedition to Tanagra, ſo that a battle became inevitable. When the armies were drawing up in order of battle, Cimon preſented himſelf before his countrymen in complete armour, and went to take poſt among thoſe of his own tribe; but the popular party raiſed ſuch a clamour againſt him, that he was forced to retire. Before he departed, however, he exhorted Euthippus and the reſt of his friends to behave in ſuch a manner that they might wipe off the aſperſion thrown upon him, as if he had deſigned to betray his country's cauſe to the Lacedemonians. Euthippus deſired him to leave his armour, which he did; and a battle enſuing, the Athenians were defeated with great loſs, and Euthippus with the reſt of Cimon's friends were all killed in defence of his armour which they had ſurrounded. Another engagement ſoon followed, wherein both armies ſuffered ſo much, that they were glad to conclude a ſhort truce, that each might have time to recruit their ſhattered forces.

100
Athenians defeated.

101
They gain great advantages over the Spartans.

The ſcale of fortune now ſeemed to turn in favour of the Athenians. The Thebans, who had been deprived of the command of Bœotia on account of their having ſided with Xerxes, were now reſtored to it by the Lacedemonians. At this the Athenians were ſo diſpleaſed, that they ſent an army under Myronides the ſon of Callias into Bœotia to overturn all that had been done. That general was met by the Thebans and their allies, who compoſed a numerous and well-diſciplined army. Nevertheleſs, though the Athenian army was but an handful in compariſon of their enemies, Myronides gained a complete victory over the allies, in ſome ſenſe more glorious than either that of Marathon or Platæa. In theſe battles they had fought againſt effeminate and ill-diſciplined Perſians, but now they encountered and defeated a ſuperior army compoſed of the braveſt Greeks. After this victory, Myronides marched to Tanagra; which he took by ſtorm, and razed to the ground: he then plundered Bœotia; defeated another army which the Bœotians had drawn together to oppoſe him; then fell upon the Locrians; and, having penetrated into Theſſaly, chaſtiſed the inhabitants of that country for having revolted from the Athenians, and from thence returned to Athens laden with riches and glory.

The next year Tolmides the Athenian admiral invaded Laconia, where he made himſelf maſter of ſeveral places; and on the back of this, Pericles invaded Peloponneſus with great ſucceſs, burning, ſpoiling, or taking whatever places he attempted. On his return he found the people greatly out of humour on account of Cimon's baniſhment; ſo he was immediately recalled.

102
Cimon recalled.

Cimon was no ſooner returned than he fell to his old employment of plundering the Perſians; and, according to Plutarch, he had now nothing leſs in view than the conqueſt of the whole Perſian empire. The Perſian monarch finding he could have no reſt, at laſt ſent orders to Artabazus and Megabizus, his commanders, to conclude a treaty; which was done on the following conditions: 1. That the Greek cities in Aſia ſhould be free, and governed by their own laws. 2. That the Perſians ſhould ſend no army within three days journey of the ſea. 3. That no Perſian ſhip of war would ſail between Theſalis and Cyrene, the former a city of Pamphylia, and the latter of Lycia.

103
His death.

While this treaty was carrying on Cimon died, whether of ſickneſs or of a wound he had received is not known; and after his death the Athenian affairs began to fall into confuſion. It was now the misfortune of this ſtate to be alike hated by her enemies and allies; the conſequence of which was, that the latter were perpetually

petually revolting whenever they thought they had an opportunity of doing ſo with impunity. The Megarians, at this time, who had been long under the protection or dominion of Athens, thought proper for ſome reaſon or other to diſclaim all dependence on their former protectors, and have recourſe to Sparta, with which ſtate they entered into a ſtrict alliance. This the Athenians revenged by ravaging the country of the Megarians; which ſoon brought on a renewal of the Lacedemonian war that had been for a little time ſuſpended. Pericles, however, procured the return of the firſt Lacedemonian army, without bloodſhed, by bribing Chandrides the young king of Sparta's tutor. In the winter, Tolmides reſolved to undertake an expedition into Bœotia with a ſmall body of troops; which deſign he put in execution contrary to the advice of Pericles, and his raſhneſs was ſoon puniſhed by his own death and the total defeat of his army. Notwithſtanding this misfortune, however, Pericles ſoon after invaded and reduced Eubœa; and the Lacedemonians, finding it was not for their intereſt to carry on the war, concluded a truce with the Athenians for 30 years.

104 A thirty years truce with the Lacedemonians.

105 Cruelty of Pericles.

106 Number of the Athenian citizens.

About this time Pſammiticus, king of Egypt, ſent by way of preſent to the people of Athens 40,000 buſhels of wheat; which proved a great misfortune to the city: for Pericles, out of ſpite to Cimon, who had children by an Arcadian woman, had preferred a law whereby the Athenians of the half-blood were diſfranchiſed; and this law, on account of the diſtribution of the corn abovementioned, was proſecuted with ſuch ſeverity, that no leſs than 5000 perſons, who till then had been conſidered as free-men, were ſold for ſlaves. This piece of cruelty has been of great ſervice to the critics, as by means of it we know exactly the number of Athenian citizens, which at this time amounted to no more than 14,040 perſons, though Athens was now aiming at no leſs than erecting an univerſal monarchy.

107 Samos reduced by Pericles.

Six years after the concluſion of the peace between Athens and Sparta, a war broke out between the Samians and Mileſians about the city of Priene, ſeated under mount Mycale in Ionia. How this war came to affect the Athenians is not certainly known: but ſomehow or other, this republic was induced to take the part of the Mileſians; and the iſland of Samos was reduced by Pericles, who eſtabliſhed there a democracy, and left an Athenian garriſon. He was no ſooner gone, however, than the Samians, diſliking their new form of government, drove out the garriſon he had left; but Pericles quickly returning, beſieged and took their city, demoliſhed their walls, and fined them of the whole expence of the war; part of which he obliged them to pay down, and took hoſtages for the remainder. When Pericles returned, he procured himſelf to be appointed to pronounce the public oration in honour of thoſe who fell; which he did with ſuch eloquence, that when he came down from the pulpit the women gathered about him, took him by the hand, and crowned him with garlands.

108 War between the Corcyrians and Corinthians.

A little after this commenced the war between the Corcyrians and Corinthians, which by degrees brought the Athenians into thoſe engagements that proved the ruin of their ſtate. The cauſes of this war were the following. An inteſtine war breaking out in the little territory of Epidamnum, a city of Macedonia founded by the Corcyrians, one party called in to their aſſiſtance the Illyrians, and the other the Corcyrians. The latter neglecting the matter, Corinth was applied to, as the Corcyrians were a colony from that place. The Corinthians, partly out of pity to the Epidamnians, and partly out of ſpleen to the Corcyrians, ſent a very great fleet to the aſſiſtance of the former, by which means that party which had applied to Corinth was thoroughly eſtabliſhed. This being reſented by the Corcyrians, they ſent a fleet to Epidamnum to ſupport the exiles; and accordingly this fleet began to act offenſively on its entering the port, the chief commanders having inſtructions to propoſe terms of accommodation, to which the Corinthians would by no means agree. The next year the Corcyrians defeated at ſea the Corinthians and their allies, and took Epidamnum by ſtorm; after which they waſted the territories of the allies of the Corinthians, which greatly exaſperated the latter. At Corinth, therefore, they began to make great preparations for carrying on the war, and preſſed their confederates to do the ſame, that they might be in a condition to retrieve the honour they had loſt, and humble this ungrateful colony which had thus inſulted her mother-city.

109 Athens ſides with the Corcyrians.

The Corcyrians were no ſooner acquainted with theſe proceedings, than they diſpatched ambaſſadors to Athens with their complaints; and theſe were quickly followed by others from Corinth on the ſame errand. At firſt the people of Athens inclined to favour the Corinthians; but they ſoon changed their minds, and took part with the Corcyrians: they contented themſelves, however, with entering into a defenſive alliance with that little ſtate, whereby they promiſed to aſſiſt each other, in caſe either party ſhould be attacked; and in conſequence of this treaty, they furniſhed the Corcyrians with ten galleys, under Lacedæmonius the ſon of Cimon, with whom were joined Diotenes and Proteus as colleagues.

As ſoon as the ſeaſon of the year permitted, the Corinthians ſailed for the coaſt of Corcyra with a fleet of 150 ſhips, under the command of Xenoclides aſſiſted by four other Corinthian admirals; each ſquadron of their allies being commanded by a chief of their own. The Corcyrian and Athenian fleet amounted to 120, but the Athenians had orders to give as little aſſiſtance as poſſible. The action was very briſk for ſome time: the Corcyrian right wing broke the left of the Corinthian fleet; and forcing ſome of the ſhips on ſhore, landed, pillaged their camp, and made a great number of them priſoners: on the other hand, the Corinthian ſhips in their right wing beat the Corcyrian ſhips there, they being but very faintly aſſiſted by the Athenians, till the latter were at laſt obliged to defend themſelves, which they did ſo well, that the Corinthians were glad to retire. The next day preparations were made on both ſides for another engagement; but 20 ſhips coming from Athens to the aſſiſtance of the Corcyrians, the Corinthians declined the combat.

110 Potidæa beſieged by the Athenians.

As ſoon as the Corcyrian war broke out, the Athenians ſent orders to the citizens of Potidæa to demoliſh a part of their wall, to ſend back the magiſtrates they had received from Corinth, and to give hoſtages for their own behaviour. Potidæa was a town in Macedonia,

donia, founded by the Corinthians, but at that time in alliance with the Athenians. Perdiccas king of Macedon, who hated the Athenians, took this opportunity to perſuade the Potidæans to revolt. Accordingly they ſent ambaſſadors to Athens to intreat the revocation of theſe orders: but at the ſame time ſent deputies to Sparta, to join with the Corinthians and Megarians in their complaints againſt the Athenians. The Athenians upon this ſent a conſiderable fleet againſt Potidæa under the command of Calias, a nobleman of great courage. The Corinthians on their part diſpatched one Ariſteus with a conſiderable body of troops to the aſſiſtance of that city. An engagement following, the Athenians were victors, but with the loſs of their general. Phormio, who ſucceeded in the command, inveſted the city in form, and ſhut up its port with his fleet; but the Potidæans dreading to fall into the hands of the Athenians, made a moſt obſtinate defence, while in the mean time they warmly ſolicited the Corinthians to perform their promiſes, and engage the reſt of the ſtates of Peloponneſus in their quarrel.

111 The Spartans demand reparation for the injuries offered to the ſtates of Greece.

The Lacedemonians having heard what the Corinthians, and other little ſtates of Greece had to ſay againſt the Athenians, ſent ambaſſadors to the latter, demanding reparation for the injuries, with orders, in caſe of a refuſal to declare war. The terms demanded were, in the firſt place the expulſion of thoſe Athenians who were allied to the family of Megacles ſo often mentioned. This article was on account of Pericles; for he was the ſon of Xanthippus the Athenian commander at Mycale, by Agariſte niece to the famous Clyſthenes, who corrupted the prieſteſs of Apollo in order to procure the expulſion of the Piſiſtratidæ. They next inſiſted that the ſiege of Potidæa ſhould be raiſed; thirdly, that the inhabitants of Ægina ſhould be left free; and, laſtly, that a decree made againſt the Megarians, whereby they were forbid the ports and markets of Athens, ſhould be revoked, and all the Grecian ſtates under the dominion of Athens ſet at liberty.

112 Their terms rejected by advice of Pericles.

Theſe terms the Athenians were perſuaded by Pericles to reject. The arguments uſed by him were in ſubſtance as follows: That whatever the Lacedemonians migh pretend as to the juſtice of the complaints of the allies, the true ground of this reſentment was the proſperity of the Athenian republic, which the Spartans always hated, and now ſought an opportunity of humbling; that it muſt be owing to the Athenians themſelves if this deſign ſucceeded, becauſe for many reaſons Athens was better able to engage in a long and expenſive war than the Peloponneſians. He then laid before the people an exact account of their circumſtances; putting them in mind, that the treaſure brought from Delos amounted to 10,000 talents; and that tho' 4000 of theſe had been expended on the ſtately gate of their citadel, yet that 6000 were ſtill in hand; that they were alſo intitled to the ſubſidies paid by the confederate ſtates; that the ſtatues of their gods, the Perſian ſpoils, &c. were worth immenſe ſums; that private men were arrived at vaſt fortunes; and that, conſidering their trade by ſea, they had a certain annual increaſe of wealth; that they had on foot an army of 12,000 men, and in their colonies and garriſons 17000; that their fleet conſiſted of 300 ſail; whereas the Peloponneſians had no ſuch advantages. For theſe reaſons he propoſed as the moſt feaſible, and likewiſe the moſt equitable ſatisfaction that could be given, that they would reverſe their decree againſt Megara, if the Lacedemonians would allow free egreſs and regreſs in their city to the Athenians and their allies; that they would leave all thoſe ſtates free who were free at the making of the laſt peace with Sparta, provided the Spartans would alſo leave all ſtates free who were under their dominion; and that future diſputes ſhould be ſubmitted to arbitration. In caſe theſe offers ſhould be rejected, he adviſed them to hazard a war; telling them, that they ſhould not think they ran that hazard for a trifle, or retain a ſcruple in their minds as if a ſmall matter moved them to it, becauſe on this ſmall matter depended their ſafety, and the reputation of their conſtancy and reſolution; whereas, if they yielded in this, the next demand of the Lacedemonians would be of a higher nature; for having once diſcovered that the Athenians were ſubject to fear, they would thence conclude that nothing could be denied to Sparta, whereas a ſtiff denial in this caſe would teach them to treat Athens for the future on terms of equality. He enforced theſe reaſons by ſhowing that their anceſtors had always acted on the like principles, and in all caſes preferred their glory to their eaſe, and their liberty to their poſſeſſions.

113 Attempt of the Thebans on Platæa.

This was the origin of the Peloponneſian war, which makes ſo great a figure in ancient hiſtory. The immediate preliminary to general hoſtilities was an attempt of the Thebans to ſurpriſe Platæa. With this view they ſent Eurymachus with 300 Thebans to aſſiſt ſuch of the Platæans as they had drawn over to their intereſt, in making themſelves maſters of the place. In this deſign they ſucceeded very well at firſt, the Platæans who had promiſed to open the gates keeping their words exactly, ſo that they were inſtantly in poſſeſſion of the city. The other party, however, perceiving how ſmall a number they had to contend with, unanimouſly roſe upon them, killing a great many, and forced the reſt to ſurrender themſelves priſoners of war. Another party came from Thebes to aſſiſt their countrymen; but they arrived too late: the Platæans, however, foreſeeing that they would waſte their country, promiſed to releaſe their priſoners if they would forbear to ſpoil their lands. On this the Thebans withdrew; and the Platæans cruelly put to death all their priſoners, to the number of 180, with Eurymachus their chief, alledging that they had not promiſed their releaſe but in caſe of peace. The Athenians, as ſoon as they had notice of this attempt of the Thebans, cauſed all the Bœotians in their territory to be arreſted; and when they underſtood how the Platæans had delivered themſelves, they ſent a great convoy of proviſions to that city, and a numerous body of troops to eſcort their wives and children to Athens.

114 They are maſſacred.

115 Account of the allies on both ſides.

Both parties now prepared in earneſt for war, both ſent ambaſſadors to the Perſians, and both ſought to rouſe their allies. Moſt of the Greek ſtates inclined to favour the Spartans, becauſe they acted on this occaſion as the deliverers of Greece, and becauſe they either had been, or feared that they would be, oppreſſed by the Athenians. With the Spartans joined all the Peloponneſians, except the Argives and part of the Achæans;

chæans; without Peloponneſus, the Megarians, Phocians, Locrians, Bœotians, Ambraciots, Leucadians, and Anactorians, declared themſelves on their ſide. On the other hand, the Chians, Leſbians, Platæans, Meſſenians, Acarnanians, Corcyrians, Zacynthians, Carians, Dorians, Thracians, moſt part of the iſlands, and all the Cyclades excepting Melos and Thera, with Eubœa and Samos, joined the Athenians.

116 First year of the war.

The Peloponneſian war commenced 431 years before Chriſt. The Lacedemonian army was aſſembled at the Iſthmus, and conſiſted of no leſs than 60,000 men; but before Archidamus king of Sparta, who commanded in chief, would enter Attica, he diſpatched a herald to Athens. The herald was ſent back without any anſwer, by which all hopes of peace were cut off. As Archidamus was a friend to Pericles, the latter apprehended that he might forbear plundering his eſtates. With this he immediately acquainted the people; telling them at the ſame time, that in ſuch a caſe he made a preſent of his lands to the public. He then adviſed the citizens to take no care of defending their country-ſeats, but to attend only to the city, buſy themſelves in the equipping of ſhips, and ſettle a thorough reſolution not to be intimidated with the firſt evils of war. This propoſal the Athenians readily complied with, and appointed Pericles commander in chief, with nine more generals to aſſiſt him.

The firſt year; the Spartan army committed great ravages in Attica, Pericles having no force capable of oppoſing it, and refuſing to engage on diſadvantageous terms, notwithſtanding prodigious clamours were raiſed againſt him by his countrymen. The allies, however, had no great reaſon to boaſt of the advantages they gained this year: an Athenian fleet ravaged the coaſts of Peloponneſus; another infeſted the Locrians, drove out the inhabitants of Ægina, and repeopled the iſland from Athens. They likewiſe reduced Cephalenia, and ſome towns in Acarnania and Leucas which had declared for the Lacedemonians; and in the autumn, when the Peloponneſians were retired, Pericles entering the Megarian territory, did all the miſchief that could be expected from a provoked enemy.

117 Second year. A dreadful plague at Athens.

The ſpring of the ſecond year was very fatal to Athens by a dreadful plague which deſtroyed great numbers of the citizens, while the Peloponneſians under Archidamus waſted every thing abroad. In the midſt of theſe diſtreſſes, however, Pericles retained his courage, and would ſuffer none of his countrymen to ſtir without the city, either to eſcape the plague or infeſt the enemy. He cauſed a great fleet to be equipped, on board which he embarked 4000 foot and 300 horſe, with which he ſailed to Epidaurus. Upon this the enemy withdrew their forces out of Attica; but Pericles was able to do no great matter on account of the plague, which made ſo great havock among his men, that he brought back to Athens only 1500 of the 4000 he carried out. By this misfortune the Athenians were thrown into deſpair; they immediately ſued for peace, which the Spartans were now too proud to grant; then turning their rage upon Pericles, they diſmiſſed and fined him. Soon after, Pericles's children and almoſt all his relations died of the plague; ſo that this great ſtateſman was overwhelmed with melancholy, and for ſome time ſhut himſelf up from public view: at laſt, through the perſuaſion of Alcibiades and ſome others, he ſhowed himſelf to the people. They received him with acclamations, and at his requeſt repealed the unjuſt law he had made, whereby all the Athenians of the half blood were disfranchiſed, and then reinſtated him in all his former honours. Hereupon he inrolled the only ſon he had left, who before had been counted a baſtard on account of his mother being a Mileſian.

118 Athenians ſue for peace.

119 Pericles requeſts the repeal of his law.

This year alſo the iſland of Zacynthus was waſted by the Peloponneſians; and the city of Potidæa ſubmitted to the Athenians, after the inhabitants had been driven to ſuch extremity as to feed upon human fleſh. The Athenians permitted the men to depart with one garment, and the women with two; after which, the town was repeopled by a colony from Athens.

120 Third year. Pericles dies.

The third year of the Peloponneſian war was remarkable for the death of the great Pericles, who was taken off by the plague. Platæa was alſo beſieged by Archidamus; but without ſucceſs, even though the greateſt part of it was ſet on fire, the Platæans reſolving to ſubmit to every kind of miſery rather than abandon the Athenian cauſe. In the end, therefore, the king of Sparta was obliged to turn the ſiege into a blockade; and having thrown up an entrenchment fortified with a deep ditch, he left a ſufficient number of men to guard his lines, and then returned back to Peloponneſus.

121 Platæa beſieged.

122 Fourth year. Deſperate attempt of the Platæans.

The following ſummer the Peloponneſians under the command of Archidamus invaded Attica, where they waſted every thing with fire and ſword; at the ſame time the whole iſland of Leſbos, except the diſtrict of Methymna, revolted from the Athenians, who hereupon inveſted the city of Mitylene. All this time the city of Platæa was blocked up by the Peloponneſians; and its inhabitants being now greatly diſtreſſed for want of proviſions, the garriſon, conſiſting of 400 natives and 80 Athenians, came to the deſperate reſolution of forcing a paſſage through the enemy's lines. When they came to attempt this, however, many of them were intimidated: but 300 perſiſted in their reſolution; and of theſe 212 got ſafe through and marched to Athens, but the reſt were compelled to retire.

123 Fifth year. Mitylene, &c. taken by the Athenians.

In the beginning of the fifth year, the Peloponneſians ſent 40 ſhips to the relief of Mitylene; but without effect, for the place had ſurrendered before the fleet could come to its aſſiſtance. Paches, the Athenian commander, likewiſe chaſed away the Peloponneſian fleet upon its arrival; and returning to Leſbos ſent the Lacedemonian miniſter, whom he found in Mitylene, together with a deputation, to Athens. On their arrival the Lacedemonian was immediately put to death; and in a general aſſembly of the people, it was reſolved, that all the Mitylenians who had arrived at man's eſtate ſhould be put to death, and the women and children ſold for ſlaves. The next day, however, this cruel decree was reverſed, and a galley ſent with all expedition to countermand theſe bloody orders. This laſt veſſel, however, could not get before the other: but Paches, being a man of great humanity, had taken a day to conſider on the orders he had received; during which time the laſt mentioned galley arrived; in conſequence of which, only about 1000 of the moſt forward rebels were put to death; the walls of the city were alſo demoliſhed, their ſhips taken away, and their lands divided among the Athenians, who let them again to their old maſters at very high rents. The ſame ſummer the Athenians ſeized the iſland of Minoas, lying over againſt the territory of Megara: and likewiſe the port Niſæa, which laſt they fortified, and it proved afterwards a place of the utmoſt importance to them.

124 Platæa taken and razed.

At this time alſo the Platæans, driven to the laſt extremity, ſurrendered to the Lacedemonians, by whom they were, to the number of 208, including 25 Athenians, put to death, and their women ſold for ſlaves. Their city was ſoon after razed by their implacable enemies the Thebans, who left only an inn to ſhow where it ſtood. The fame of Platæa, however, induced Alexander the Great afterwards to rebuild it.

125 Sedition of Corcyra.

In this year happened the famous ſedition of Corcyra, whence other ſeditions, when their effects rendered them terrible, have been called *Corcyrian*. It hath been already obſerved, that the war between the Corcyrians and Corinthians brought on the general war throughout Peloponneſus. A great number of Corcyrians were in the beginning of this war carried away priſoners into Peloponneſus, where the chief of them were very well treated, but the reſt ſold for ſlaves. The reaſon of this conduct of the Corinthians was a deſign they had formed of engaging theſe Corcyrians to influence their countrymen to ſide with them and their allies. With this view they treated them with all imaginable lenity and tenderneſs, inſtilling into them by degrees an hatred of democratic government; after which they were told, that they might obtain their liberty upon condition of uſing all their influence at home in favour of the allies, and to the prejudice of Athens. This the Corcyrians readily promiſed, and endeavoured to perform. At firſt, thoſe who were for an ariſtocracy prevailed, and murdered all thoſe of the oppoſite party that fell into their hands, in which they were aſſiſted by a fleet of Peloponneſians: but the Athenians ſending firſt one fleet and then another to the aſſiſtance of the diſtreſſed party, the Peloponneſians were forced to withdraw; after which, the democratic party ſufficiently revenged themſelves, and deſtroyed their antagoniſts without mercy. The worſt of all was, that, this example once ſet, the ſeveral ſtates of Greece felt in their turns the like commotions, which were always heightened by agents from Sparta and Athens; the former endeavouring to ſettle ariſtocracy, and the latter democracy, wherever they came.

126 Athenians engage in a war with Sicily.

While the Athenians were thus engaged in a war wherein they were already overmatched, they fooliſhly engaged in a new one, which in the end proved more fatal than all the reſt. The inhabitants of Sicily were ſplit into two factions; the one called the *Doric*, at the head of which was the city of Syracuſe; the other the *Ionic*, which owned the Leontines for their chiefs: the latter perceiving themſelves too weak without foreign aid, ſent one Georgias, a celebrated orator, to apply to Athens for relief; and he by his fine ſpeeches ſo captivated the giddy and inconſtant Athenians, that they ran headlong into a war which they were unable to maintain, while engaged with all the Peloponneſians. Enticed by this new proſpect, therefore, and graſping at the conqueſt of Sicily, as well as of all Greece, they ſent a fleet to the aſſiſtance of the Leontines, under the command of Lachetes and Chabrias; and they were no ſooner ſailed, than another fleet for the ſame purpoſe was begun to be fitted out. All this time the plague continued to rage with great violence at Athens, cutting off this year 4000 citizens, beſides a much greater number of the meaner ſort of people.

127 Sixth year.

The ſixth year of the Peloponneſian war was remarkable for no great exploit: Agis the ſon of Archidamus, king of Sparta, aſſembled an army in order to invade Attica, but was prevented from ſo doing by many great earthquakes which happened throughout Greece.

128 Seventh year. Pylus fortified by the Athenians.

The next year, however, he entered Attica with his army, while the Athenians on their part ſent a fleet under the command of Demoſthenes, to infeſt the coaſts of Peloponneſus. As this fleet paſſed by Laconia, the commander took notice that the promontory of Pylus, which was joined to the continent by a narrow neck of land, had before it a barren iſland about two miles in circumference, in which, however, there was a good and ſafe port, all winds being kept off by the headland, or by the iſle. Theſe advantages made him apprehend, that a garriſon left here would give the Peloponneſians ſo much trouble, that they would find it more adviſeable to protect their own country than to invade that of their neighbours. Accordingly, having raiſed a ſtrong fortification, he himſelf with five ſhips ſtaid to defend it, while the reſt of the fleet proceeded on their intended expedition.

129 Beſieged.

On the news of this event, the Peloponneſian army immediately returned to beſiege Pylus. When they arrived before the place they took poſſeſſion of the harbour, and then cauſed a choſen body of Spartans to take poſſeſſion of the iſland of Sphacteria, after which they attacked the fort with great vigour. Demoſthenes and his garriſon defended themſelves with great valour; and an Athenian fleet arriving very ſeaſonably, offered battle to the Peloponneſian fleet.

130 Spartan fleet deſtroyed.

This being refuſed, the Athenians boldly ſailed into the harbour, broke and ſunk moſt of the veſſels therein, after which they beſieged the Spartans in Sphacteria. The Peloponneſians now began to treat with their enemies, and a truce was concluded during the time that negociations were carried on at Athens. One of the articles of this truce was, that the Peloponneſians ſhould deliver up all their ſhips, on condition of having them punctually returned in caſe the treaty did not take effect. The Athenians having heard the Spartan ambaſſadors, were inclined to put an end to this deſtructive war: but Cleon, one of their orators, a warm and obſtinate man, perſuaded his countrymen to inſiſt on very unreaſonable terms; upon which the ambaſſadors returned, and by ſo doing put an end to the truce.

131 Treachery of the Athenians.

The Peloponneſians then demanded their veſſels; but the Athenians refuſed to deliver them, under pretence of their having broke the truce.

132 They attack Sphacteria.

Hoſtilities being thus recommenced on both ſides, the Lacedemonians attacked the Athenians at Pylus, while the latter attacked the Spartans at Sphacteria. The Spartans, though but an handful of men and under every imaginable diſcouragement, behaved with ſuch bravery, that the ſiege proceeded very ſlowly, ſo that the people of Athens became very uneaſy.

133 Cleon the orator appointed general.

They began then to wiſh they had embracced the offers of the Spartans, and to rail vehemently againſt Cleon, who, to excuſe himſelf, ſaid, it would be eaſy for the general of the forces they were at that time ſending, to attack the Spartans in the iſle, and reduce them at once. Nicias, who had been appointed to this command, replied, that if Cleon believed he could do ſuch great things, he would do well to go thither in perſon: the latter, imagining this only meant to try him, ſaid he was ready to go with all his heart; whereby Nicias catched him, and declared that he had relinquiſhed his charge. Cleon thereupon ſaid, that he was no general: but Nicias told him that he might become one; and the people, pleaſed with the controverſy, held the orator to his word. Cleon then advancing, told them he was ſo little afraid of the enemy, that, with a very inconſiderable force, he would undertake, in conjunction with thoſe already at Pylus, to bring to Athens the Spartans who gave them ſo much trouble in 20 days. The people laughed at theſe promiſes: however, they furniſhed him with the troops he deſired; and to their ſurpriſe, Cleon brought the Spartans priſoners to Athens within the time appointed.

134
He takes the place.

135
End of the Corcyrian ſedition.

This ſummer, likewiſe, an Athenian fleet was ſent to Sicily, with inſtructions to put in at Corcyra, and aſſiſt the government againſt the Lacedemonian faction which ſtill ſubſiſted in that iſland. This they effectually performed; for by their means the exiles fell into the hands of the other party: theſe they impriſoned; and then drew them out by 20 at a time, to ſuffer death, which was inflicted with all the circumſtances of cruelty that party-rage could ſuggeſt. When only 60 remained, they intreated the Athenians to put them to death, and not to deliver them up to their countrymen: but upon this the Corcyrians ſurrounded the place where they were confined, endeavouring to bury them under their darts; upon which the unhappy captives all put an end to their own lives.

136
Eighth year. Succeſs of the Athenians.

In the eighth year Nicias reduced the iſle of Cythera on the coaſt of Laconia; as likewiſe Thyræa, on the confines of that country. The latter had been given to the Æginetans when expelled from their own country by the Athenians: and they were now condemned to death, as inveterate enemies of the Athenian ſtate and nation.—In Sicily, one Hermocrates of Syracuſe perſuaded all the inhabitants of the iſland to adjuſt their differences among themſelves; upon which the Athenian generals returned home, and for ſo doing two of them were baniſhed, and the third ſentenced to pay a heavy fine.

137
Spartan party prevails in Megara.

The Athenians next laid ſiege to Megara under the conduct of Hippocrates and Demoſthenes; but Braſidas a Spartan general coming to its relief, a battle enſued, by which, though neither party got the better, the Lacedemonian faction prevailed in Megara, and many who favoured the Athenians were forced to withdraw. After this, ſuch as had been baniſhed for adhering to the Lacedemonians were allowed to return, on their taking an oath to forget what was paſt, and attempt nothing that might diſturb their country. As ſoon as they were ſettled, however, they forgot their oath; and cauſing 100 of thoſe who were moſt obnoxious to be apprehended, forced the people to condemn them to death. They then changed the whole form of government, introduced an oligarchy, and poſſeſſed themſelves of the ſupreme power.

138
Athenians loſe their power in Bœotia.

In Bœotia ſome commotions were raiſed in favour of the Athenians; but their generals Hippocrates and Demoſthenes being defeated by the oppoſite party, all hopes ceaſed of the Athenian power being eſtabliſhed in Bœotia. In the mean time Braſidas reduced the city of Amphipolis, which greatly alarmed the Athenians, who thereupon ſent new ſupplies of men, money, and ſhips to the Macedonian coaſt; but all their care could not prevent a great deſertion from their intereſt in thoſe parts, where the valour and conduct of Braſidas carried all before him.

139
Ninth year. A truce concluded and broken.

In the ninth year, the Spartans made new propoſals of peace, which the Athenians were now more inclined to accept than formerly; and finding their affairs very much unſettled by the loſs of Amphipolis, a truce for a year was quickly agreed on, while negociations were in the mean time carrying on for a general peace. This pacific ſcheme, however, was very ſoon overthrown by the following accident in Thrace. The city of Scione, and that of Menda, revolted to Braſidas; who, knowing nothing of the truce, ſought to draw over Potidæa alſo. The Athenians, pretending that Scione revolted two days after the truce was concluded, made heavy complaints, aſſerting that this was a breach of the truce, and that both it and Menda ſhould be reſtored to them. This not being effected by negociations, an army was ſent againſt the two cities, by which Menda was reduced; but Scione making an obſtinate defence, the ſiege was turned into a blockade.

140
Tenth year Cleon defeated and killed by Braſidas.

In the tenth year, Braſidas made an attempt upon Potidæa; which having failed, the Athenians began to recover ſome courage. The truce expiring on the day of the Pythian games, Cleon perſuaded the Athenians to ſend an army into Thrace under his command. It conſiſted of 1200 foot and 300 horſe, all Athenian citizens, who embarked on board 30 galleys. Braſidas had an army much inferior; but obſerving that the Athenian general was become careleſs, and neglected diſcipline, he attacked him. In this engagement Cleon was killed, and the Athenians defeated with the loſs of 600 men, while the Spartans loſt only ſeven; but among theſe was their great commander Braſidas, whoſe death affected them almoſt as much as the loſs of their army did the Athenians.

141
A fifty years peace

As the death of Cleon deprived the Athenians of one of their beſt ſpeakers, and one who had been very induſtrious in promoting the war, they were now much more diſpoſed than formerly to hearken to terms of accommodation. Amongſt the Spartans, too, there was a party, at the head of whom was Pliſtonax their king, who earneſtly wiſhed for peace; and as Nicias laboured no leſs aſſiduouſly at Athens to bring about this deſirable event, a peace was at laſt concluded for fifty years between the two nations. The conditions were, that a reſtitution of places and priſoners ſhould be made on both ſides; excepting that Niſœa ſhould remain to the Athenians, who had taken it from the Megarians; and that Platæa ſhould continue with the Thebans, becauſe they abſolutely would not give it up. The Bœotians, Corinthians, and Megarians, refuſed to be included in this peace: but the reſt of the allies yielded to it; and it was accordingly ratified, receiving the name of the *Nician* peace, from Nicias who had ſo vigorouſly promoted it.

142
New diſcontents.

By this means, however, tranquillity was far from being reſtored. Such of the ſtates of Peloponneſus as were diſſatisfied, began immediately to league among themſelves, and to ſet on foot a new confederacy, the head of which was to be the ſtate of Argos. The Lacedemonians, too, found it impoſſible to perform exactly the articles of agreement; the city of Amphipolis

in

143 Heightened by Alcibiades.

in particular, abſolutely refuſed to return under the Athenian government; for which reaſon the Athenians refuſed to evacuate Pylus. In the winter, new negociations were entered into on all ſides, but nothing determined, and univerſal murmuring and diſcontent took place. Theſe diſcontents were not a little heightened by Alcibiades, who now began to rival Nicias, and, perceiving the Lacedemonians made their court moſtly to his rival, took all opportunities to incenſe his countrymen againſt that nation. Nicias, on the other hand, who wiſhed for nothing ſo much as a peace, uſed all his endeavours to bring about a reconciliation. The artifices of Alcibiades, however, added to the turbulent and haughty diſpoſition of both nations, rendered this impoſſible; ſo that though Nicias went on purpoſe to Sparta, he returned without doing any thing.

144 His meaſures for the ſafety of Attica.

Alcibiades having thus diſpoſed every thing according to his wiſhes, and a war being inevitable, he began to take the moſt prudent methods for preſerving his country in ſafety. With this view he entered into a league for 100 years with the Argives, which he hoped would keep the war at a diſtance: he next paſſed over into the territories of Argos, at the head of a conſiderable army; and laboured, both at that city and at Patræ, to perſuade the people to build walls to the ſea, ſo that they might the more eaſily receive aſſiſtance from the Athenians. But though great preparations for war were now made, nothing was undertaken this year; only the Argives thought to have made themſelves maſters of Epidaurus, but were hindered by the Lacedemonians putting a garriſon into it.

145 Fourteenth year. War renewed.

146 Athenians, &c. defeated at Mantinea.

The next year, (the 14th after the Peloponneſian war was firſt begun) a Spartan army, under the command of Agis, entered the territory of Argos where the confederate army lay; but juſt as the engagement was about to begin, a truce was ſuddenly concluded by two of the Argive generals and the king of Sparta. With this neither party was pleaſed, and both the king and generals were very ill treated by their citizens. On the arrival of ſome freſh troops from Athens, therefore, the Argives immediately broke the truce: but the allied army was ſoon after defeated with great ſlaughter by Agis; notwithſtanding which, however, the Eleans and Athenians inveſted Epidaurus. In the winter, a ſtrong party in Argos joined the Lacedemonians; in conſequence of which that city renounced her alliance with Athens, and concluded one with Sparta for 50 years. In compliment to their new allies, alſo, the Argives aboliſhed democracy in their city, eſtabliſhing an ariſtocracy in its place, and aſſiſted the Lacedemonians with a conſiderable body of troops to force the Sicyonians to do the ſame.

147 Fifteenth year.

In the beginning of the 15th year, the Argives, with a levity ſeemingly natural to all the Greeks, renounced their alliance with Sparta, aboliſhed ariſtocracy, drove all the Lacedemonians out of the city, and renewed their league with Athens. The Athenians, in the mean time, being convinced of the treachery of Perdiccas king of Macedon, renounced their alliance with him, and declared war againſt him.

148 Sixteenth year. Melos reduced by the Athenians.

Next year Alcibiades terminated the diſputes in the city of Argos, by the baniſhment of the Spartan faction; after which he ſailed to the iſland of Melos, whoſe inhabitants had acted with the greateſt inveteracy againſt his countrymen: perceiving, however, that the reduction of the iſland would be a work of time, he left a conſiderable body of forces there, and returned to Athens. In his abſence the capital of Melos ſurrendered at diſcretion, and the inhabitants were treated with the utmoſt cruelty; all the men capable of bearing arms being ſlaughtered, and the women and children carried into captivity.

149 Seventeenth year. Athenian army in Sicily loſt, and Alcibiades flies to Sparta.

In the beginning of the 17th year, Nicias was appointed commander of an expedition againſt the Syracuſans, along with Alcibiades and Lamachus as colleagues. But while the neceſſary preparations were making, all things were thrown into confuſion by the defacing of the Hermæ, or ſtatues of Mercury, of which there was a great number in the city. The authors of this ſacrilege could by no means be diſcovered, though rewards were offered for this purpoſe; at laſt the ſuſpicion fell upon Alcibiades; and for this weighty reaſon he was commanded to return from Sicily to take his trial. Alcibiades, however, knew the temper of his countrymen too well to truſt himſelf to their mercy; and therefore, inſtead of returning to Athens, he fled immediately to Sparta, where he met with a gracious reception; while the infatuated Athenians were ſeverely puniſhed by the loſs of their armies, generals, and fleet, in Sicily, which the ſuperior abilities of Alcibiades would in all probability have prevented.

150 Nineteenth and twentieth years, &c.

151 Alcibiades flies to Perſia.

The 19th and 20th years of the war were ſpent by the Athenians in equipping a new fleet in order to repair their vaſt loſſes: but Alcibiades hurt their intereſts very much, by perſuading Tiſſaphernes the Perſian to league with the Spartans againſt them; at the ſame time he perſuaded ſeveral of the Ionian ſtates to revolt from Athens, but they were in a ſhort time obliged again to ſubmit. Notwithſtanding all theſe ſervices, however, Alcibiades had rendered himſelf ſo hateful to Agis by debauching his wife, that he ſoon found himſelf obliged to fly to the Perſians, where Tiſſaphernes gave him a very favourable reception, and profited much by his advice, which was to let the Greeks weaken one another by their mutual wars, and that the Perſians ought never to ſee one ſtate totally deſtroyed, but always to ſupport the weaker party.

152 Propoſes the abolition of democracy at Athens.

When Tiſſaphernes had acquieſced with theſe counſels, Alcibiades privately wrote to ſome of the officers in the Athenian army at Samos, that he had been treating with the Perſians in behalf of his countrymen, but did not chooſe to return till the democracy ſhould be aboliſhed; and to incline the citizens to comply with this meaſure, he told them that the Perſian king diſliked a democracy, but would immediately aſſiſt them if that was aboliſhed, and an oligarchy erected in its ſtead.

On the arrival of Piſander and other deputies from the army, with the propoſals of Alcibiades, the Athenians without heſitation reſolved to overturn that democracy which they had all along ſo ſtrenuouſly defended. The iſſue of their preſent debates was, that Piſander with ten deputies ſhould return to Alcibiades, in order to know on what terms the king of Perſia would make an alliance with them; but that cunning Athenian having perceived that Tiſſaphernes was by no means diſpoſed to aſſiſt the Athenians on account of their having been lately ſucceſsful, he ſet up ſuch high demands in the king of Perſia's name, that the Athenians of themſelves broke off the treaty, and thus Alcibiades preſerved the friendſhip of both parties.

Piſander having engaged the army at Samos in his ſcheme of overturning democracy, that form of government was aboliſhed firſt in the cities ſubject to Athens, and laſtly in the capital itſelf. Piſander's new ſcheme was, That the old form of government ſhould be totally diſſolved: that five prytanes ſhould be elected: that theſe five ſhould chooſe 100; and that each of the hundred ſhould chooſe three: that the 400 thus elected ſhould become a ſenate with full power; but ſhould occaſionally conſult with 5000 of the moſt wealthy citizens, who ſhould thenceforward be eſteemed only *the people;* and that no authority ſhould remain with the loweſt claſs. Though the people were not very fond of this change, thoſe who conducted it, being men of great parts found means to eſtabliſh it by force; for when the people were gone out of the city to their ordinary employments, the 400, having each a dagger concealed under his veſt, attended by a guard of 120 men, entered the ſenate-houſe, diſſolved the old ſenate, and without ceremony turned them out; after which the commons, not knowing whom to ſubmit to, or to whom to apply, made no oppoſition.

153
New form of government eſtabliſhed.

The firſt ſtep of the new governors was to deſtroy all their enemies; who, however, were not very numerous, ſo that little blood was ſhed. They next ſent ambaſſadors to Agis to ſue for peace; but he, taking for granted that the Athenians would never defend an oligarchy, gave no anſwer to the ambaſſadors, but immediately marched towards the capital with a deſign to attack it. On his arrival, however, he was quickly convinced of his miſtake, being repulſed with loſs, and obliged to retire to his old poſt.

154
The army declare for democracy, and recall Alcibiades.

In the mean time the Athenian army declared again for a democracy, and having recalled Alcibiades, inveſted him with full power, and inſiſted on his immediate return to Athens to reſtore the ancient government. This meaſure he refuſed to comply with, and perſuaded them to ſtay where they were, in order to ſave Ionia: he alſo prevailed on them to allow ſome deputies, who had been ſent from the new governors of Athens, to come and deliver their meſſage. To theſe deputies Alcibiades replied, that they ſhould immediately return to Athens, and acquaint the 400, that they were commanded immediately to reſign their power and reſtore the ſenate; but that the 5000 might retain theirs, provided they uſed it with moderation.

155
Great confuſion at Athens.

By this anſwer the city was thrown into the utmoſt confuſion; but the new government party prevailing, ambaſſadors were diſpatched to Sparta with orders to procure peace on any terms. This, however, was not to be effected; and Phrynicus, the head of the embaſſy, and likewiſe of the new government party, was murdered on his return. After his death, Theramenes the head of the other party, ſeized the chiefs of the 400; upon which a tumult enſued that had almoſt proved fatal to the city itſelf. The mob, however, being at laſt diſperſed, the 400 aſſembled, though in great fear, and ſent deputies to the people, promiſing to ſet all things to rights. In conſequence of this deputation, a day was appointed for convoking a general aſſembly, and ſettling the ſtate; but when that day came, news was brought that the Lacedemonian fleet appeared in view, and ſteered directly for Salamis. Thus all was again thrown into confuſion; for the people, inſtead of deliberating on the ſubject propoſed, ran in crowds down to the port, and perceiving the Spartans made towards Eubœa, a fleet of 36 ſhips was immediately diſpatched under the command of Thymochares, to engage the enemy. This fleet was utterly defeated, 22 of the Athenian ſhips being taken, and moſt of the others ſunk or diſabled; but what was worſe, this defeat was followed by the revolt of all the country of Eubœa except Orcus.

156
Athenian fleet deſtroyed by the Spartans.

When theſe diſmal tidings arrived at Athens, every thing was given up for loſt; and had the Lacedemonians taken this opportunity of attacking the city, they had undoubtedly ſucceeded, and thus put an end to the war: but being at all times ſlow, eſpecially in naval affairs, they gave the Athenians time to equip a new fleet, and to retrieve their affairs. One good effect of this diſaſter, however, was the putting an end for a time to the internal diſſenſions of this turbulent people; inſomuch that Thucydides the hiſtorian is of opinion, that the republic never enjoyed ſo much quiet as at this time.

157
Exploits of Alcibiades.

Alcibiades now ſhowed his abilities and inclination to ſerve his country in an eminent manner. By his intrigues he ſo effectually embroiled the Perſians and Peloponneſians with each other, that neither party knew whom to truſt. Thraſybulus, with 55 ſhips, gained a victory over the Peloponneſian fleet conſiſting of 73: after which he took 8 galleys coming from Byzantium; which city had revolted from the Athenians, but was ſoon after taken, and the inhabitants ſeverely fined. The fleet being afterwards joined by Alcibiades, nine more of the Peloponneſian galleys were taken, the Halicarnaſſians were conſtrained to pay a large ſum of money, and Cos was ſtrongly fortified; which tranſactions ended the 21ſt year of the Peloponneſian war.

In the ſucceeding years of this famous war, the Athenians had at firſt great advantages. Thraſybulus gained a ſignal victory at ſea; and Alcibiades gained two victories, one by ſea and another by land, in one day, took the whole Peloponneſian fleet, and more ſpoil than his men could carry away. The Spartans were now humbled in their turn, and ſued for peace; but the Athenians were ſo intoxicated with their ſucceſs, that they ſent back the ambaſſadors without an anſwer; which they ſoon had ſufficient reaſon to repent of. The beginning of the Athenians misfortunes was the taking of Pylus by the Spartans. The Athenians had ſent a fleet under the command of one Anytus to its defence: but he was driven back by contrary winds; upon which he was condemned to death, becauſe he could not cauſe the wind blow from what quarter he pleaſed: this ſentence, however, was remitted on his paying a vaſt ſum of money. This miſfortune was quickly followed by another. The Megarians ſurpriſed Niſæa; which enraged the Athenians ſo much, that they immediately ſent an army into that country, who defeated the Megarians who oppoſed them, with great ſlaughter, and committed horrid devaſtations.

158
The Spartans ſue for peace.

159
They take Pylus.

Theſe misfortunes as yet, however, were overbalanced by the great actions of Alcibiades, Thraſybulus, and

160 Alcibiades enters Athens in triumph.

161 He is diſgraced.

and Theramenes. When Alcibiades returned, he brought with him a fleet of 200 ſhips, and ſuch a load of ſpoils as had never been ſeen in Athens ſince the concluſion of the Perſian war. The people left their city deſtitute, that they might crowd to the port, to behold Alcibiades as he landed; old and young bleſſed him as he paſſed; and the next day when he made a harangue to the aſſembly, they directed the record of his baniſhment to be thrown into the ſea, abſolved him from the curſes he lay under, and created him general with full power. Nor did he ſeem inclined to indulge himſelf in eaſe, but ſoon put to ſea again with a fleet of 100 ſhips. He had not been long gone, however, before all this was forgot. Alcibiades ſailed to the Helleſpont with part of his fleet, leaving the reſt under the command of Antiochus his pilot, but with ſtrict orders to attempt nothing before his return. This command the pilot paid no regard to, but provoked Lyſander the Lacedemonian admiral to an engagement, and in conſequence of his temerity was defeated with the loſs of 15 ſhips, himſelf being killed in the engagement. On the news of this defeat Alcibiades returned, and endeavoured to provoke the Lacedemonians to a ſecond battle: but this Lyſander prudently declined; and in the mean time the Athenians, with unparalleled ingratitude and inconſtancy, deprived Alcibiades of his command, naming ten new generals in his room.

162 The Athenians gain a great victory and put ſix of their generals to death.

This was the laſt ſtep the Athenians had to take for perfecting their ruin. Conon, who ſucceeded to the command, was defeated by Callicratidas Lyſander's ſucceſſor; but being afterwards ſtrongly reinforced, the Lacedemonians were entirely defeated with the loſs of 77 ſhips. Such a victory might at this time have inſpired the Athenians with ſome kind of gratitude towards the generals who gained it: but inſtead of this, on pretence of their not having aſſiſted the wounded during the engagement, eight of them were recalled; two were wiſe enough not to return; and the ſix who truſted to the juſtice of their country were all put to death.

163 They are utterly defeated by Lyſander;

The next year Lyſander was appointed commander of what fleet the Peloponneſians had left, with which he took Thaſus and Lampſacus. Conon was diſpatched againſt him with 180 ſhips, which being greatly ſuperior to Lyſander's fleet, that general refuſed to come to an engagement, and was blocked up in the river Ægos. While the Athenians lay there, they grew quite idle and careleſs; inſomuch that Alcibiades, who had built a caſtle for himſelf in the neighbourhood, intreated them to be more on their guard, as he well knew Lyſander's abilities. They anſwered, that they wondered at his aſſurance, who was an exile and a vagabond, to come and give laws to them; telling him, that if he gave them any farther trouble, they would ſeize and ſend him to Athens. At the ſame time they looked on victory as ſo certain, that they conſulted what they ſhould do with their priſoners; which, by the advice of Philocles their general, was, to cut off all their right hands, or according to Plutarch, their right thumbs; and Adiamantus one of their officers rendered himſelf very obnoxious by ſaying, that ſuch idle diſcourſe did not become Athenians. The conſequences of ſuch conduct may be eaſily imagined. Lyſander fell unexpectedly upon them, and gained a moſt complete victory; Conon, with eight galleys only, eſcaping to Cyprus; after which Lyſander returned to Lampſacus, where he put to death Philocles with 3000 of his ſoldiers, and all the officers except Adiamantus. This execution being over, he reduced all the cities ſubject to Athens; and with great civility ſent home their garriſons, that ſo the city might be overſtocked with inhabitants, and deſtitute of proviſions, when he came to beſiege it; which he did ſoon after by ſea, while Agis with a great army inveſted it by land.

164 Who takes Athens.

165 Terms of peace.

For a long time the Athenians did not ſo much as deſire a peace; but at laſt were forced to ſend deputies to Agis, who ſent them to Sparta, where no terms could be granted except they conſented to demoliſh their walls. They next ſent to Lyſander, who after a long attendance referred them to Sparta; and thither Theramenes with ſome other deputies was immediately ſent. On their arrival, they found the council of the confederates ſitting, who all except the Spartans gave their votes that Athens ſhould be utterly deſtroyed; but they would not conſent to the ruin of that city, which had deſerved ſo well of Greece. On the return of Theramenes, peace was concluded, on condition, that the long walls and the fortifications of the port ſhould be demoliſhed; that they ſhould give up all their ſhips but 12, receive all they had baniſhed, and follow the fortune of the Lacedemonians. Theſe ſevere terms were punctually executed. Lyſander cauſed the walls to be pulled down; all the muſic in his army playing, on that very day of the year on which they had beat the Perſians at Salamine. He likewiſe eſtabliſhed an oligarchy expreſsly againſt the will of the people; and thus the ruin of Athens ended the 27th year of the Peloponneſian war, and the 404th before Chriſt.

166 The thirty tyrants.

As ſoon as Lyſander had demoliſhed the long walls, and the fortifications of the Piræum, he conſtituted a council of thirty, with power, as was pretended, to make laws, but in truth to ſubjugate the ſtate. Theſe are the perſons ſo famous in hiſtory, under the title of *the thirty tyrants.* They were all the creatures of Lyſander; who, as they derived their riſe from conqueſt and the law of the ſword, exerciſed their offices in a ſuitable manner; that is, with the higheſt teſtimonies of pride, inſolence, and cruelty. Inſtead of making laws, they governed without them; appointed a ſenate and magiſtrates at their will; and, that they might do all things without danger of controul, they ſent for a garriſon from Lacedemon; which was accordingly granted them, under the command of Callidius, upon their promiſe to pay the ſoldiers regularly. One of the firſt ſteps they took was to puniſh all informers; which, though ſevere, was popular: but when, through flattery and bribes, they had wholly drawn over Callidius to their party, they ſuffered bad men to live in quiet, and turned their rage againſt the good.

167 Critias and Theramenes, their oppoſite characters.

Critias and Theramenes were at the head of the thirty, men of the greateſt power and abilities in Athens. The former was ambitious and cruel without meaſure; the latter was ſomewhat more merciful: the former puſhed on all the bloody ſchemes framed by his confederates, and carried into execution many of his own; the latter always oppoſed them, at firſt with moderation, at laſt with vehemence. He ſaid, that power was given them to rule, and not to ſpoil, the commonwealth; that it became them to act like ſhepherds, not like wolves; and that they ought to beware of rendering themſelves at once odious and ridiculous, by attempting to domineer over all, being ſuch a handful of men as they were. The reſt, diſliking much the former part of his diſcourſe, catched hold of the latter, and immediately choſe out 3000, whom they made the repreſentatives of the people, and to whom they granted this notable privilege, that none of them ſhould be put to death but by the judgment of the ſenate, thereby openly aſſuming a power of putting any other of the Athenian citizens to death by their own authority. A glorious uſe they made of this new-aſſumed privilege; for as many as they conjectured to be no friends to the government in general, or to any of themſelves in particular, they put to death, without cauſe, and without mercy. Theramenes openly oppoſing this, and abſolutely refuſing to concur in ſuch meaſures, Critias accuſed him to the ſenate as a man of unſteady principles, ſometimes for the people, ſometimes againſt them, always for new things and ſtate-revolutions. Theramenes owned, that he had ſometimes changed his meaſures, but alledged that he had always done it to ſerve the people. He ſaid that it was ſolely with this view he made the peace with Sparta, and accepted the office of one of the thirty: that he had never oppoſed their meaſures while they cut off the wicked; but when they began to deſtroy men of fortune and family, then he owned he had differed with them, which he conceived to be no crime againſt the ſtate.

168
Theramenes put to death.

While Theramenes was ſpeaking, Critias withdrew, perceiving that the ſenate were thoroughly convinced of the truth of what Theramenes had ſaid: but he quickly returned with a guard, crying out, that he had ſtruck Theramenes's name out of the liſt of the 3000; that the ſenate had therefore no longer cognizance of the cauſe, which the thirty had already judged, and condemned him to death. Theramenes perceiving that they intended to ſeize him, fled to the altar, which was in the midſt of the ſenate-houſe, and laying his hands thereon, ſaid, "I do not ſeek refuge here becauſe I expect to eſcape death or deſire it; but that, tearing me from the altar, the impious authors of my murder may intereſt the gods in bringing them to ſpeedy judgment, and thereby reſtore freedom to my country." The guards then dragged him from the altar, and carried him to the place of execution, where he drank the poiſon with undaunted courage, putting the people in mind with his laſt breath, that as they had ſtruck his name out of the 3000, they might alſo ſtrike out any of theirs. His death was followed by a train of murders, ſo that in a ſhort time 60 of the worthieſt and moſt eminent citizens of Athens fell by the cruelty of the thirty. Amongſt theſe, the moſt pitied was Niceratus the ſon of Nicias; a man univerſally beloved for his goodneſs, and univerſally admired for his virtues. As for the Spartans, they, loſing their former generoſity, were extremely pleaſed with theſe things, and by a public decree commanded that ſuch as fled from the thirty tyrants ſhould be carried back bound to Athens: which extraordinary proceeding frightened all Greece; but the Argives and Thebans only had courage to oppoſe it: the former received the Athenian exiles with humanity and kindneſs; the latter puniſhed with a mulct ſuch of their citizens as did not riſe and reſcue the Athenian priſoners, who in purſuance of the Lacedemonian decree were carried bound through their territories.

169
Thraſybulus ſeizes Phyla.

170
Critias killed.

Thraſybulus, and ſuch as with him had taken ſhelter in the Theban territory, reſolved to hazard every thing, rather than remain perpetual exiles from their country; and though he had but 30 men, on whom he could depend, yet conſidering the victories he had heretofore obtained in the cauſe of his country he made an irruption into Attica, where he ſeized Phyla, a caſtle at a very ſmall diſtance from Athens, where in a very ſhort ſpace his forces were augmented to 700 men; and though the tyrants made uſe of the Spartan garriſon in their endeavours to reduce him and his party, yet Thraſybulus prevailed in various ſkirmiſhes, and at laſt obliged them to break up the blockade of Phyla, which they had formed. The thirty and their party conceiving it very advantageous for them to have the poſſeſſion of Eleuſina, marched thither, and having perſuaded the people to go unarmed out of their city, that they might number them, took this opportunity moſt inhumanly to murder them. The forces of Thraſybulus increaſing daily, he at length poſſeſſed himſelf of the Piræum, which he fortified in the beſt manner he could; but the tyrants being determined to drive him from thence, came down againſt him with the utmoſt force they could raiſe. Thraſybulus defended himſelf with great obſtinacy; and in the end they were forced to retreat, having loſt before the place not only a great number of their men, but Critias the preſident of the thirty, another of the ſame body, and one who had been a captain of the Piræum.

171
The tyrants expelled.

172
Attempt of the Spartans to reduce Athens a ſecond time.

When they came to demand the dead from Thraſybulus, in order for their interment, he cauſed a crier he had with him to make a ſhort ſpeech in a very loud voice to the people, intreating them to conſider, that as they were citizens of Athens without, ſo thoſe againſt whom they fought, and thoſe who fought to preſerve themſelves within the fort, were Athenian citizens alſo; wherefore, inſtead of thinking how to ruin and deſtroy their brethren, they ought rather to conſult how all differences ought to be compoſed, and eſpecially ought to rid themſelves of thoſe bloody tyrants, who, in the ſhort time they had had the adminiſtration in their hands, had deſtroyed more than had fallen in the Peloponneſian war. The people, though moved by theſe diſcourſes, differed among themſelves; the conſequence of which was, that they expelled the thirty, and choſe ten men out of each tribe to govern in their ſtead, whereupon the tyrants retired to Eleuſina. The citizens, however, though they changed the government, made no agreement with thoſe in the Piræum; but ſent away deputies to Sparta, as did alſo the tyrants from Eleuſina, complaining, that the Athenians had revolted, and deſiring their aſſiſtance to reduce them. The Spartans ſent thereupon a large ſum of money to encourage their confederates, and appointed Lyſander commander in chief, and his brother to be admiral; reſolving to ſend ſea and land forces to reduce Athens a ſecond time; intending, as moſt of the Greek ſtates ſuſpected, to add it now to their own dominions. It is very probable that this deſign of theirs would have taken effect, if Pauſanias king of Sparta, envying Lyſander, had not reſolved to obſtruct it. With this view, he procured another army to be raiſed againſt the Athenians,

nians, of which himſelf had the command, and with which he marched immediately to beſiege the Piræum. While he lay before the place, and pretended to attack it, he entered into a private correſpondence with Thraſybulus, informing him what propoſitions he ſhould make in order to force the Lacedemonians, who were ſuſpected by their allies, to grant them peace.

173 How fruſtrated.

The intrigues of Pauſanias had all the ſucceſs he could wiſh. The Ephori who were with him in the camp concurred in his meaſures, ſo that in a ſhort ſpace a treaty was concluded on the following terms: That all the citizens of Athens ſhould be reſtored to their houſes and privileges, excepting the thirty, the ten which had ſucceeded them and who had acted no leſs tyrannically than they, and the eleven who during the time of the oligarchy had been conſtituted governors or keepers of the Piræum; that all ſhould remain quiet for the future in the city; and that if any were afraid to truſt to this agreement, they ſhould have free leave to retire to Eleuſina. Pauſanias then marched away with the Spartan army, and Thraſybulus at the head of his forces marched into Athens, where, having laid down their arms, they ſacrificed with the reſt of the citizens in the temple of Minerva, after which the popular government was reſtored. Yet quiet was not thoroughly eſtabliſhed. The exiles at Eleuſina having endeavoured by the help of money to raiſe an army of foreigners, by whoſe aid they might recover the authority they had loſt: but firſt depending on their friends in the city, they ſent ſome of the principal perſons amongſt them as deputies, to treat with the citizens; but ſtrictly inſtructed them to ſow jealouſies and excite diſcords among them. This the latter quickly perceiving, put theſe perſons to death; and then remonſtrating to thoſe at Eleuſina, that theſe contentions would undoubtedly end either in their own or the deſtruction of their country, they offered immediately to paſs an act of oblivion, which they would confirm with an oath.

174 Virtue of Thraſybulus.

This being accepted, thoſe who had withdrawn returned to the city, where all differences were adjuſted, and both parties moſt religiouſly obſerved the agreement they had made, and thereby thoroughly reſettled the ſtate. In this whole tranſaction, the virtue of Thraſybulus deſerves chiefly to be admired. When he firſt ſeized the caſtle of Phyla, the tyrants privately offered to receive him into their number inſtead of Theramenes, and to pardon at his requeſt any 12 perſons he ſhould name: but he generouſly anſwered, That his exile was far more honourable than any authority could be, purchaſed on ſuch terms; and by perſiſting in his deſign, accompliſhed, as we have ſeen, the deliverance of his country. A glorious deliverance it was; ſince, as Iſocrates informs us, they had put 1400 citizens to death contrary to and without any form of law, and driven 5000 more into baniſhment; procuring alſo the death of Alcibiades, as many think, tho' at a great diſtance from them.

From this time to the reign of Philip of Macedon, the Athenians continued in a pretty proſperous ſituation, though they never performed any ſuch great exploits as formerly. By that monarch and his ſon Alexander all Greece was in effect ſubdued; and the hiſtory of all the Grecian ſtates from that time becomes much leſs intereſting. Of the hiſtory of Athens from that time to the preſent, the following elegant abridgment is given by Dr Chandler†. "On the death of Alexander, the Athenians revolted, but were defeated by Antipater, who gariſoned Munychia. They rebelled again, but the garriſon and oligarchy were reinſtated. Demetrius the Phalerean, who was made governor, beautified the city, and they erected to him 360 ſtatues; which on his expulſion they demoliſhed, except one in the Acropolis. Demetrius Poliorcetes withdrew the garriſon, and reſtored the democracy; when they deified him, and lodged him in the Opiſthodomos or the back part of the Parthenon, as a gueſt to be entertained by their goddeſs Minerva. Afterwards they decreed, that the Piræus, with Munychia, ſhould be at his diſpoſal; and he took the Muſeum. They expelled his garriſon, and he was perſuaded by Craterus a philoſopher to leave them free. Antigonus Gonatas, the next king, maintained a garriſon in Athens: but, on the death of his ſon Demetrius, the people, with the aſſiſtance of Aratus, regained their liberty; and the Piræus, Munychia, Salamis, and Sunium, on paying a ſum of money.

175 Hiſtory of Athens from the time of Alexander the Great to the preſent.

"Philip, ſon of Demetrius, encamping near the city, deſtroying and burning the ſepulchres and temples in the villages, and laying their territory waſte, the Athenians were reduced to ſolicit protection from the Romans and to receive a garriſon, which remained until the war with Mithridates king of Pontus, when the tyrant Ariſtion made them revolt.

176 Athens beſieged and taken by Sylla.

"Archelaus the Athenian general, unable to withſtand the Roman fury, relinquiſhed the *long walls*, and retreated into the Piræus and Munychia. Sylla laid ſiege to the Piræus and to the city, in which Ariſtion commanded. He was informed that ſome perſons had been overheard talking in the Ceramicus, and blaming Ariſtion for his neglect of the avenues about the Heptachalcos, where the wall was acceſſible. Sylla reſolved to ſtorm there, and about midnight entered the town at the gate called *Dypylon* or *the Piræan*; having levelled all obſtacles in the way between it and the gate of the Piræus. Ariſtion fled to the Acropolis, but was compelled to ſurrender by the want of water; when he was dragged from the temple of Minerva, and put to death. Sylla burned the Piræus and Munychia, and defaced the city and ſuburbs not ſparing even the ſepulchres."

The civil war between Cæſar and Pompey ſoon followed, and their natural love of liberty made them ſide with Pompey. Here again they were unfortunate, for Cæſar conquered. But Cæſar did not treat them like Sylla, with that clemency which made ſo amiable a part of his character, he dimiſſed them by a fine alluſion to their illuſtrious anceſtors, ſaying, that he ſpared the living for the ſake of the dead.

Another ſtorm followed ſoon after this; the wars of Brutus and Caſſius with Auguſtus and Antony. Their partiality for liberty did not here forſake them: they took part in the conteſt with the two patriot Romans, and erected there ſtatues near their own ancient deliverers Harmodious and Ariſtogiton, who had ſlain Hipparchus. But they were ſtill unhappy, for their enemies triumphed.

"They next joined Antony, who gave them Ægina and Cea, with other iſlands. Auguſtus was unkind to them; and they revolted four years before he died. Under Tiberius the city was declining, but free, and regarded as an ally of the Romans. The high privilege of having a lictor to precede the magiſtrates was conferred on it by Germanicus; but he was cenſured as treating with too much condeſcenſion a mixture of nations inſtead of genuine Athenians, which race was then conſidered as extinct.

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† *Travels in Greece*, p. 28, &c.

“ The emperor Veſpaſian reduced Achaia to a province paying tribute and governed by a proconſul. Nerva was more propitious to the Athenians; and Pliny, under Trajan his ſucceſſor, exhorts Maximus to be mindful whether he was ſent, to rule genuine Greece, a ſtate compoſed of free cities. ‘ You will revere the gods and heroes their founders. You will reſpect their priſtine glory, and even their age. You will honour them for the famous deeds, which are truly, nay for thoſe which are fabulouſly recorded of them. Remember, it is Athens you approach.’ This city was now entirely dependent on Rome, and was reduced to ſell Delos and the iſlands in its poſſeſſion.

“ Hadrian, who was at once emperor and an archon of Athens, gave the city laws, compiled from Draco, Solon, and the codes of other legiſlators; and diſplayed his affection for it by unbounded liberality. Athens reflouriſhed, and its beauty was renewed. Antoninus Pius who ſucceeded, and Antoninus the Philoſopher, were both benefactors.

The barbarians of the north, in the reign of Valerian, beſieging Theſſalonica, all Greece was terrified, and the Athenians reſtored their city-wall, which had been diſmantled by Sylla, and afterwards neglected.

“ Under the next emperor, who was the archon Gallienus, Athens was beſieged, the archontic office ceaſed; and the Strategus or general, who had before acted as overſeer of the agora or market, then became the ſupreme magiſtrate. Under Claudius his ſucceſſor, the city was taken, but ſoon recovered.

“ It is related, that Conſtantine, when emperor, gloried in the title of *general of Athens*; and rejoiced exceedingly on obtaining from the people the honour of a ſtatue with an inſcription, which he acknowledged by a yearly gratuity of many buſhels of grain. He conferred on the governor of Attica and Athens the title of *grand duke* μεγας δουξ. That office was at firſt annual, but afterwards hereditary. His ſon Conſtans beſtowed ſeveral iſlands on the city, to ſupply it with corn.

“ In the time of Theodoſius the Firſt, 380 years after Chriſt, the Goths laid waſte Theſſaly and Epirus; but Theodore, general of the Achæans, by his prudent conduct preſerved the cities of Greece from pillage, and the inhabitants from being led into captivity. A ſtatue of marble was erected to him at Athens by order of the city; and afterwards one of braſs, by command of the emperor, as appears from an inſcription in a church dedicated to a ſaint of the ſame name, not far from the French convent. It is on a round pedeſtal, which ſupports a flat ſtone ſerving for the holy table. Eudocia the wife of Theodoſius the ſecond was an Athenian.

177
By Alaric the Goth.

“ The fatal period now approached, and Athens was about to experience a conqueror more ſavage even than Sylla. This was Alaric king of the Goths; who under the emperors Arcadius and Honorius, over-ran Greece and Italy, ſacking, pillaging, and deſtroying. Then the Peloponneſian towns were overturned, Arcadia and Lacedemon were laid waſte, the two ſeas by the Iſthmus were burniſhed with the flames of Corinth, and the Athenian matrons were dragged in chains by barbarians. The invaluable treaſures of antiquity, it is related, were removed; the ſtately and magnificent ſtructures converted into piles of ruin; and Athens was ſtripped of every thing ſplendid or remarkable. Syneſius a writer of that age, compares the city to a victim, of which the body had been conſumed, and the hide only remained.

“ After this event, Athens became an unimportant place, and as obſcure as it once had been famous. We read that the cities of Hellas were put into a ſtate of defence by Juſtinian, who repaired the walls, which at Corinth had been ſubverted by an earthquake, and at Athens and in Bœotia were impaired by age: and here we take a long farewel of this city. A chaſm of near 700 years enſues in its hiſtory, except that, about the year 1130, it furniſhed Roger the firſt king of Sicily with a number of artificers, whom he ſettled at Palermo, where they introduced the culture of ſilk, which then paſſed into Italy. The worms had been brought from India into Conſtantinople in the reign of Juſtinian.

“ Athens as it were, re-emerges from oblivion in the 13th century, under Baldwin, but beſieged by a general of Theodorus Laſcaris, the Greek emperor. It was taken in 1427 by Sultan Morat. Boniface, marquis of Montſerrat, poſſeſſed it with a garriſon; after whom it was governed by Delves, of the houſe of Arragon. On his death, it was ſeized, with Macedonia, Theſſaly, Bœotia, Phocis, and the Peloponneſus, by Bajazet; and then, with the iſland Zante, by the Spaniards of Catalonia in the reign of the Greek emperor Andronicus Palæologus the elder. Theſe were diſpoſſeſſed by Reinerius Acciaioli, a Florentine; who, leaving no legitimate male iſſue, bequeathed it to the ſtate of Venice. His natural ſon, Antony, to whom he had given Thebes with Bœotia, expelled the Venetians. He was ſucceeded in the dukedom by his kinſman Nerius, who was diſplaced by his own brother named *Antony*, but recovered the government when he died. Nerius leaving only an infant ſon, was ſucceeded by his wife. She was ejected by Mahomet on a complaint from Francus ſon of the ſecond Antony, who confined her at Megara and made away with her; but her ſon accuſing him to Mahomet the Second, the Turkiſh army under Omar advanced, and he ſurrendered the citadel in 1455; the Latins refuſing to ſuccour him unleſs the Athenians would embrace their religious tenets. Mahomet, it is related, when he had finiſhed the war with the deſpot of the Morea, four years after, ſurveyed the city and Acropolis with admiration. The janizaries informed him of a conſpiracy; and Francus Acciaioli, who remained lord of Bœotia, was put to death. In 1464 the Venetians landed at the Piræus, ſurpriſed the city, and carried off their plunder and captives to Eubœa.

178
By the Turks.

“ It is remarkable, that after theſe events Athens was again in a manner forgotten. So lately as about the middle of the 16th century, the city was commonly believed to have been utterly deſtroyed, and not to exiſt, except a few huts of poor fiſhermen. Cruſius, a learned and inquiſitive German, procured more authentic information from his Greek correſpondents reſiding in Turky, which he publiſhed in 1584, to awaken curioſity and to promote farther diſcoveries. One of theſe letters is from a native of Nauplia, a town near Argos in the Morea. This writer ſays, that he had been often at Athens, and that it ſtill contained many things worthy to be ſeen, ſome of which he enumerates, and then ſubjoins: "But why do I dwell on this place? It is as the ſkin of an animal that has been long dead."

It now remains to give ſome idea of the character, government, and religion of this once ſo famous people.

179 Character of the ancient Athenians.

The Athenians, ſays Plutarch, are very ſubject to violent anger; but they are ſoon pacified. They are likewiſe eaſily impreſſed with humanity and compaſſion. That this was their temper, is proved by many hiſtorical examples. We ſhall produce a few. The ſentence of death pronounced againſt the inhabitants of Mitylene, and revoked the next day: The condemnation of Socrates, and that of the ten chiefs, each followed by quick repentance and moſt pungent grief.

The minds of the ſame people adds Plutarch, are not formed for laborious reſearches. They ſeize a ſubject, as it were by intuition; they have not patience and phlegm enough to examine it gradually and minutely. This part of their character may ſeem ſurpriſing and incredible. Artiſans, and and other people of their rank, are in general ſlow of comprehenſion. But the Athenians of every degree were endowed with an inconceivable vivacity, penetration, and delicacy of taſte. Even the Athenian ſoldiers could repeat the fine paſſages of the tragedies of Euripides. Thoſe artiſans and thoſe ſoldiers aſſiſted at public debates, were bred to political affairs, and were equally acute in apprehenſion and in judgment. We may infer the underſtanding of the hearers of Demoſthenes from the genius of his orations, which were laconic and poignant.

As their inclination, continues Plutarch, leads them to aſſiſt and ſupport people of low condition, they like diſcourſe ſeaſoned with pleaſantry, and productive of mirth. The Athenians patronize people of low degree; becauſe from them their liberty is in no danger, and becauſe ſuch patronage tends to ſupport a democratical conſtitution. They love pleaſantry; which turn of mind proves that they are a humane ſocial people, who have a taſte for raillery and wit, and are not ſoured with that reſerve which marks the deſpot or the ſlave.

They take pleaſure in hearing themſelves praiſed; but they can likewiſe patiently bear raillery and cenſure. We know with what art and ſucceſs Ariſtophanes and Demoſthenes applied their praiſe and their irony to the Athenian people. When the republic enjoyed peace, ſays the ſame Plutarch in another place, it encouraged the adulation of its orators: but when it had important affairs to diſcuſs, when the ſtate was in danger, it became ſerious; and preferred, to its eloquent ſycophants, the honeſt orators who oppoſed its follies and its vices: ſuch ingenious and bold patriots as a Pericles, a Phocion, and a Demoſthenes.

The Athenians, continues Plutarch, often make their governors tremble, and ſhow great humanity to their enemies. They were very attentive to the information and inſtruction of thoſe citizens who were moſt eminent for their policy and eloquence; but they were on their guard againſt the ſuperiority of their talents; they often checked their boldneſs, and repreſſed their exuberant reputation and glory. That this was their temper, we are convinced by the oſtraciſm; which was eſtabliſhed to reſtrain the ambition of thoſe who had great talents and influence, and which ſpared neither the greateſt nor the beſt men. The deteſtation of tyranny and tyrants, which was inherent in the Athenians, rendered them extremely jealous of their privileges, made them zealous and active in defence of their liberty, whenever they thought it was violated by men in power.

As to their enemies, they did not treat them with rigour. They did not abuſe victory by a brutal inhumanity to the vanquiſhed. The act of amneſty, which they paſſed after the uſurpation of the 30 tyrants, proves that they could eaſily forgive injuries. It was this mildneſs, this humanity of diſpoſition, which made the Athenians ſo attentive to the rules of politeneſs and decorum. In their war with Philip, having ſeized one of his couriers, they read all the letters he bore, except one from Olympias to her huſband, which they ſent back unopened. Such was their veneration of love and conjugal ſecrecy; thoſe ſacred rights, which no enmity, no hoſtility, warrants us to violate!

The views of conqueſt cheriſhed by a ſmall republic, were extenſive and aſtoniſhing; but this people, ſo great ſo ambitious in their projects, were, in other reſpects, of a different character. In the expences of the table, in dreſs, in furniture, in houſes, in ſhort, in private life, they were frugal, ſimple, modeſt, poor; but ſumptuous and magnificent whenever the honour of the ſtate was concerned. Their conqueſts, their victories, their riches, their connections with the inhabitants of Aſia Minor, never reduced them to luxury, to riot, to pomp, to profuſion. Xenophon remarks, that a citizen was not diſtinguiſhed from a ſlave by his dreſs. The wealthieſt citizen, the moſt renowned general, was not aſhamed to go himſelf to market.

The taſte of the Athenians, for all the arts and ſciences, is well known. When they had delivered themſelves from the tyranny of Piſiſtratus, and after this had defeated the vaſt efforts of the Perſians, they may be conſidered as at the ſummit of their national glory. For more than half a century afterwards they maintained, without controul, the ſovereignty of Greece; and that aſcendant produced a ſecurity, which left their minds at eaſe, and gave them leiſure to cultivate every thing liberal or elegant. It was then that Pericles adorned the city with temples, theatres, and other beautiful public buildings. Phidias, the great ſculptor, was employed as his architect, who, when he had erected edifices, adorned them himſelf; and added ſtatues and baſſo-relievo's, the admiration of every beholder. It was then that Polignotus and Myro painted; that Sophocles and Euripides wrote; and not long after, that they ſaw the divine Socrates.

Human affairs are, by nature, prone to change; and ſtates, as well as individuals, are born to decay. Jealouſy and ambition inſenſibly fomented wars, and ſucceſs in theſe wars, as in others, was often various. The military ſtrength of the Athenians was firſt impaired by the Lacedemonians; after that, it was again humiliated, under Epaminondas, by the Thebans: and laſt of all it was wholly cruſhed by the Macedonian, Philip.

Nor, when their political ſovereignty was loſt, did their love of literature and arts ſink along with it. Juſt at the cloſe of their golden days of empire flouriſhed Xenophon and Plato, the diſciples of Socrates, and from Plato deſcended that race of philoſophers called the *Old Academy*. Ariſtotle, who was Plato's diſciple, may be ſaid, not to have invented a new philoſophy, but rather to have tempered the ſublime and rapturous myſteries of his maſter with method, order, and a ſtricter mode of reaſoning. Zeno, who was himſelf alſo educated in the principles of Platoniſm, only differed from Plato in the comparative eſtimate of things, allowing nothing to be intrinſically good but virtue, nothing intrinſically bad but vice, and conſidering all other things to be in themſelves indifferent. He too and Ariſtotle accurately cultivated logic, but in different ways; for Ariſtotle chiefly dwelt upon the ſimple ſyllogiſm; Zeno upon that which is derived out of it, the compound or hypothetic. Both too, as well as other philoſophers, cultivated rhetoric along with logic; holding a knowledge in both to be requiſite for thoſe who think of addreſſing mankind with all the efficacy of perſuaſion. Zeno elegantly illuſtrated the force of theſe two powers by a ſimile, taken from the hand: the cloſe power of logic he compared to the fiſt, or hand compreſt: the diffuſe power of logic, to the palm, or hand open.

The new academy was founded by Arceſilas, and ably maintained by Carneades. From a miſtaken imitation of the great parent of philoſophy Socrates (particularly as he appears in the dialogues of Plato); becauſe Socrates doubted ſome things, therefore Arceſilas and Carneades doubted all.—Epicurus drew from another ſource; Democritus had taught him atoms and a void: by the fortuitous concourſe of atoms he fancied he could form a world; while by a feigned veneration he complimented away his gods, and totally denied their providential care, leſt the trouble of it ſhould impair their uninterrupted ſtate of bliſs. Virtue he recommended, though not for the ſake of virtue, but pleaſure: pleaſure, according to him, being our chief and ſovereign good. See ARISTOTLE, EPICURUS, PLATO, SOCRATES, &c.

We have already mentioned the alliance between philoſophy and rhetoric. This cannot be thought wonderful, if rhetoric be the art by which men are perſuaded, and if men cannot be perſuaded without a knowledge of human nature: for what but philoſophy can procure us this knowledge? It was for this reaſon the ableſt Greek philoſophers not only taught, but wrote alſo treatiſes upon rhetoric. They had a farther inducement, and that was the intrinſic beauty of their language as it was then ſpoken among the learned and polite. They would have been aſhamed to have delivered philoſophy, as it has been too often delivered ſince, in compoſitions as clumſy as the common dialect of the mere vulgar.

The ſame love of elegance, which made them attend to their ſtyle, made them attend even to the places where their philoſophy was taught. Plato delivered his lectures in a place ſhaded with groves, on the banks of the river Iliſſus; and which, as it once belonged to a perſon called *Academus*, was called after his name, the ACADEMY. Ariſtotle choſe another ſpot of a ſimilar character, where there were trees and ſhade; a ſpot called the LYCÆUM. Zeno taught in a portico or colonnade, diſtinguiſhed from other buildings of that ſort (of which the Athenians had many) by the name, the *Variegated Portico*, the walls being decorated with various paintings of Polygnotus and Myro, two capital maſters of that tranſcendent period. Epicurus addreſſed his hearers in thoſe well known gardens, called, after his own name, *The gardens of Epicurus*.

Theſe places of public inſtitution were called among the Greeks by the name of *Gymnaſia*; in which, whatever that word might have originally meant, were taught all thoſe exerciſes, and all thoſe arts, which tended to cultivate not only the body but the mind. As man was a being conſiſting of both, the Greeks could not conſider that education as complete, in which both were not regarded, and both properly formed. Hence their Gymnaſia, with reference to this double end, were adorned with two ſtatues, thoſe of Mercury and of Hercules, the corporeal accompliſhments being patroniſed (as they ſuppoſed) by the god of ſtrength, the mental accompliſhments by the god of ingenuity.

It was for the cultivation of every liberal accompliſhment that Athens was celebrated (as we have ſaid) during many centuries, long after her political influence was loſt and at an end.

She was the place of education, not only for Greeks but for Romans. It was hither that Horace was ſent by his father; it was here that Cicero put his ſon Marcus under Cratippus, one of the ableſt philoſophers then belonging to that city.—The ſects of philoſophers, which we have already deſcribed, were ſtill exiſting when St Paul came thither. We cannot enough admire the ſuperior eloquence of that apoſtle, in his manner of addreſſing ſo intelligent an audience. We cannot enough admire the ſublimity of his exordium; the propriety of his mentioning an altar which he had found there; and his quotation from Aratus, one of their well-known poets. Nor was Athens only celebrated for the reſidence of philoſophers, and the inſtitution of youth: men of rank and fortune found pleaſure in a retreat, which contributed ſo much to their liberal enjoyment.

We ſhall finiſh this picture of the Athenians by the addition of one object more, to which every one will admit they have a right; an object which was prominent and ſtriking, in all their actions and in all their enterprizes: we mean their ardent love of liberty. This was their predominant quality; the main ſpring of their government. From the beginning of the Perſian war they ſacrificed every thing to the liberty of Greece. They left, without heſitation, their cities, their houſes, to fight at ſea the common enemy, from whom they were in danger of ſervitude. What a glorious day was it for Athens, when all her allies, growing flexible to the advantageous offers which were made to them by the king of Perſia, ſhe replied by Ariſtides, to the ambaſſadors of that monarch,—"That it was impoſſible for all the gold in the world to tempt the republic of Athens: to prevail with her to ſell her liberty, and that of Greece." It was by theſe generous ſentiments that the Athenians not only became the bulwark of Greece, but likewiſe guarded the reſt of Europe from a Perſian invaſion.

Theſe great qualities were blended with great failings, ſeemingly incompatible with Patriotiſm. For the Athenians, notwithſtanding their tenacious jealouſy of the rights of their country, were a volatile, inconſtant capricious people.

180
Religion.

There never was a people more attentive to the worſhip of the gods than the Athenians. The worſhip of their principal deities was diffuſed over all Greece, and even beyond its limits.

Each temple had its particular religious rites: the pomp, the ceremonies, the duration, and the ſucceſſion of the ſolemn feaſts, were all appointed by fixed rules. The worſhip paid to each divinity, whether public or private, was founded on traditions, or on laws conſtantly obeyed. The feaſt of Bacchus, the Panathenæa, the feaſt of the myſteries of Eleuſis, were celebrated according to eſtabliſhed rules, moſt of which were as ancient as the feaſts themſelves. The old cuſtoms, of which the prieſts were the guardians, were obſerved in the temples. It is probable that the prieſts were conſulted on affairs in which the worſhip of a deity was intereſted, and that their anſwer was deciſive. We are certain that the Eumolpidæ had this authority. They were the interpreters of the ancient laws on which the worſhip of Ceres was founded, its magnificence, and its mode—laws which were not written, as Lyſias informs us, but were perpetuated by a conſtant obſervation. The abuſes which had gradually crept into the celebration of thoſe feaſts, had given riſe to ſeveral new regulations; to that of the orator Lycurgus, for example, and to the law of Solon, which enjoined the ſenate to repair to Eleuſis on the ſecond day of the feaſt; but neither theſe nor the other particular regulations which we find in Samuel Petit's collection of Attic laws, could make a religious code. There was no general ſyſtem which comprehended all the branches of their religion, which, by combining all its articles, might regulate their belief and conduct, and direct the judges in their deciſions.

181
Crimes againſt religion why ſometimes puniſhed with ſeverity.

Crimes againſt religion were only puniſhed as they affected the ſtate; and conſequently they were tried by the magiſtrate. Mere raillery, though ſomewhat profane, was thought productive of no worſe conſequence than offending the miniſters of the gods. The Athenians acknowledged no other religion than the hereditary public worſhip; no other gods than thoſe they had received from their anceſtors; no other ceremonies than thoſe which had been eſtabliſhed by the laws of the ſtate, and practiſed by their country from time immemorial. They were only ſolicitous to preſerve this worſhip, which was cloſely interwoven with their government, and made a part of its policy. They were likewiſe attentive to the ceremonial pomp; becauſe order, the regular vigour of legiſlation, depends greatly on the awe impreſſed by externals. But as to the inconſiſtent and monſtrous romance of fables, foreign opinions, popular traditions, and poetical fictions, which formed a religion quite different from that of the ſtate—in it they were very little intereſted, and allowed every one to think of it as he pleaſed.

This explanation will reconcile a ſeeming contradiction in the conduct of the Athenians, who gave great licence to their poets, and ſeverely puniſhed the citizens who were guilty of impiety. Ariſtophanes, who made as free with the gods as with the great, was applauded by the Athenians. They condemned Socrates to death, who revered the deity, but diſapproved the public manner of worſhipping him. The life of Æſchylus was in danger from a ſuſpicion that he had revealed ſome of the ſecrets of Eleuſis in one of his pieces. The wit of Ariſtophanes's drama was unpuniſhed.

182
Prieſts their duty.

The prieſts were not confined to the care of the altars; they who were veſted with the ſacerdotal dignity, which was only incompatible with profeſſions merely uſeful and lucrative, might likewiſe hold the moſt important offices of the commonwealth. This we could prove by a great number of examples; we ſhall cite that of Xenophon the illuſtrious hiſtorian and philoſopher: he was likewiſe a famous general, and he was a prieſt. He was performing the ſacerdotal function when he received the news of his ſon's death, who was killed at the battle of Mantinèa.

The ſacred miniſtry was not only compatible with civil offices, but likewiſe with the profeſſion of arms. The prieſt and the ſoldier were often blended. Callias, the prieſt of Ceres, fought at Platæa. This cuſtom was not peculiar to the Athenians. The Lacedemonians, after the battle which we have juſt mentioned, made three graves for their ſlain; one for the prieſts, one for the other Spartans, and one for the Helots.

183
Sacred revenues, &c.

As every mean employment was incompatible with the ſacerdotal dignity, the prieſts had a revenue fixed to their office. We know that a part of the victims was their right, and that apartments were aſſigned them near the temples. But, beſide theſe advantages, they had a ſalary proportioned to the dignity of their functions and to the rank of the deities whom they ſerved. Their ſalary was probably paid from the revenue of the temples. Thoſe revenues, which kept the temples in repair, and defrayed the ſacrificial expences, were very conſiderable. They were of many different kinds.

A great part of the ſacred revenues aroſe from fines, which individuals were condemned to pay for various offences; fines, of which the tenth part was appropriated to Minerva Polias, and the fiftieth to the other gods and to the heroes whoſe names their tribes bore. Beſides, if the Prytanes did not hold the aſſemblies conformably with the laws, they were obliged to pay a fine of 1000 drachms to the goddeſs. If the Proedri, *i. e.* the ſenators whoſe office it was to lay before the aſſembly the matters on which they were to deliberate, did not diſcharge that duty according to the rules preſcribed to them, they were likewiſe condemned to pay a fine, which, as the former, was applied to the uſe of Minerva. By theſe fines her temple muſt have been greatly enriched.

Beſides this revenue, which was the common property of the gods, and which varied according to the number and degrees of the miſdemeanors, the temples had their permanent revenues: We mean the produce of the lands which were conſecrated to the deities. We do not here allude to the lands conſecrated to the gods, which were never to be cultivated; ſuch as the territory of Cirrha, proſcribed by a ſolemn decree of the Amphictyons; the land betwixt Megara and Attica, which was conſecrated to the goddeſſes of Eleuſis, and many others. We would ſpeak only of thoſe which were cultivated, the fruits of which enriched the temples.

There were likewiſe lands belonging to the ſtate, the produce of which was deſtined to defray the expence of the ſacrifices which were offered in the name of the republic. There were likewiſe firſt-fruits which the public officers levied on all lands, for the uſe of the gods. All theſe emoluments made a part of the revenue of the temples.

The gods, beſides the revenues immediately appertaining to their temples, had certain rights which were granted them by particular compact. The Leprèatæ, for inſtance, were obliged to pay every year a talent to Olympian Jupiter, on account of a treaty of alliance which they made with the Elèans in one of their wars. The inhabitants of Epidaurus, to obtain leave from the Athenians to cut down olive-trees for ſtatues, which the Pythian prieſteſs had commanded them to make, engaged to ſend deputies every year to Athens, to offer ſacrifices in their name to Minerva and to Neptune. But this prerogative was rather honorary than lucrative.

The tenth part of the ſpoils taken in war was likewiſe the property of Minerva. Sacred veſſels were bought with the effects of the 30 tyrants. In ſhort, the gods were profited by almoſt every public accident. But what contributed moſt to enrich the famous temples of Greece, was the money which was conſtantly brought to them by individuals, in conſequence of vows they had made, or to pay for ſacrifices which were offered in their names. The credulity of the people was an inexhauſtible fund. That credulity enriched the temples of Deli and Eleuſis, and ſupported the magnificence of Delphi. And thoſe immenſe treaſures which were the fruit of ſuperſtition, were often a prey to avarice.

Theſe revenues were not depoſited with the prieſts; nor did they expend them. A moderate ſalary was all their gain; and to offer ſacrifices to the deities whoſe miniſters they were, was all their employment.

It is very probable that all the ſacred revenues were paid into the hands of officers who were appointed to receive them, and who were to give an account of the diſcharge of their truſt. Nay, we cannot doubt of this, after reading a paſſage in Ariſtotle, who, ſpeaking of the officers of the temples, expreſsly mentions thoſe who were entruſted with the money appertaining to the gods. Citizens, without doubt, of approved integrity, were choſen to this office; and their duty muſt have been, to keep the temples in repair and order, and to diſburſe and keep an account of the ordinary ſacred expences.

As to the ſolemn feaſts, which were incredibly magnificent, ſuch as the feaſt of Bacchus, and the Panathenæa, they were celebrated at the expence of the Chorègus; *i. e.* of the chief of the choir of each tribe: for each tribe had its poet and its muſicians, who ſung, emulating each other, hymns in honour of the deity. The richeſt citizens were appointed chiefs of the different choirs; and as their office was very expenſive, to indemnify them in ſome degree, the Chorègus of the victorious tribe had the privilege of engraving his name on the tripod which that tribe ſuſpended to the roof of the temple. This office, though ruinous, was eagerly ſolicited; and naturally, in a republican ſtate. It led to honours, like the Curule dignity at Rome; and it greatly tended to ingratiate its poſſeſſor with a people, who were more affected with pleaſures than with eſſential ſervices, and who, conſequently, would more highly eſteem a profuſe Chorègus than a victorious general.

With regard to the fines, which were in the whole, or in part, the property of Minerva and of the other deities, there were at Athens public treaſurers appointed to receive them. They were ten in number, and they were nominated by lot. They were called *Treaſurers of the Goddeſs*, or *Receivers of the ſacred money*. That money they received in the preſence of the ſenate; and they were empowered to diminiſh or to annihilate the fine, if they thought it unjuſt. The ſtatue of Minerva, that of the victories, and the other invaluable pledges of the duration of the ſtate, were depoſited with them.

The treaſury in which the money conſecrated to the gods was kept, was in the citadel, behind the temple of Minerva Polias; and from its ſituation it was termed *Opiſtodomus*. It was ſurrounded with a double wall. It had but one door, the key of which was kept by the Epiſtates, or chief of the Prytanes: his dignity was very conſiderable; but it laſted only one day. In this treaſury a regiſter was kept, in which were written the names of all thoſe who were indebted to the ſtate: he who owed the ſmalleſt fine was not omitted. If the debtors proved inſolvent, they were proſecuted with extreme rigour, and often puniſhed with a cruelty which religion could not excuſe; though the intereſt of the gods was the motive, or rather the pretext. The ſacred treaſurers held a conſiderable rank among the magiſtrates, who received the public finances. Of theſe magiſtrates there were many kinds, as there were many ſorts of revenues.

The Athenian prieſts did not compoſe an order diſtinct and ſeparate from the other orders of the ſtate. They did not form a body united by particular laws, under a chief whoſe authority extended to all his inferiors. The dignity of ſovereign pontiff was unknown at Athens; and each of the prieſts ſerved his particular temple, connected with his brethren. The temples, indeed, of the principal deities; thoſe of Minerva, for inſtance, of Neptune, of Ceres, and of Proſerpine, had many miniſters; and in each of them a chief preſided, who had the title of *High-Prieſt*. The number of ſubaltern miniſters was in proportion to the rank of the deity; but the prieſts of one temple were altogether a ſeparate ſociety from thoſe of another. Thus at Athens there was a great number of high prieſts, becauſe many deities were worſhipped there, whoſe ſervice required many miniſters. The power of each prieſt was confined to his temple; and there was no ſovereign pontiff, the miniſter general of the gods, and the preſident at all the feaſts.

It naturally follows from this account, that the miniſters of the gods at Athens were not judges in matters of religion. They were neither authoriſed to take cogniſance of crimes committed againſt the deity, nor to puniſh them. Their function was to offer ſacrifices to the gods, and to intreat their acceptance of the adorations of the people. But the puniſhment of impiety, of ſacrilege, of the profanation of myſteries, and of other irreligious crimes, was not entruſted to their zeal.

The prieſts were not only incapable of avenging crimes againſt religion by a temporal proceſs; they even could not, without an expreſs order either from the ſenate or the people, exerciſe their right of devoting criminals to the infernal gods. It was in conſequence of a civil ſentence pronounced againſt Alcibiades, that the Eumolpidæ launched their anathema againſt him. It was in virtue of another decree that they revoked their imprecations, when his countrymen wanted his ſervice, and therefore reſtored him to their favour.

Religious cauſes, according to M. de Bougainville, fell under the juriſdiction of the Heliaſtæ.

The government, though often altered, continued pretty much on the plan eſtabliſhed by Solon.

184 People divided into different tribes, &c.

The people of Athens were freemen, ſojourners, or ſlaves. The citizens, called in Greek *Politai*, were very numerous; but what may ſeem ſtrange, were as many in the time of Cecrops as in the moſt flouriſhing ſtate of the commonwealth, hardly ever exceeding 20,000. It was Solon who decreed that none ſhould be accounted free but ſuch as were Athenians both by father and mother. After his time it fell into deſuetude, till revived by Pericles, and again at his inſtance repealed. After the expulſion of the 30 tyrants, Solon's law was reſtored. A perſon born of a ſtranger was ſtyled *Nothos*, a baſtard; whereas the ſon of a free woman was called *Gneſios*, i. e. *legitimate*. There was in Cynoſarges a court of judicature, to which cauſes of illegitimacy properly belonged; and the utmoſt care was taken to prevent any from being inrolled Athenian citizens, who had not a clear title thereto. The citizens were divided by Cecrops into four tribes: the firſt called *Cecropes*, from Cecrops; the ſecond, *Autochthon*, from a king of that name; the third, *Actai*, from Acteus another king of Athens, or rather from *Acte*, which ſignifies a *ſhore*: the fourth, *Pluralia*: theſe names were altered by Cranaus, and again by Ericthonius. In the reign of Erictheus, they were again changed: the ſoldiers were called *Oplitai*, the craftſmen *Ergatai*, the farmers *Georgoi*, the graziers and ſhepherds *Aigicorai*: in this ſtate they were when Solon ſettled the commonwealth, and appointed the ſenate to be compoſed of 400, 100 out of each tribe. Clyſthenes increaſed the number of the tribes to 10, and made the ſenate conſiſt of 500, taking 50 out of each tribe. In ſucceeding times, two other tribes were added. Each tribe was ſubdivided into its *Demoi* or wards; and with reſpect to theſe it was that Solon inſtituted the public feaſts beforementioned, at which ſometimes the whole tribe aſſembled, ſometimes ſeveral wards, and ſometimes only the inhabitants of one ward.

The ſecond ſort of inhabitants we mentioned were called *Metoicoi*, i. e. *ſojourners*; theſe were perſons who lived always at Athens, yet were not admitted free denizens; as for ſuch as did not conſtantly reſide in Athens, they were ſtyled *Xenoi*; i. e. *ſtrangers*. The ſojourners were obliged to chooſe out of the citizens protectors, who were ſtyled *Patrons*: they paid ſervices to the ſtate, and beſides theſe an annual tribute of 12 drachms for every man, and ſix for every woman; but ſuch as had ſons, and paid for them, were exempted. If people fell to poverty, and were not able to pay the tribute, they were ſeized by the tax-maſters, and actually ſold for ſlaves: which, as Diogenes Laertius tells us, was the fate of Xenocrates the philoſopher. The ſojourners in Attica were under the ſame law as thoſe in Athens. As to ſervants, they were freemen, who through indigency were driven to receive wages, and while they were in this ſtate had no vote in the aſſembly. As to ſlaves, they were abſolutely the property of their maſters, and as ſuch were uſed as they thought fit: They were forbidden to wear clothes, or to cut their hair like their maſters; and which is indeed amazing, Solon prohibited them to love boys, as if that had been honourable: They were likewiſe debarred from anointing or perfuming themſelves, and from worſhipping certain deities: They were not allowed to be called by honourable names; and in moſt other reſpects were uſed like dogs. They ſtigmatized them at their pleaſure, that is, branded them with letters in the forehead and elſewhere. However, Theſeus's temple was allowed them as a ſanctuary, whither, if they were exceedingly ill uſed, they might fly, and thereby oblige their owners to let them be transferred to another maſter. In this and many other reſpects the Athenian ſlaves were in a much better condition than thoſe throughout the reſt of Greece: they were permitted to get eſtates for themſelves, giving a ſmall premium to their maſters, who were obliged to make them free if they could pay their ranſom; they likewiſe obtained the ſame favour from the kindneſs of their maſters, or for having rendered military ſervices to the ſtate. When they were made free, they were obliged to chooſe patrons; and had likewiſe the privilege of chooſing a curator, who, in caſe their patrons injured them, was bound to defend them.

185 General aſſembly of the people.

The general aſſembly of the people, which Solon made the dernier reſort, was called the *Eccleſia*; and conſiſted of all the freemen of Athens, excepting ſuch as were *atimoi* or infamous. The meetings of theſe aſſemblies were either ordinary or extraordinary. The ordinary were ſuch as were appointed by law, the extraordinary ſuch as neceſſity required. Of the firſt there were four in 35 days. In the firſt aſſembly they approved or rejected magiſtrates, heard propoſals for the public good, and certain cauſes. In the ſecond they received petitions, and heard every man's judgement on the matters that were before them. In the third they gave audience to foreign ambaſſadors. The fourth was employed altogether in affairs relating to the gods and their worſhip. The extraordinary meetings were appointed by the magiſtrates when occaſion required, whereas to the ordinary aſſemblies the people came of their own accord. The firſt were held either in the market-place, in the Pnyx, a place near the citadel, or in the theatre of Bacchus; as to the latter, the magiſtrates who appointed the extraordinary meeting appointed alſo the place where they ſhould be held. If any ſudden tempeſt aroſe, or any earthquake happened, or any ſign notoriouſly inauſpicious appeared, the aſſembly was immediately adjourned, to prevent the people from apprehending unhappy conſequences from their deliberations. But if the weather was fair and ſerene, and nothing happened out of the ordinary courſe of things, they proceeded to purify the place where the aſſembly was held, which was done by ſprinkling it round with the blood of young pigs: then the crier made a ſolemn prayer for the proſperity of the republic, and that heaven would beſtow a happy iſſue on their counſels and undertakings; he then pronounced a bitter execration againſt any who ſhould in that aſſembly propound what might be diſadvantageous to the ſtate. Theſe ceremonies being over, they proceeded to buſineſs.

186 Method of giving their opinions.

There were ſeveral magiſtrates who had the overſeeing and regulating theſe aſſemblies. Theſe were, firſt, the Epiſtate, or preſident of the aſſembly, who was choſen by lot out of the Proedri: his office was to give the ſignal for the people's voting. Next to him were the Prytanes, *i. e.* a committee of the ſenate, who of courſe were preſent on this occaſion: by their order a programma, or ſcheme of the buſineſs to be propoſed at the aſſembly, was previouſly ſet up in ſome public place, that every man might know what buſineſs to apply his thoughts to. The Proedri were nine in number, appointed by lots out of all the tribes to which the Prytanes did not belong: they had the right of propoſing to the people what they were to deliberate upon, and their office ended with the aſſembly; there ſat with them aſſeſſors, who were to take care that nothing they propoſed was detrimental to the commonwealth. The firſt ſtep to buſineſs was the crier's reading the decree of the ſenate whereon the aſſembly was to deliberate; when he had finiſhed this, he made proclamation in theſe words: *Who of the men above* 50 *will make an oration?* When the old men had done ſpeaking, the crier made proclamation again that any Athenian might then offer his ſentiments, whom the law allowed ſo to do; that is, all ſuch as were above 30 years old, and were not infamous. If ſuch a one roſe up to ſpeak, the Prytanes interpoſed, and bid him be ſilent; and if he did not obey them, the lictors pulled him down by force. When the debates were over, the preſident permitted the people to vote; which they did by caſting firſt beans, but in after-times pebbles, into certain veſſels: theſe were counted, and then it was declared that the decree of the ſenate was either rejected or approved: after which, the Prytanes diſmiſſed the aſſembly.

187 The ſenate.

The ſenate was inſtituted by Solon to prevent the dangerous conſequences of leaving the ſupreme power in the people. At the time of his inſtitution, it was to conſiſt of 400, 100 out of each tribe; it was increaſed to 500, when the tribes were augmented to 10; and when they came to 12, it was alſo ſwelled to 600. They were elected by lots after this manner: At a day appointed, towards the cloſe of the year, the preſident of each tribe gave in a liſt of ſuch perſons belonging thereto, as were fit for and deſired to appear for this dignity: theſe names were engraven on tablets of braſs, and a number of beans equal to the number of the amount of them, among which were 100 white ones, put into a veſſel; and then the names of the candidates and the beans were drawn one by one, and ſuch as were drawn by the white beans were received into the ſenate. After the ſenate was elected, they proceeded to appoint the officers who were to preſide in the ſenate: theſe were the Prytanes beforementioned, and they were elected thus: The names of the ten tribes were thrown into one veſſel, and nine black beans and a white one into another veſſel. Then the names of the tribes were drawn with the beans. The tribe to which the white bean anſwered, preſided firſt; and the reſt according to the order in which they were drawn.

188 Prytanes.

The Prytanes, while the ſenate conſiſted of 500, were 50 in number. For the farther avoiding of confuſion therefore, 10 of theſe preſided a week, during which ſpace they were called *Proedri;* and out of theſe an Epiſtate or preſident was choſen, whoſe office laſted but one day, and by law no man could hold it more than once: the reaſon of this was, that he had in his cuſtody the public ſeal, the keys of the citadel, and the charge of the exchequer. The reader muſt diſtinguiſh between the Epiſtates and Proedri laſt-mentioned, and thoſe ſpoken of in the former paragraph, becauſe, though their titles were the ſame, their office were perfectly diſtinct. The ſenate aſſembled by direction of the Prytanes once every day, excepting feſtivals, and ſometimes oftner in the ſenate-houſe, which was thence called *Prytaneum.*

189 Laws how eſtabliſhed, &c.

When a member of the ſenate made a motion for a new law, it was immediately engraven on tablets, that the members when they came next might be prepared to ſpeak to it. At the ſubſequent aſſembly the Epiſtates opened the matter, after which every ſenator that pleaſed delivered his ſentiments; then any of the Prytanes drew up the decree, and repeated it aloud: after which they proceeded to vote, and if there was a majority of white beans, then it became *pſephiſma,* and was afterwards propounded to the people: if they approved it, it became a law; otherwiſe it was of no force longer than the ſenate who decreed it ſubſiſted. The power of the ſenate was very great: for they took the account of magiſtrates at the expiration of their offices; they directed the proviſions made for poor citizens out of the public treaſure; they had the ſuperintendancy of public priſons, and a power of puniſhing ſuch as committed acts morally evil, though not prohibited by any law; they had the care likewiſe of the fleet; and beſides all theſe they had many other branches of authority, which it is not neceſſary for us to mention. Before they took their ſeats, they were conſtrained to undergo a very ſtrict examination, wherein the whole courſe of their lives was inquired into; and if the leaſt ſlur on their reputation appeared, they were ſet aſide. When this examination was over, they took an oath, whereby they bound themſelves to promote in all their councils the public good, to adviſe nothing contrary to the laws, and to execute their functions exactly. The higheſt fine the ſenate could impoſe was 500 drachms: if they thought the offender deſerved a heavier mulct, they then tranſmitted the cauſe to the Theſmothetæ, who puniſhed them as they thought fit. The ſenators, when their year was out, gave an account of their management to the people: but that they might have the leſs to do, they always puniſhed ſuch of their number as they found had offended, by expulſion; and in this they were mighty exact. Yet an expelled ſenator was notwithſtanding eligible to any other office, the moſt trivial omiſſion being ſufficient to occaſion a diſmiſſion from the ſenatorial dignity; and therefore, when the tribes choſe their ſenators, they alſo choſe a certain number of ſubſidiaries, out of which, when a ſenator was expelled, another was ſubſtituted in his place. Each ſenator was allowed a drachm every day: for it was a conſtant rule with the Athenians, that the public ought to pay for every man's time; and therefore ſuch of the poor Athenians as thought fit to demand it, had three oboli for going to the aſſembly. If during their adminiſtration any ſhips of war were built, the ſenators had crowns decreed them; but if not, they were forbid to ſue for them.

Next to the ſenate was the court of AREOPAGUS, for a deſcription of which ſee that article.

200 Archons, Nomophylaces, &c.

The chief magiſtrates of Athens were Archons, and inferior to them there were many others; of whom it will be neceſſary to mention ſome. In the firſt place they had Nomophylaces, who were alſo ſtyled *the eleven*, becauſe they were ſo many in number, one choſen out of each tribe, and a clerk or ſecretary who made up the eleventh. Their duty it was to look to the execution of the laws: they had authority to ſeize robbers and other capital offenders; and if they confeſſed, to put them to death. Dr Potter thinks they reſembled our ſheriffs. The Phylarchi were the preſidents of the Athenian tribes; but in time this became a military title. The Philobaſileus was an officer in each tribe, who did the ſame things within his juriſdiction as the Baſileus did with reſpect to the ſtate. The Demarchi were the principal magiſtrates in wards. The Lexarchi were ſix in number, and were bound to take care that the people came duly to the aſſemblies; in their cuſtody was the public regiſter of the citizens names. They had under them Toxotæ, who were lictors or bailiffs; they were ſometimes 1000 in number: theſe men were neceſſary: but, like moſt of their ſort, were in a manner infamous, as may be gathered from the comedies of Ariſtophanes; they were generally Scythians, raw-boned, brawny fellows, ready to execute any thing they were commanded. The Nomothetæ were 1000 in number; their buſineſs was to watch over and inſpect into the laws. There were two ſorts of orators in the ſervice of the ſtate, ſome were appointed to defend an old law, when a motion was made to repeal it; theſe had their fee from the ſtate, but the ſame man was incapable of being elected twice. Beſides theſe, there were 10 ſettled orators called *Rhetores*, elected by lot; their buſineſs was to plead public cauſes in the ſenate-houſe.

201 Laws regarding orators.

For this they had their ſtated fees; and with reſpect to their qualifications, the law run thus: "Let no one be a public orator who hath ſtruck his parents, denied them maintenance, or ſhut them out of his doors; who hath refuſed to ſerve in the army; who hath thrown away his ſhield; who hath been addicted to lewd women, notoriouſly effeminate, or who has run out his patrimony. If any man who has been guilty of theſe crimes dare to deliver an oration, let him be brought to trial upon the ſpot. Let an orator have children lawfully begotten, and an eſtate within Attica; if in his oration he talks impertinently, makes idle repetitions, affects an unbecoming raillery, digreſſes from the point in queſtion, or after the aſſembly is over, abuſes the preſident, let the Proedri fine him 50 drachms; and if that is not thought enough, let him be brought before the next aſſembly and fined again."

202 Courts of juſtice.

We ſhall conclude this draught of the Athenian government with an account of their courts of juſtice, which, excluſive of the Areopagus, were 10 in number; four had cogniſance of criminal, and ſix of civil cauſes. Theſe 10 courts were numbered with the 10 firſt letters of the alphabet, and were thence ſtyled, *Alpha*, *Beta*, *Gamma*, &c. When an Athenian was at leiſure to hear cauſes, he wrote his own name, that of his father, and the ward to which he belonged, upon a tablet; this he preſented to the Theſmothetæ, who returned it again to him with another tablet, with the letter which fell to his lot; then he went to the crier of the court, who preſented him a ſceptre, and gave him admiſſion. When the cauſes were over, every judge went and delivered his ſceptre to the Prytanes, and received a ſtated fee for every cauſe that was tried. But as this was intended only to compenſate their loſs of time, ſo that there might be no appearance of covetouſneſs, a man was forbid to ſit in two courts on the ſame day. The firſt criminal court after the Areopagus, was that of the *Ephetæ*. It conſiſted of 51 members, all upwards of 51 years old. Draco gave it a very extenſive juriſdiction; but Solon took away from them the power of judging in any other cauſes than thoſe of manſlaughter, accidental killing, and lying in wait to deſtroy: the Baſileus entered all cauſes in this court. The ſecond criminal court was called *Delphinium*, becauſe it was held in the temple of Apollo Delphinius; it had cogniſance of ſuch murders as were confeſſed by the criminal, but at the ſame time juſtified under ſome pretence or other. The *Prytaneum* was the third criminal court. It held plea of ſuch caſes where death enſued from inanimate things: cauſes were heard here with the ſame ſolemnity as in other courts; and on judgment given, the thing, or whatever it was, that had occaſioned the death of a man, was thrown out of the territory of Athens. The laſt criminal court was ſtyled *Phreatum*. It ſat in a place not far from the ſea-ſhore; and ſuch perſons were brought before this court as had committed murders in their own country and fled to Attica: the proceedings of this court were ſo ſevere that they did not permit the criminal to come on ſhore, but obliged him to plead his cauſe in his veſſel; and if he was found guilty, he was committed to the mercy of the wind and ſeas.

Of the judicatures for hearing civil cauſes, the firſt was the *Parabaſton*, ſo called, as ſome think, becauſe in it no matter could be heard if the cauſe of action was above one drachm. The *Cainon*, or new court, was the ſecond tribunal. The third was ſtyled the *court of Lycus*, becauſe it aſſembled in a temple dedicated to that hero, whoſe ſtatue, repreſented with the face of a wolf, was ſet up in all courts of juſtice. The *Trigonon* was ſo called, becauſe it was triangular in its form. The court of *Metidius* derived its appellation from the architect who built it. The ſixth and laſt court was called *Heliæa*; it was by far the greateſt, and is generally conceived to have derived its name from the judges ſitting in the open air expoſed to the ſun. All the Athenians who were free citizens were allowed by law to ſit in theſe courts as judges; but before they took their ſeats were ſworn by Apollo Patrius, Ceres, and Jupiter the king, that they would decide all things righteouſly and according to law, where there was any law to guide them; and by the rules of natural equity, where there was none. The Helæaſtic court conſiſted at leaſt of 50, but its uſual number was 500, judges: when cauſes of very great conſequence were to be tried, 1000 ſat therein, and now and then the judges were increaſed to 1500, and even to 2000. There were many inferior courts in Athens for the deciſion of trivial cauſes; but of theſe there is no neceſſity of ſpeaking, ſince we deſign no more than a ſuccinct view of the Athenian republic, as it was ſettled by and in conſequence of Solon's laws.

ATTICUS (Titus Pomponius), one of the moſt honourable men of ancient Rome. He underſtood the art of managing himſelf with ſuch addreſs, that, without leaving his ſtate of neutrality, he preſerved the eſteem and affection of all parties. His ſtrict friendſhip with Cicero did not hinder him from having great intimacy with Hortenſius. The conteſts at Rome between Cinna's party and that of Marius induced him to go to Athens, where he continued for a long time. He was very fond of polite learning, and kept at his houſe ſeveral librarians and readers. He might have obtained the moſt conſiderable poſts in the government; but choſe rather not to meddle, becauſe in the corruption and faction which then prevailed he could not diſcharge them according to the laws. He wrote Annals. He married his daughter to Agrippa; and attained to the age of 77.

ATTILA, king of the Huns, ſurnamed *the ſcourge of God*, lived in the 5th century. He may be ranked among the greateſt conquerors, ſince there was ſcarcely any province in Europe which did not feel the weight of his victorious arms.

Gibbons's Rome, vol. iii. p. 357.

Attila deduced his noble, perhaps his regal, deſcent from the ancient Huns, who had formerly contended with the monarchs of China. His features, according to the obſervation of a Gothic hiſtorian, bore the ſtamp of his national origin; and the portrait of Attila exhibits the genuine deformity of a modern Caulmuck; a large head, a ſwarthy complexion, ſmall deep-ſeated eyes, a flat noſe, a few hairs in the place of a beard, broad ſhoulders, and a ſhort ſquare body, of nervous ſtrength, though of a diſproportioned form. The haughty ſtep and demeanour of the king of the Huns expreſſed the conſciouſneſs of his ſuperiority above the reſt of mankind; and he had a cuſtom of fiercely rolling his eyes, as if he wiſhed to enjoy the terror which he inſpired. Yet this ſavage hero was not inacceſſible to pity; his ſuppliant enemies might confide in the aſſurance of peace or pardon; and Attila was conſidered by his ſubjects as a juſt and indulgent maſter. He delighted in war: but, after he had aſcended the throne in a mature age, his head, rather than his hand atchieved the conqueſt of the north; and the fame of an adventurous ſoldier was uſefully exchanged for that of a prudent and ſucceſsful general. The effects of perſonal valour are ſo inconſiderable, except in poetry or romance, that victory, even among barbarians, muſt depend on the degree of ſkill, with which the paſſions of the multitude are combined and guided for the ſervice of a ſingle man. The Arts of Attila were ſkilfully adapted to the character of his age and country. It was natural enough, that the Scythians ſhould adore, with peculiar devotion, the god of war; but as they were incapable of forming either an abſtract idea, or a corporeal repreſentation, they worſhipped their tutelar deity under the ſymbol of an iron ſcimitar. One of the ſhepherds of the Huns perceived, that a heifer, who was grazing, had wounded herſelf in the foot; and curiouſly followed the track of the blood, till he diſcovered, among the long graſs the point of an ancient ſword; which he dug out of the ground, and preſented to Attila. That magnanimous, or rather that artful prince, accepted with pious gratitude this celeſtial favour; and, as the rightful poſſeſſor of the *ſword of Mars*, aſſerted his divine and indefeaſible claim to the dominion of the earth. If the rites of Scythia were practiſed on this ſolemn occaſion, a lofty altar, or rather pile of faggots, 300 yards in length and in breadth, was raiſed in a ſpacious plain; and the ſword of Mars was placed erect on the ſummit of this ruſtic altar, which was annually conſecrated by the blood of ſheep, horſes, and of the hundredth captive. Whether human ſacrifices formed any part of the worſhip of Attila, or whether he propitiated the god of war with the victims which he continually offered in the field of battle, the favourite of Mars ſoon acquired a ſacred character, which rendered his conqueſts more eaſy and more permanent; and the barbarian princes confeſſed, in the language of devotion or flattery, that they could not preſume to gaze with a ſteady eye on the divine majeſty of the king of the Huns. His brother Bleda, who reigned over a conſiderable part of the nation, was compelled to reſign his ſceptre and his life. Yet even this cruel act was attributed to a ſupernatural impulſe; and the vigour with which Attila wielded the ſword of Mars, convinced the world that it had been reſerved alone for his invincible arm. But the extent of his empire affords the only remaining evidence of the number and importance of his victories; and the Scythian monarch, however ignorant of the value of ſcience and philoſophy, might perhaps lament that his illiterate ſubjects were deſtitute of the art which could perpetuate the memory of his exploits.

If a line of ſeparation were drawn between the civilized and the ſavage climates of the globe; between the inhabitants of cities who cultivated the earth, and the hunters and ſhepherds who dwelt in tents; Attila might aſpire to the title of ſupreme and ſole monarch of the Barbarians. He alone, among the conquerors of ancient and modern times, united the two mighty kingdoms of Germany and Scythia; and thoſe vague appellations, when they are applied to his reign, may be underſtood with an extenſive latitude. Thuringia, which ſtretched beyond its actual limits as far as the Danube, was in the number of his provinces: he interpoſed, with the weight of a powerful neighbour, in the domeſtic affairs of the Franks; and one of his lieutenants chaſtiſed, and almoſt exterminated, the Burgundians of the Rhine. He ſubdued the iſlands of the ocean, the kingdoms of Scandinavia, encompaſſed and divided by the waters of the Baltic; and the Huns might derive a tribute of furs from that northern region, which has been protected from all other conquerors by the ſeverity of the climate, and the courage of the natives. Towards the eaſt, it is difficult to circumſcribe the dominion of Attila over the Scythian deſerts: yet we may be aſſured, that he reigned on the banks of the Volga, that the king of the Huns was dreaded, not only as a warrior, but as a magician; that he inſulted and vanquiſhed the Khan of the formidable Geougen: and that he ſent ambaſſadors to negociate an equal alliance with the empire of China. In the proud review of the nations who acknowledged the ſovereignty of Attila, and who never entertained during his lifetime the thought of a revolt, the Gepidæ and the Oſtrogoths were diſtinguiſhed by their numbers, their bravery, and the perſonal merit of their chiefs. The renowned Ardaric king of the Gepidæ, was the faithful and ſagacious councellor of the monarch; who eſteemed his intrepid genius, whilſt he loved the mild and diſcreet virtues of the noble Walamir king of the Oſtrogoths. The crowd of vulgar kings, the leaders of ſo many martial tribes, who ſerved under the ſtandard of Attila, were ranged in the ſubmiſſive order of guards and domeſtics round the perſon of their maſter. They watched his nod; they trembled at his frown; and at the firſt ſignal of his will, they executed without murmur or heſitation his ſtern and abſolute commands. In time of peace, the dependent princes, with their national troops, attended the royal camp in regular ſucceſſion; but when Attila collected his military force, he was able to bring into the field an army of five, or, according to another account, of ſeven hundred thouſand Barbarians.

For an account of his exploits and death, ſee the article HUNS.

ATTIRE, in hunting, ſignifies the head or horns of a deer. The attire of a ſtag, if perfect, conſiſts of bur, pearls, beams, gutters, antler, ſur-antler, royal, ſur-royal, and crotches; of a buck, of the bur, beam, brow-antler, advancer, palm, and ſpellers.

ATTITUDE, in painting and ſculpture, the geſture of a figure or ſtatue; or it is ſuch a diſpoſition of their parts as ſerves to expreſs the action and ſentiments of the perſon repreſented.

ATTIUM, (anc. geog.) a promontory on the north-weſt of Corſica, (Ptolemy). It ſtill retains ſome traces of its ancient name, being now called *Punta di Acciuolo* (Cluverius).

ATTLEBURY, a town in the county of Norfolk in England. E. Long. 0. 40. N. Lat. 52. 23.

ATTOLLENS, in anatomy, an appellation given to ſeveral muſcles otherwiſe called *levatores* and *elevatores*. See ANATOMY, *Table of the Muſcles*.

ATTORNEY AT LAW, anſwers to the Procurator, or Proctor of the civilians and canoniſts: And he is one who is put in the place, ſtead, or turn of another, to manage his matters of law. Formerly every ſuitor was obliged to appear in perſon, to proſecute or defend his ſuit (according to the old Gothic conſtitution), unleſs by ſpecial licence under the king's letters patent. This is ſtill the law in criminal caſes. And an idiot cannot to this day appear by attorney, but in perſon; for he hath not diſcretion to enable him to appoint a proper ſubſtitute; and upon his being brought before the court in ſo defenceleſs a condition, the judges are bound to take care of his intereſts, and they ſhall admit the beſt plea in his behalf that any one preſent can ſuggeſt. But, as in the Roman law, *cum olim in uſu fuiſſet, alterius nomine agi non poſſe, ſed, quia hoc non minimam incommoditatem habebat, cœperunt homines per procuratores litigare*; ſo, in England, on the ſame principle of convenience, it is now permitted in general, by divers ancient ſtatutes, whereof the firſt is ſtatute Weſt. 2. c. 10. that attorneys may be made to proſecute or defend any action in the abſence of the parties to the ſuit. Theſe attorneys are now formed into a regular corps; they are admitted to the execution of their office by the ſuperior courts of Weſtminſter-hall; and are in all points officers of the reſpective courts in which they are admitted; and as they have many privileges on account of their attendance there, ſo they are peculiarly ſubject to the cenſure and animadverſion of the judges. No man can practiſe as an attorney in any of thoſe courts, but ſuch as is admitted and ſworn an attorney of that particular court; an attorney of the court of king's bench cannot practiſe in the court of common pleas; nor *vice verſa*. To practiſe in the court of chancery, it is alſo neceſſary to be admitted a ſolicitor therein; and by the ſtatute 22 Geo. II. c. 46. no perſon ſhall act as an attorney at the court of quarter-ſeſſions, but ſuch as has been regularly admitted in ſome ſuperior court of record. So early as the ſtatute 4 Henry IV. c. 18. it was enacted, that attorneys ſhould be examined by the judges, and none admitted but ſuch as were virtuous, learned, and ſworn to do their duty. And many ſubſequent ſtatutes have laid them under farther regulations.

Letter of attorney pays by different acts, 6s. By 25 Geo. III. c. 80. the following duties are to be paid by every ſolicitor, attorney, notary, proctor, agent or procurator, viz. for every warrant to proſecute for a debt of 40s. or to defend, a ſtamp duty of 2s. 6d. And they are to take out certificates annually; and if reſident in London, Weſtminſter, the bills of mortality, or Edinburgh, they are now obliged to pay L. 5 for the ſame; and in every other part of Great Britain, L. 3. The duties are under the management of the commiſſioners of ſtamps: and every acting ſolicitor, and other perſon as above, ſhall annually deliver in a note of his name and reſidence, to the proper officer of the court in which he practiſes; the entering officers are to certify notes delivered, and iſſue annual certificates, ſtamped as above, which muſt be renewed ten days before the expiration. Refuſing to iſſue, or improperly iſſuing certificates, is a penalty of L. 50, and damages to the party aggrieved. Acting without a certificate, or giving in a falſe place of reſidence, is a penalty of L. 50, and incapacity to ſue for fees due. A ſtamped memorandum ſhall be given to the proper officer, of the names of the parties in every action; and in ſuch caſes as uſed to require precipes. Officers who receive ſtamped memorandums, are to file the ſame, on penalty of L. 50; and perſons not acting conformable to this act forfeit L. 5.

ATTORNEY General, is a great officer under the king, made by letters patent. It is his place to exhibit informations, and proſecute for the crown, in matters criminal; and to file bills in the exchequer, for any thing concerning the king in inheritance or profits; and others may bring bills againſt the king's attorney. His proper place in court, upon any ſpecial matters of a criminal nature, wherein his attendance is required, is under the judges on the left hand of the clerk of the crown; but this is only upon ſolemn and extraordinary occaſions; for uſually he does not ſit there, but within the bar in the face of the court.

ATTOURNMENT, or ATTORNMENT, in law, a transfer from one lord to another of the homage and ſervice a tenant makes; or that acknowledgment of duty to a new lord.

ATTRACTION, in natural philoſophy, a general term uſed to denote the cauſe by which bodies tend towards each other, and cohere till ſeparated by ſome other power.

The principle of attraction, in the Newtonian ſenſe of it, ſeems to have been firſt ſurmiſed by Copernicus. "As for gravity," ſays Copernicus, "I conſider it as nothing more than a certain natural appetence (*appetentia*) that the Creator has impreſſed upon all the parts of matter, in order to their uniting or coaleſcing into a globular form, for their better preſervation; and it is credible that the ſame power is alſo inherent in the ſun and moon, and planets, that thoſe bodies may conſtantly retain that round figure in which we behold them." *De Rev. Orb. Cœleſt.* lib. i. cap. 9. And Kepler calls gravity a corporeal and mutual affection between ſimilar bodies, in order to their union. *Aſt. Nov. in Introd.* And he pronounces more poſitively, that no bodies whatſoever were abſolutely light, but only relatively ſo; and conſequently, that all matter was ſubjected to the law of gravitation. *Ibid.*

The firſt in Britain who adopted the notion of attraction, was Dr Gilbert, in his book *De Magnete*; and the next was the celebrated Lord Bacon, *Nov. Org.* lib. ii. aphor. 36. 45. 48. *Sylv.* cent. i. exp. 33. In France it was received by Fermat and Roberval; and in Italy by Galileo and Borelli. But till Sir Iſaac Newton appeared, this principle was very imperfectly defined and applied.

It muſt be obſerved, that though this great author makes uſe of the word attraction, in common with the ſchool philoſophers; yet he very ſtudiouſly diſtinguiſhes between the ideas. The ancient attraction was ſuppoſed a kind of quality, inherent in certain bodies themſelves, and ariſing from their particular or ſpecific forms. The Newtonian attraction is a more indefinite principle; denoting not any particular kind or manner of action, nor the phyſical cauſe of ſuch action; but only a tendency in the general, a *conatus accedendi*, to whatever cauſe, phyſical or metaphyſical, ſuch effect be owing; whether to a power inherent in the bodies themſelves, or to the impulſe of an external agent. Accordingly, that author, in his *Philoſoph. Nat. Prin. Math.* notes, "that he uſes the words *attraction*, *impulſe*, and *propenſion* to the center, indifferently; and cautions the reader not to imagine that by attraction he expreſſes the modus of the action, or the efficient cauſe thereof, as if there were any proper powers in the centres, which in reality are only mathematical points; or, as if centres could attract." Lib. i. p. 5. So he "conſiders centripetal powers as attractions, though, phyſically ſpeaking, it were perhaps more juſt to call them impulſes." Ib. p. 147. He adds, "that what he calls attraction may poſſibly be effected by impulſe, though not a common or corporeal impulſe, or after ſome other manner unknown to us." *Optic.* p. 322.

Attraction, if conſidered as a quality ariſing from the ſpecific form of bodies, ought, together with ſympathy, antipathy, and the whole tribe of occult qualities, to be exploded. But when we have ſet theſe aſide, there will remain innumerable phenomena of nature, and particularly the gravity or weight of bodies, or their tendency to a centre, which argue a principle of action ſeemingly diſtinct from impulſe, where at leaſt their is no ſenſible impulſion concerned. Nay, what is more, this action in ſome reſpects differs from all impulſion we know of; impulſe being always found to act in proportion to the ſurfaces of bodies, whereas gravity acts according to their ſolid content, and conſequently muſt ariſe from ſome cauſe that penetrates or pervades the whole ſubſtance thereof. This unknown principle, unknown we mean in reſpect of its cauſe, for its phenomena and effects are moſt obvious, with all the ſpecies and modifications thereof, we call *attraction*; which is a general name, under which all mutual tendencies, where no phyſical impulſe appears, and which cannot therefore be accounted for from any known laws of nature, may be ranged.

And hence ariſe divers particular kinds of attraction; as, *Gravity*, *Magnetiſm*, *Electricity*, &c. which are ſo many different principles acting by different laws, and only agreeing in this, that we do not ſee any phyſical cauſes thereof; but that, as to our ſenſes, they may really ariſe from ſome power or efficacy in ſuch bodies, whereby they are enabled to act even upon diſtant bodies, though our reaſon abſolutely diſallows of any ſuch action.

Attraction may be divided, with reſpect to the law it obſerves, into two kinds.

1. That which extends to a ſenſible diſtance. Such are the attraction of gravity, found in all bodies; and the attraction of magnetiſm and electricity, found in particular bodies. The ſeveral laws and phenomena of each, ſee under their reſpective articles.

The attraction of gravity, called alſo among mathematicians the *centripetal force*, is one of the greateſt and moſt univerſal principles in all nature. We ſee and feel it operate on bodies near the earth, and find by obſervation that the ſame power (*i. e.* a power which acts in the ſame manner, and by the ſame rules, *viz.* always proportionably to the quantities of matter, and as the ſquares of the diſtances reciprocally) does alſo obtain in the moon, and the other planets, primary and ſecondary, as well as in the comets; and even that this is the very power whereby they are all retained in their orbits, &c. And hence, as gravity is found in all the bodies which come under our obſervation, it is eaſily inferred, by one of the ſettled rules of philoſophizing, that it obtains in all others: and as it is found to be as the quantity of matter in each body, it muſt be in every particle thereof; and hence every particle in nature is proved to attract every other particle, &c. See the demonſtration hereof laid down at large, with the application of the principle to the celeſtial motions, under the article ASTRONOMY, Sect. IV.

From this attraction ariſes all the motion, and conſequently all the mutation, in the great world. By this heavy bodies deſcend, and light ones aſcend; by this projectiles are directed, vapours and exhalations riſe, and rains, &c. fall. By this rivers glide, the air preſſes, the ocean ſwells, &c. In effect, the motions ariſing from this principle make the ſubject of that extenſive branch of mathematics, called *mechanics* or *ſtatics*, with the parts or appendages thereof, hydroſtatics, pneumatics, &c.

2. That which does not extend to ſenſible diſtances. Such is found to obtain in the minute particles whereof bodies are compoſed, which attract each other at or extremely near the point of contact, with a force much ſuperior to that of gravity, but which at any diſtance from it decreaſes much faſter than the power

of gravity. This power a late ingenious author chooſes to call the *attraction of coheſion*, as being that whereby the atoms or inſenſible particles of bodies are united into ſenſible maſſes.

This latter kind of attraction owns Sir Iſaac Newton for its diſcoverer; as the former does for its improver. The laws of motion, percuſſion, &c. in ſenſible bodies under various circumſtances, as falling, projected, &c. aſcertained by the later philoſophers, do not reach to thoſe more remote, inteſtine motions of the component particles of the ſame bodies, whereon the changes of the texture, colour, properties, &c. of bodies depend: ſo that our philoſophy, if it were only founded on the principle of gravitation, and carried ſo far as that would lead us, would neceſſarily be very deficient.

But beſide the common laws of ſenſible maſſes, the minute parts they are compoſed of are found ſubject to ſome others, which have been but lately taken notice of, and are even yet imperfectly known. Sir Iſaac Newton, to whoſe happy penetration we owe the hint, contents himſelf to eſtabliſh that there are ſuch motions in the *minima naturæ*, and that they flow from certain powers or forces, not reducible to any of thoſe in the great world. In virtue of theſe powers, he ſhows, "That the ſmall particles act on one another even at a diſtance; and that many of the phenomena of nature are the reſult thereof. Senſible bodies, we have already obſerved, act on one another divers ways; and as we thus perceive the tenor and courſe of nature, it appears highly probable that there may be other powers of the like kind: nature being very uniform and conſiſtent with herſelf. Thoſe juſt mentioned reach to ſenſible diſtances, and ſo have been obſerved by vulgar eyes; but there may be others which reach to ſuch ſmall diſtances as have hitherto eſcaped obſervation; and it is probable electricity may reach to ſuch diſtances, even without being excited by friction."

The great author juſt mentioned proceeds to confirm the reality of theſe ſuſpicions from a great number of phenomena and experiments, which plainly argue ſuch powers and actions between the particles, *e. g.* of ſalts and water, oil of vitriol and water, aquafortis and iron, ſpirit of vitriol and ſaltpetre. He alſo ſhows, that theſe powers, &c. are unequally ſtrong between different bodies; ſtronger, *e. g.* between the particles of ſalt of tartar and thoſe of aquafortis than thoſe of ſilver, between aquafortis and lapis calaminaris than iron, between iron than copper, copper than ſilver or mercury. So ſpirit of vitriol acts on water, but more on iron or copper, &c.

The other experiments which countenance the exiſtence of ſuch principle of attraction in the particles of matter are innumerable.

Theſe actions, in virtue whereof the particles of the bodies abovementioned tend towards each other, the author calls by a general indefinite name, *attraction*; which is equally applicable to all actions whereby diſtant bodies tend towards one another, whether by impulſe or by any other more latent power: and from hence he accounts for an infinity of phenomena, otherwiſe inexplicable, to which the principle of gravity is inadequate.

"Thus (adds our author) will nature be found very conformable to herſelf, and very ſimple; performing all the great motions of the heavenly bodies by the attraction of gravity, which intercedes thoſe bodies, and almoſt all the ſmall ones of their parts, by ſome other attractive power diffuſed through the particles thereof. Without ſuch principles, there never would have been any motion in the world; and without the continuance thereof, motion would ſoon periſh, there being otherwiſe a great decreaſe or diminution thereof, which is only ſupplied by theſe active principles."

We need not ſay how unjuſt it is in the generality of foreign philoſophers to declare againſt a principle which furniſhes ſo beautiful a view, for no other reaſon but becauſe they cannot conceive how one body ſhould act on another at a diſtance. It is certain, philoſophy allows of no action but what is by immediate contact and impulſion (for how can a body exert any active power there where it does not exiſt? to ſupppoſe this of any thing, even the Supreme Being himſelf, would perhaps imply a contradiction): yet we ſee effects without ſeeing any ſuch impulſe; and where there are effects, we can eaſily infer there are cauſes whether we ſee them or no. But a man may conſider ſuch effects without entering into the conſideration of the cauſes, as indeed it ſeems the buſineſs of a philoſopher to do: for to exclude a number of phenomena which we do ſee, will be to leave a great chaſm in the hiſtory of nature; and to argue about actions which we do not ſee, will be to build caſtles in the air.—It follows, therefore, that the phenomena of attraction are matters of phyſical conſideration, and as ſuch intitled to a ſhare in the ſyſtem of phyſics; but that the cauſes thereof will only become ſo when they become ſenſible, *i. e.* when they appear to be the effect of ſome other higher cauſes (for a cauſe is no otherwiſe ſeen than as itſelf is an effect, ſo that the firſt cauſe muſt from the nature of things be inviſible): we are therefore at liberty to ſuppoſe the cauſes of attractions what we pleaſe, without any injury to the effects.—The illuſtrious author himſelf ſeems a little irreſolute as to the cauſes; inclining ſometimes to attribute gravity to the action of an immaterial cauſe (*Optics*, p. 343, &c.) and ſometimes to that of a material one (Ib. p. 325.)

In his philoſophy, the reſearch into cauſes is the laſt thing, and never comes under conſideration till the laws and phenomena of the effect be ſettled; it being to theſe phenomena that the cauſe is to be accommodated. The cauſe even of any, the groſſeſt and moſt ſenſible action, is not adequately known. How impulſe or percuſſion itſelf produces its effects, *i. e.* how motion is communicated by body to body, confounds the deepeſt philoſophers; yet is impulſe received not only into philoſophy, but into mathematics: and accordingly the laws and phenomena of its effects make the greateſt part of common mechanics.

The other ſpecies of attraction, therefore, in which no impulſe is remarkable, when their phenomena are ſufficiently aſcertained, have the ſame title to be promoted from phyſical to mathematical conſideration; and this without any previous inquiry into their cauſes, which our conceptions may not be proportionate to: let their cauſes be occult, as all cauſes ſtrictly ſpeaking are, ſo that their effects, which alone immediately concern us, be but apparent.

Our great philoſopher, then, far from adulterating ſcience with any thing foreign or metaphyſical, as many have reproached him with doing, has the glory of having thrown every thing of this kind out of his ſyſtem, and of having opened a new ſource of ſublimer mechanics, which duly cultivated might be of infinitely greater extent than all the mechanics yet known. It is hence alone we muſt expect to learn the manner of the changes, productions, generations, corruptions, &c. of natural things; with all that ſcene of wonders opened to us by the operations of chemiſtry.

Some ſucceeding philoſophers have proſecuted the diſcovery with laudable zeal: Dr Keil particularly has endeavoured to deduce ſome of the laws of this new action, and applied them to ſolve divers of the more general phenomena of bodies, as coheſion, fluidity, elaſticity, ſoftneſs, fermentation, coagulation, &c.; and Dr Friend, ſeconding him, has made a further application of the ſame principles, to account at once for almoſt all the phenomena that chemiſtry preſents: ſo that ſome philoſophers are inclined to think that the new mechanics ſhould ſeem already raiſed to a complete ſcience, and that nothing now can occur but what we have an immediate ſolution of from the attractive force.

But this ſeems a little too precipitate: A principle ſo fertile ſhould have been further explored; its particular laws, limits, &c. more induſtriouſly detected and laid down, before we had proceeded to the application. Attraction in the groſs is ſo complex a thing, that it may ſolve a thouſand different phenomena alike. The notion is but one degree more ſimple and preciſe than action itſelf; and, till more of its properties are aſcertained, it were better to apply it leſs and ſtudy it more. It may be added, that ſome of Sir Iſaac Newton's followers have been charged with falling into that error which he induſtriouſly avoided, viz. of conſidering attraction as a cauſe or active property in bodies, not merely as a phenomenon or effect.

Attraction of Mountains. See Mountains.

Elective Attraction. See Chemistry-*Index*.

ATTREBATII. See Atrebatii.

ATTRIBUTE, in a general ſenſe, that which agrees with ſome perſon or thing; or a quality determining ſomething to be after a certain manner. Thus underſtanding is an attribute of mind, and extenſion an attribute of body. That attribute which the mind conceives as the foundation of all the reſt, is called its *eſſential attribute*: thus extenſion is by ſome, and ſolidity by others, eſteemed the eſſential attributes of body or matter.

ATTRIBUTES, in theology, the ſeveral qualities or perfections of the Divine nature.

Attributes, in logic, are the predicates of any ſubject, or what may be affirmed or denied of any thing.

Attributes, in painting and ſculpture, are ſymbols added to ſeveral figures, to intimate their particular office and character. Thus the eagle is an attribute of Jupiter; a peacock, of Juno; a caduce, of Mercury; a club, of Hercules; and a palm, of Victory.

ATTRIBUTIVES, in grammar, are words which are ſignificant of attributes; and thus include adjectives, verbs, and particles, which are attributes of ſubſtances; and adverbs, which denote the attributes only of attributes. But Harris, who has introduced this diſtribution of words, denominates the former *attributives of the firſt order*, and the latter *attributives of the ſecond order*.

ATTRITION, the rubbing or ſtriking of bodies one againſt another, ſo as to throw off ſome of their ſuperficial particles.

ATURÆ, an ancient town in the diſtrict of Novempopulana in Aquitania, on the river Aturus; now Aire in Gaſcony, on the Adour. E. Long. 0. 3. N. Lat. 43. 40.

AVA, a kingdom of Aſia, in the peninſula beyond the Ganges. The king is very powerful, his dominions being bounded by Mogulſtan on the weſt, Siam on the ſouth, Tonquin and Cochin-China on the eaſt, and by Tibet and China on the north. Several large rivers run through this country, which annually overflow their banks like the Nile, and thus render it extremely fertile. Here are mines of lead and copper, together with ſome of gold and ſilver, beſides large quantities of the fineſt oriental rubies, ſapphires, emeralds, &c.

Ava, the metropolis of the kingdom of the ſame name, is ſituated in E. Long. 96. 30. N. Lat. 21. 0. It is pretty large; the houſes built with timber or bamboo canes, with thatched roofs, and floors made of teak plank or ſplit bamboo. The ſtreets are very ſtraight, with rows of trees planted on each ſide. The king's palace is an exact quadrangle, each ſide of which is 800 paces, and is ſurrounded with a brick wall; but the palace itſelf is of ſtone. It has four gates: the golden gate, through which all ambaſſadors enter; the gate of juſtice, through which the people bring petitions, accuſations, or complaints; the gate of grace, through which thoſe paſs who have received any favours, or have been acquitted of crimes laid to their charge; and the gate of ſtate, through which his majeſty himſelf paſſes when he ſhows himſelf to the people.

AVA ava, a plant ſo called by the inhabitants of Otaheite, in the South Sea, from the leaves of which they expreſs an intoxicating juice. It is drank very freely by the chiefs and other conſiderable perſons, who vie with each other in drinking the greateſt number of draughts, each draught being about a pint: but it is carefully kept from their women.

AVADOUTAS, a ſect of Indian Bramins, who in auſterity ſurpaſs all the reſt. The other ſects retain earthen veſſels for holding their proviſions, and a ſtick to lean on: but none of theſe are uſed by the Avadoutas; they only cover their nakedneſs with a piece of cloth; and ſome of them lay even that aſide, and go ſtark naked, beſmearing their bodies with cow-dung. When hungry, ſome go into houſes, and, without ſpeaking, hold out their hand; eating on the ſpot whatever is given them. Others retire to the ſides of holy rivers, and there expect the peaſants to bring them proviſions, which they generally do very liberally.

AVAIL of Marriage, in Scots law, that caſualty in ward-holding, by which the ſuperior was intitled to a certain ſum from his vaſſal, upon his attaining the age of puberty, as the value or avail of his tocher.

AVALANCHES, a name given to prodigious ſnow-balls that frequently roll down the mountains in

Savoy, particularly Mount Blanc, to the extreme danger of ſuch adventurous travellers as attempt to aſcend thoſe ſtupendous heights. Some of the avalanches are about 200 feet diameter; being fragments of the ice-rocks which break by their own weight from the tops of the precipices. See *Mount Blanc*.

AVALON, a ſmall but ancient city of Burgundy in France, about 500 paces long and 300 broad. E. Long. 3. 5. N. Lat. 47. 38.

AVANIA, in the Turkiſh legiſlature, a fine for crimes and on deaths, paid to the governor of the place. In the places wherein ſeveral nations live together under a Turkiſh governor, he takes this profitable method of puniſhing all crimes among the Chriſtians or Jews, unleſs it be the murder of a Turk.

AVARICUM, an ancient town of the Bituriges in Gallia Celtica, ſituated on the rivulet Avara, in a very fertile ſoil (Cæſar). Now *Bourges* in Berry. E. Long. 2. 30. N. Lat. 47. 10.

AVAST, in the ſea-language, a term requiring to ſtop, or to ſtay.

AVAUNCHERS, among hunters, the ſecond branches of a deer's horns.

AUBAGNE, a town of Provence in France, ſituated on the river Veaune, on the road from Marſeilles to Toulon. The ſtates ſometimes hold their ſeſſions at this place. E. Long. 5. 52. N. Lat. 43. 17.

AUBAINE, in the cuſtoms of France, a right veſted in the king of being heir to a foreigner that dies within his dominions.

By this right the French king claims the inheritance of all foreigners that die within his dominions, notwithſtanding of any teſtament the deceaſed could make. An ambaſſador is not ſubject to the right of aubaine; and the Swiſs, Savoyards, Scots, Portugueſe, and citizens of the United States of North-America, are alſo exempted, being deemed natives and regnicoles.

AUBENAS, a town of Languedoc in France, ſituated on the river Ardeſche, at the foot of the mountains called the *Cevennes*, E. Long. 4. 32. N. Lat. 44. 40.

AUBENTON, a town of Picardy in France, ſituated on the river Aube. E. Long. 4. 25. N. Lat. 49. 51.

AUBETERRE, a town of France in the Angoumois, on the river Dronne. E. Long. 0. 10. N. Lat. 45. 15.

AUBIGNE, a town of Berry in France, ſituated on the river Verre, in a flat agreeable country. It is ſurrounded with high ſtrong walls, wide ditches, and high counterſcarps. The caſtle is within the town, and is very handſome. E. Long. 2. 20. N. Lat. 47. 29.

AUBIGNY, a dukedom in France belonging to the Dukes of Richmond in England; confirmed to the preſent duke, and regiſtered in the parliament of Paris 1777.

AUBIN DU COMIER, a town of Britanny in France. W. Long. 1. 15. N. Lat. 48. 15.

AUBIN, in horſemanſhip, a broken kind of gate, between an amble and a gallop, accounted a defect.

AUBONNE, a town of Switzerland, in the canton of Bern. E. Long. 5. 54. N. Lat. 48. 30. It is ſituated near a river of the ſame name, ſeven miles north of the lake of Geneva, upon an eminence which has a gentle declivity, at the foot of which runs the river with an impetuous torrent. The town is built in the form of an amphitheatre; on the upper part of which ſtands a very handſome caſtle with a fine court, and a portico ſupported by pillars of a ſingle ſtone each; above there is a covered gallery that runs round the court; and as the caſtle ſtands high, there is a moſt delightful proſpect, not only of the town and neighbouring fields, but of the whole lake of Geneva and the land that ſurrounds it. At Thonen, in Savoy on the other ſide of the lake, is a town covered with tin, which makes a glittering appearance when the ſun is in a certain poſition; and the caſtle of Aubonne has likewiſe a tower of the ſame kind, which at certain hours makes a ſimilar appearance to the Savoyards. The balliage of Aubonne contains ſeveral villages, which are moſtly at the foot of the mountain Jura. In one part of this mountain there is a very deep cave, wherein thoſe that go down find a natural and perpetual ice-houſe. At the bottom is heard a great noiſe like that of a ſubterraneous river, which is ſuppoſed to be that of the river Aubonne, becauſe it firſt appears, with ſeveral ſources, about 100 paces from the foot of that mountain.

AUBREY (John), a famous Engliſh antiquary, deſcended from an ancient family in Wiltſhire, was born in 1626. He made the hiſtory and antiquities of England his peculiar ſtudy and delight; and contributed conſiderable aſſiſtance to the famous *Monaſticon Anglicanum*. He ſucceeded to ſeveral good eſtates; but law-ſuits and other misfortunes conſumed them all, ſo that he was reduced to abſolute want. In this extremity he found a valuable benefactreſs in the Lady Long of Draycot in Wilts, who gave him an apartment in her houſe, and ſupported him to his death, which happened about the year 1700. He was a man of capacity, learning, and application, a good Latin poet, an excellent naturaliſt, but ſomewhat credulous, and tinctured with ſuperſtition. He left many works behind him. He wrote, 1. Miſcellanies. 2. A Perambulation of the county of Surry, in five volumes, octavo. 3. The Life of Mr Hobbes of Malmſbury. 4. *Monumenta Britannica*, or a diſcourſe concerning Stonehenge, and Roll-Rich ſtones in Oxfordſhire. 5. *Architectonica Sacra*; and ſeveral other works ſtill in manuſcript.

AUBURN, a market-town in Wiltſhire, in England. W. Long. 1. 20. N. Lat. 53. 20.

AUBUSSON, a ſmall town of France, in the province of La Marche, and the government of the Lyonnois. Its ſituation is very irregular, on the river Creuſe, in a bottom ſurrounded with rocks and mountains. A manufacture of tapeſtry is carried on here, by which the town is rendered very populous. E. Long. 2. 15. N. Lat. 45. 58.

AUCAUGREL, the capital of the kingdom of Adel in Africa, ſeated on a mountain. E. Long. 44. 25. N. Lat. 9. 10.

AUCH, a city of France, the capital of the county of Armagnac, and the metropolis of all Gaſcony. The archbiſhop aſſumes the title of primate of Aquitain. It lies on the ſummit and declivity of a very ſteep hill, which is ſurrounded by other hills that riſe at a ſmall diſtance; and through the vale below runs a rivulet, called the *Gers*. The inhabitants are about 6000; the buildings are modern and elegant; the ſtreets, though in general narrow, yet are clean and well paved. In the centre of the city ſtands the cathedral, which is one of the moſt magnificent in France, both as to its conſtruction and the internal decorations. The painted windows are only inferior to thoſe of Gouda in Holland. The chapels are of equal beauty, and ornamented at a prodigious expence. The revenues of the ſee of Auch, amount annually to three hundred thouſand livres.. The palace is a very handſome building; and its apartments are furniſhed with a voluptuous ſplendor, rather becoming a temporal than a ſpiritual prince. E. Long. 0. 40. N. Lat. 43. 40.

AUCTION, a kind of public ſale, very much in uſe for houſehold goods, books, plate, &c. By this method of ſale the higheſt bidder is always the buyer. This was originally a kind of ſale among the ancient Romans, performed by the public crier *ſub haſta, i. e.* under a ſpear ſtuck up on that occaſion, and by ſome magiſtrate, who made good the ſale by delivery of the goods.

AUDEUS, the chief of the Audeans, obtained the name of an heretic, and the puniſhment of baniſhment, for celebrating Eaſter in the manner of the Jews, and attributing an human form to the Deity. He died in the country of the Goths, about the year 370.

AUDEANISM, the ſame with anthropomorphiſm. See ANTHROPOMORPHITES.

AUDIENCE given to ambaſſadors, a ceremony obſerved in courts at the admiſſion of ambaſſadors or public miniſters to a hearing.

In England, audience is given to ambaſſadors in the preſence-chamber; to envoys and reſidents, in a gallery, cloſet, or in any place where the king happens to be. Upon being admitted, as is the cuſtom of all courts, they make three bows; after which they cover and ſit down; but not before the king is covered and ſat down, and has given them the ſign to put on their hats. When the king does not care to have them covered, and ſit, he himſelf ſtands uncovered; which is taken as a ſlight. At Conſtantinople, miniſters uſually have audience of the prime vizier.

AUDIENCE is alſo the name of a court of juſtice eſtabliſhed in the Weſt-Indies by the Spaniards, anſwering in effect to the parliament in France. Theſe courts take in ſeveral provinces, called alſo *audiences* from the names of the tribunal to which they belong.

AUDIENCE is alſo the name of an eccleſiaſtical court held by the archbiſhop of Canterbury, wherein differences upon elections, conſecrations, inſtitutions, marriages, &c. are heard.

AUDIENDO & TERMINANDO, a writ, or rather a commiſſion to certain perſons, when any inſurrection or great riot is committed in any place, for the appeaſing and puniſhment thereof.

AUDIENTES, or AUDITORES, in church-hiſtory, an order of catechumens; conſiſting of thoſe newly inſtructed in the myſteries of the Chriſtian religion, and not yet admitted to baptiſm.

AUDIT, a regular hearing and examination of an account by ſome proper officers, appointed for that purpoſe.

AUDITOR, in a general ſenſe, a hearer, or one who liſtens and attends to any thing.

AUDITOR, according to the Engliſh law, is an officer of the king, or ſome other great perſon, who, by examining yearly the accounts of the under officers, makes up a general book, with the difference between their receipts and charges, and their allowances to allocations.

AUDITORS of the Receipts, is an officer of the exchequer who files the tellers bills, makes an entry of them, and gives the lord treaſurer a certificate of the money received the week before. He alſo makes debentures to every teller, before they receive any money, and takes their accounts. He keeps the black book of receipts, and the treaſurer's key of the treaſury, and ſees every teller's money locked up in the new treaſury.

AUDITORS of the Revenue, or of the exchequer, officers who take the accounts of thoſe who collect the revenues and taxes raiſed by parliament, and take the accounts of the ſheriffs, eſcheators, collectors, tenants, and cuſtomers, and ſet them down in a book, and perfect them.

AUDITORS of the Preſt and Impreſt, officers of the exchequer, who take and make up the accounts of Ireland, Berwick, the mint, and of any money impreſſed to any man for the king's ſervice. They received poundage on all accounts paſſed by them, which amounted to a prodigious ſum, eſpecially in time of war. But the office is now aboliſhed, and L. 7000 a year given to the incumbents.

AUDITORS Collegiate, Conventual, &c. officers formerly appointed in colleges, &c. to examine and paſs their accounts.

AUDITORES, in church hiſtory. See AUDIENTES.

The auditores formed one branch of the Manichean ſect, which was divided into *elect* and *auditors*; correſponding, according to ſome writers, to *clergy* and *laity*; and according to others, to the *faithful* and *catechumens* among the Catholics. By the Manichean rule, a different courſe of life was preſcribed to the elect from that of the auditors. The latter might eat fleſh, drink wine, bathe, marry, traffic, poſſeſs eſtates, bear magiſtracy, and the like; all which things were forbidden to the elect. The auditors were obliged to maintain the elect, and kneeled down to aſk their bleſſing. Beauſobre obſerves, that the elect were eccleſiaſtics, and in general ſuch as made profeſſion of obſerving certain counſels, called *evangelic*; ſuch as the clergy and Monks; and they were called the *perfect* by Theodoret. The auditors were the laity, and ſo denominated, becauſe they heard in the church whilſt others taught and inſtructed.

AUDITORIUM, in the ancient churches, was that part of the church where the audientes ſtood to hear and be inſtructed.

The auditorium was that part now called *navis eccleſiæ* *. In the primitive times, the church was ſo ſtrict in keeping the people together in that place, that the perſon who went from thence in ſermon-time was ordered by the council of Carthage to be excommunicated.

* See *Nave*.

AUDITORY, ſomething relating to the ſenſe of hearing.

AUDITORY, or AUDIENCE, an aſſembly of people who attend to hear a perſon that ſpeaks in public.

Auditory is alſo uſed for the bench whereon a magiſtrate or judge hears cauſes.

Auditory, in ancient churches. See Auditorium.

Auditory Paſſage, (meatus auditorius), in anatomy; the entrance of the ear. See Anatomy, p. 763, nº 141.

Auditory Nerves. See Anatomy, p. 760.

AUDRAN (Claude), a French engraver, the firſt of the celebrated artiſts of that name, was the ſon of Lewis Audran, an officer belonging to the wolf-hunters in the reign of Henry IV. of France; and was born at Paris in 1592. He never made any great progreſs in the art; ſo that his prints are held in little or no eſtimation. Yet though he acquired no great reputation by his own works, it was no ſmall honour to him to be the father of three great artiſts, Germain, Claude, and Girard; the laſt of whom has immortalized the name of the family for ever. Claude Audran retired from Paris to Lyons, where he reſided, and died in 1677.

Audran (Carl), a very eminent engraver, was brother to the preceding, though ſome aſſert he was only his couſin-german, and was born at Paris in 1594. In his infancy he diſcovered much taſte, and a great diſpoſition for the arts; and to perfect himſelf in engraving, which he appears to have been chiefly fond of, he went to Rome, where he produced ſeveral prints that did him great honour. At his return, he adopted that ſpecies of engraving which is performed with the graver only. He ſettled at Paris, where he died in 1674, without having ever been married. The Abbé Marolles, who always ſpeaks of this artiſt with great praiſe, attributes 130 prints to him: amongſt which, the *annunciation*, a middling-ſized plate, upright, from Annabale Carracci; and the *aſſumption*, in a circle, from Domenichino, are the moſt eſteemed. In the early part of his life he marked his prints with C, or the name of Carl, till his brother Claude publiſhed ſome plates with the initial only of his baptiſmal name; when, for diſtinction ſake, he uſed the letter K, or wrote his name Karl, with the K inſtead of the C.

Audran (Germain), the eldeſt ſon of Claude, mentioned in the preceding article but one, was born in 1631 at Lyons, where his parents then reſided. Not content with the inſtructions of his father, he went to Paris, and perfected himſelf under his uncle Carl; ſo that, upon his return to Lyons, he publiſhed ſeveral prints which did great honour to his graver. His merit was in ſuch eſtimation, that he was made a member of the academy eſtabliſhed in that town, and choſen a profeſſor. He died at Lyons in 1710, and left behind him four ſons, all artiſts; namely, Claude, Benoiſt, John, and Louis.

Audran (Claude), the ſecond of this name, and ſecond ſon to Claude abovementioned, was born at Lyons in 1639, and went to Rome to ſtudy painting, where he ſucceeded ſo well, that at his return he was employed by Le Brun to aſſiſt him in the battles of Alexander, which he was then painting for the king of France. He was received into the Royal Academy in the year 1675, and died unmarried at Paris in 1684. His virtues, (ſays Abbé Fontenai) were as praiſe-worthy as his talents were great. M. Heineken mentions this artiſt as an engraver, without ſpecifying any of his works in that line.

Audran (Girard, or Gerard), the moſt celebrated artiſt of the whole family of the Audrans, was the third ſon of Claude Audran mentioned in a preceding article, and born at Lyons, in 1640. He learned from his father the firſt principles of deſign and engraving; and following the example of his brother, he left Lyons and went to Paris, where his genius ſoon began to manifeſt itſelf. His reputation there brought him to the knowledge of Le Brun, who employed him to engrave the *battle of Conſtantine*, and the *triumph* of that emperor; and for theſe works he obtained apartments at the Gobelins. At Rome, whither he went for improvement, he is ſaid to have ſtudied under Carlo Maratti, in order to perfect himſelf in drawing; and in that city, where he reſided three years, he engraved ſeveral fine plates. M. Colbert, that great encourager of the arts, was ſo ſtruck with the beauty of Audran's works while he reſided at Rome, that he perſuaded Louis XIV. to recall him. On his return, he applied himſelf aſſiduouſly to engraving; and was appointed engraver to the king, from whom he received great encouragement. In the year 1681 he was named counſellor of the Royal Academy; and died at Paris in 1703. He had been married; but left no male iſſue behind him.

Strutt's Dictionary.

The great excellency of this artiſt above that of any other engraver was, that though he drew admirably himſelf, yet he contracted no manner of his own; but tranſcribed on copper ſimply, with great truth and ſpirit, the ſtyle of the maſter whoſe pictures he copied. On viewing his prints you loſe ſight of the engraver, and naturally ſay, it is Le Brun, it is Pouſſin, it is Mignard, or it is Le Sueur, &c. as you turn to the prints which he engraved from thoſe maſters. Let any one examine the *battles* above-mentioned from Le Brun, the *preſervation of the young Pyrrhus* from Nicholas Pouſſin, the *peſt* from Mignard, and the *martyrdom of St Lawrence* from Le Sueur, and then judge candidly of the truth of this obſervation. The following judicious obſervations by the Abbé Fontenai, taken chiefly from M. Baſan, with ſome ſmall variation and additions, will fully illuſtrate the merits of Gerard Audran. "This ſublime artiſt, far from conceiving that ſervile arrangement of ſtrokes, and the too frequently cold and affected clearneſs of the graver, were the great eſſentials of hiſtorical engraving, gave worth to his works by a bold mixture of free hatchings and dots, placed together apparently without order, but with an inimitable degree of taſte; and has left to poſterity moſt admirable examples of the ſtyle in which grand compoſitions ought to be treated. His greateſt works, which have not a very flattering appearance to the ignorant eye, are the admiration of true connoiſſeurs and perſons of fine taſte. He acquired the moſt profound knowledge of the art by the conſtant attention and ſtudy which he beſtowed upon the ſcience of deſign, and the frequent uſe he made of painting from nature. This great man always knew how to penetrate into the genius of the painter he copied from; often improved upon, and ſometimes even ſurpaſſed him. Without exception, he was the moſt celebrated engraver that ever exiſted in the hiſtorical line. We have ſeveral ſubjects which he engraved from his own deſigns, that manifeſted as much taſte as character and facility. But, in the *battles of Alexander,* he ſurpaſſed even the expectations of Le Brun himſelf." Theſe conſiſt of three very large prints, length-ways, each conſiſting of four plates, which join together, from Le Brun, namely, *the paſſage of the Granicus; the battle of Arbela; Porus brought to Alexander,* after his defeat.—To this ſet are added two more large prints, length-ways, on two plates each, alſo from Le Brun, as follow: *Alexander entering the tent of Darius;* and *The Triumphal entry of Alexander into Babylon.* The former was engraved by Girard Edelink, and the latter by Girard Audran. It is to be remarked of all theſe plates, that thoſe impreſſions are generally moſt eſteemed which have the name of Goyton the printer marked upon them.—The *Peſt,* from Peter Mignard, a large plate, length-ways, alſo deſerves particular notice. In the firſt impreſſions, the figure in the clouds is Juno with her peacock behind her; in the latter, the peacock is obliterated, and the wings of an angel are added to the figure.

AUDRAN (Benoit), the ſecond ſon of Germain Audran, was born at Lyons, in 1661, where he learned the firſt principles of deſign and engraving under the inſtruction of his father. But ſoon after going to Paris, his uncle Girard Audran took him under his tuition; and Benoit ſo greatly profited by his inſtructions, that though he never equalled the ſublime ſtyle of his tutor, yet he deſervedly acquired great reputation. Nay, the Abbé Fontenai adds this eulogium: "We admire in his works a ſhare of thoſe beauties which we find in the engravings of the illuſtrious Girard." He was honoured with the appellation of the king's engraver, and received the royal penſion. He was made an academician, and admitted into the council in 1715. He died unmarried at Louzouer, where he had an eſtate, in 1721. His manner was founded on the bold clear ſtyle of his uncle. His outlines were firm and determined; his drawing correct; the heads of his figures are in general very expreſſive; and the other extremities well marked. His works, when compared with thoſe of his uncle, appear to want that mellowneſs and harmony which are ſo conſpicuous in the latter; they are more dry; and the round dots with which he finiſhes his fleſh upon the lights are often too predominant. In his moſt finiſhed plates, we find the mechanical part of the engraving extremely neat, and managed with great taſte and judgment. Among his neateſt prints may be reckoned that which repreſents *Alexander ſick,* drinking from the cup which his phyſician preſents to him; a circular plate, from Le Sueur.

AUDRAN (John), the third ſon of Germain Audran, was born at Lyons in 1667; and, after having received inſtructions from his father, went to Paris to perfect himſelf in the art of engraving under his uncle Girard Audran. At the age of 20 years, the genius of this great artiſt begun to diſplay itſelf in a ſurpriſing manner; and his future ſucceſs was ſuch, that in 1707, he obtained the title of engraver to the king, and had a penſion allowed him by his majeſty, with apartments in the Gobelins; and the following year he was made a member of the Royal Academy. He was 80 years of age before he quitted the graver; and near 90 when he died at his apartments aſſigned him by the king. He left three ſons behind him; one of whom was alſo an engraver, as we ſhall ſee below. "The moſt maſterly and beſt prints of this artiſt (in Mr Strutt's opinion) are thoſe which are not ſo pleaſing to the eye at firſt ſight. In theſe the etching conſtitutes a great part; and he has finiſhed them in a bold rough ſtyle. The ſcientific hand of the maſter appears in them on examination. The drawing of the human figure, where it is ſhewn, is correct. The heads are expreſſive and finely finiſhed; the other extremities well marked. He has not, however, equalled his uncle. He wants that harmony in the effect; his lights are too much and too equally covered; and there is not ſufficient difference between the ſtyle in which he has engraved his back grounds and his draperies. This obſervation refers to a fine print by him of Athaliah, and ſuch as he engraved in that ſtyle. At other times he ſeems almoſt to have quitted the point, and ſubſtituted the graver. But here I think he has not ſo well ſucceeded. The effect is cold and ſilvery: ſee, for example, the *Andromache* from Sylveſtre. One of his beſt finiſhed prints, in this neat ſtyle, ſeems to me to be *Cupid* and *Pſyche* from Ant. Coypel."

AUDRAN (Louis), the laſt ſon of Germain Audran, was born at Lyons in 1670; from whence he went to Paris, after the example of his brothers, to complete his ſtudies in the ſchool of his uncle Girard. He died ſuddenly at Paris in 1712, before he had produced any great number of prints by his own hand. He aſſiſted, it is preſumed, his brothers in their more extenſive works. Among the moſt eſteemed prints by this artiſt are *the ſeven acts of mercy,* on ſeven middling-ſized plates, length-ways, from Sebaſtian Bourdon.

AUDRAN (Benoit), the ſecond engaver of that name, was the ſon of John Audran, and nephew to the former Benoit; and was alſo eſtabliſhed at Paris. He engraved but a few plates. It is neceſſary, however, to be careful not to confound him with his uncle. But a little attention will eaſily prevent this miſtake; for the ſecond Benoit is vaſtly inferior to the firſt in point of merit. We have ſome few portraits by this artiſt; and among other plates, *the deſcent from the croſs,* from a picture of Pouſſin.

AVEIRO, a conſiderable city of Portugal, ſeated near the head of a ſmall gulf formed by the tide at the mouth of the river Vouga. This river forms a ſmall haven with a bar, over which veſſels may paſs that do not draw above eight or nine feet water. The city ſtands in a long plain, well watered, and very fertile. This plain is nine miles broad, from Porto to Coimbro; and is bounded on the eaſt by a chain of mountains called *Sara d'Alcoba,* which reach from the one town to the other. Near this city there is ſalt made in ſufficient quantity to ſerve two or three provinces. Here is a remarkable nunnery, where none are received but the daughters of the ancient nobility. The inhabitants of Aveiro have the ſingular privilege, that no ſtranger whatever can paſs a night there without leave of the magiſtrate. W. Long. 9. 8. N. Lat. 40. 30.

AVELLANE, in heraldry, a croſs, the quarters of which ſomewhat reſemble a filbert-nut. Sylvanus Morgan ſays, that it is the croſs which enſigns the mound of authority, or the ſovereign's globe.

AVELLINO, a city of Italy, in the kingdom of Naples, with a biſhop's ſee. It was almoſt ruined by an earthquake in 1694. It is, however, at preſent a pretty conſiderable place, extending a mile in length down the declivity of a hill, with ugly ſtreets but tolerable houſes. The churches have nothing to recommend them, being crowded with monſtrous ornaments in a barbarous ſtyle, which the Neapolitans ſeem to have borrowed from the Spaniards. The cathedral is a poor building, in a wretched ſituation, with little to attract the eye. The good people here need not run to Naples to ſee the blood of St. Januarius; for they have a ſtatue of St Lawrence, with a phial of his blood, which for eight days in Auguſt entertains them with a ſimilar miraculous liquefaction. Their only edifice of note is a public granary, of the Compoſite order, adorned with antique ſtatues, and a very elegant bronze one of Charles II. of Spain, while a boy, caſt by Cavalier Coſimo. The number of inhabitants amounts to 8000, ſome ſay 10,000. The biſhop's revenue is about 6000 ducats (L. 1125) a-year. The magiſtracy conſiſts of a Syndic and four Eletti, all annual; which offices are engroſſed by a certain number of families of ſome diſtinction, that neither intermarry nor aſſociate with the reſt of the burghers. There is a conſiderable manufacture of cloth here of various qualities and colours, but chiefly blue. Many wealthy merchants have a concern in this buſineſs, ſome with a capital of eighty thouſand ducats (L. 15,000). The poor women who ſpin the wool muſt work very hard to earn above four grana a-day. The ſecond article of trade is maccaroni and paſte of many kinds, which being of an excellent quality, are in high repute all over the country. Wooden chairs are alſo made and ſold here in great quantities. Avellino abounds with proviſions of every ſort; each ſtreet is ſupplied with wholeſome water; the wine is but indifferent. The ſoil of this diſtrict, which conſiſts chiefly of volcanic ſubſtances, produces little corn, but fruit in abundance, of which the apple is deſervedly held in great eſteem. The moſt profitable, however, of all its fruit-trees is the hazel. Nut buſhes cover the face of the valley, and in good years bring in a profit of ſixty thouſand ducats (L. 11,250). The nuts are moſtly of the large round ſpecies of filbert, which we call *Spaniſh*. Theſe buſhes were originally imported into Italy from Pontus, and known among the Romans by the appellation of *Nux Pontica*, which in proceſs of time was changed into that of *Nux Avellana*, from the place where they had been propagated with the greateſt ſucceſs. The proprietors plant them in rows, and by dreſſing, form them into large buſhes of many ſtems. Every year they refreſh the roots with new earth, and prune off the ſtraggling ſhoots with great attention.

AVE-MARIA, the angel Gabriel's ſalutation of the Virgin Mary, when he brought her the tidings of the incarnation.—It is become a prayer or form of devotion in the Romiſh church. Their chaplets and roſaries are divided into ſo many ave-marias, and ſo many pater-noſters, to which the Papiſts aſcribe a wonderful efficacy.

AVENA, OATS: A genus of the digynia order, belonging to the triandria claſs of plants; and in the natural method ranking under the 4th order, *Gramina*. The calyx has a double valve, and the awn on the back is contorted. The ſpecies are 13; ſix of them natives of Britain: *viz.* 1. The nuda, or naked oats. 2. The fatua, or bearded oat-graſs. 3. The pratenſis, or meadow oat-graſs. 4. The pubeſcens, or rough oat-graſs. 5. The elatior, or tall oat-graſs. 6. The flaveſcens, or yellow oat-graſs. It is remarkable, that the native place of the ſativa, or common oat, cultivated in our fields, is almoſt totally unknown. Anſon ſays, that he obſerved it growing wild or ſpontaneouſly in the iſland of Juan Fernandez. But a vague obſervation from an author of that kind is not to be depended on.—For the culture, ſee AGRICULTURE, nº 137.

Oats are an article of the materia medica. Gruels made from them have a kind of ſoft mucilaginous quality; by which they obtund acrimonious humours, and prove uſeful in inflammatory diſeaſes, coughs, hoarſeneſs, and exulcerations of the fauces.

AVENACEOUS, ſomething belonging to or partaking of the nature of oats.

AVENAGE, in law, a certain quantity of oats paid by a tenant to a landlord, inſtead of rent or ſome other duties.

AVENCHE, an ancient city of Switzerland, in the canton of Bern, formerly the capital of all Switzerland, but now ſhows its former greatneſs only by its ruins. E. Long. 7. 7. N. Lat. 46. 50.

AVENES, a ſmall but ſtrong town in French Flanders, in the county of Hainalt, ſeated on the river Theſpes. It contains about 2500 inhabitants; but the houſes are wretchedly built, and the ſtreets irregular. It was fortified by M. Vauban in a ſtrong regular manner. About this place are a prodigious number of white ſtones proper for building, and uſed by ſculptors for ſtatues: they are known by the name of *Stones of Avenes*. E. Long. 3. 40. N. Lat. 50. 10.

AVENIO, an ancient town of the Cavares, and one of the moſt opulent in Gallia Narbonenſis; now *Avignon*, in Provence. See AVIGNON.

AVENOR, an officer belonging to the king's ſtables, who provides oats for the horſes. He acts by warrant from the maſter of the horſe.

AVENS, in botany. See CARIOPHILLUS.

AVENTINE (John), author of the Annals of Bavaria, was born of mean parentage, in the year 1466, at Abenſperg in the country juſt named. He ſtudied firſt at Ingoldſtadt, and afterwards in the univerſity of Paris. In 1503, he privately taught eloquence and poetry at Vienna; and in 1507, he publicly taught Greek at Cracow in Poland. In 1509, he read lectures on ſome of Cicero's pieces at Ingoldſtadt; and in 1512, was appointed to be preceptor to prince Lewis and prince Erneſt, ſons of Albert the Wiſe, duke of Bavaria; and travelled with the latter of thoſe two princes. After this he undertook to write the Annals of Bavaria, being encouraged by the dukes of that name, who ſettled a penſion upon him, and gave him hopes that they would defray the charges of the book. This work, which gained its author great reputation, was firſt publiſhed in 1554, by Jerome Zieglerus, profeſſor of poetry in the univerſity of Ingoldſtadt; and afterwards at Baſil in 1580, by Nicholas Ciſner. An affront which Aventine received in the year 1529, ſtuck by him all the reſt of his life: he was forcibly taken out of his ſiſter's houſe at Abenſperg, and hurried to a jail; the true cauſe of which violence was never known: but it would probably have been carried to a much greater length, had not the Duke of Bavaria interpoſed, and taken this learned man into his protection. Mr Bayle remarks, that the incurable melancholy which from this time poſſeſſed Aventine, was ſo far from determining him to lead a life of celibacy, as he had done till he was 64, that it induced him perhaps to think of marrying. The violence of his new paſſion was not, however, ſo great, but that it ſuffered him to adviſe with two of his friends, and conſult certain paſſages of the bible relative to marriage. The reſult was, that it was beſt for him to marry; and having already loſt too much time, conſidering his age, he took the firſt woman he met with, who happened to be his own maid, ill-tempered, ugly, and extremely poor. He died in 1534, aged 68; leaving one daughter, who was then but two months old. He had a ſon, who died before.

AVENTINUS MONS, one of the ſeven hills on which ancient Rome ſtood. The origin of the name *Aventinus* is uncertain: but this hill was alſo called *Murcius*, from Murcia the goddeſs of ſloth, who had a little chapel there; and *Collis Dianæ*, from the temple of Diana; likewiſe *Remonius*, from Remus, who wanted to build the city and who was buried there. It was taken within the compaſs of the city by Ancus Marcius. To the eaſt it had the city walls; to the ſouth the Campus Figulinus; to the weſt, the Tiber; and to the north, Mons Palatinus, in circuit two miles and a quarter.

AVENTURE, in law-books, means a miſchance cauſing the death of a perſon without felony.

AVENUE, in gardening, a walk planted on each ſide with trees, and leading to an houſe, garden-gate, wood, &c. and generally terminated by ſome diſtant object.

All avenues that lead to a houſe ought to be at leaſt as wide as the whole front of the houſe, if wider they are better ſtill; and avenues to woods and proſpects ought not to be leſs than 60 feet wide. The trees ſhould not be planted nearer to one another than 35 feet, eſpecially if they are trees of a ſpreading kind; and the ſame ought to be the diſtance, if they are for a regular grove.

The trees moſt proper for avenues with us, are the Engliſh elm, the lime, the horſe-cheſnut, the common cheſnut, the beach, and the abele. The Engliſh elm will do in all grounds, except ſuch as are very wet and ſhallow; and this is preferred to all other trees, becauſe it will bear cutting, heading, or lopping in any manner, better than moſt others. The rough or ſmooth Dutch elm is approved by ſome, becauſe of its quick growth; this is a tree which will bear removing very well, it is alſo green almoſt as ſoon as any plant whatever in ſpring, and continues ſo as long as any, and it makes an incomparable hedge, and is preferable to all other trees for lofty eſpaliers. The lime is valued for its natural growth and fine ſhade. The horſe-cheſnut is proper for all places that are not too much expoſed to rough winds. The common cheſnut will do very well in a good ſoil; and riſes to a conſiderable height, when planted ſomewhat cloſe; though, when it ſtands ſingle, it is rather inclined to ſpread than to grow tall. The beech is a beautiful tree, and naturally grows well with us in its wild ſtate; but it is leſs to be choſen for avenues than the before-mentioned, becauſe it does not bear tranſplanting well, but it is very ſubject to miſcarry. Laſtly, the abele is fit for any ſoil, and is the quickeſt grower of any foreſt-tree. It ſeldom fails in tranſplanting; and ſucceeds very well in wet ſoils, in which the others are apt to fail. The oak is but little uſed for avenues, becauſe of its ſlow growth.

The old method of planting avenues was with regular rows of trees, and this has been always kept to till of late: but we have now a much more magnificent way of planting avenues; this is by ſetting the trees in clumps, or platoons, making the opening much wider than before, and placing the clumps of trees at about 300 feet diſtant from one another. In each of theſe clumps there ſhould be planted either ſeven or nine trees; but it is to be obſerved, that this is only to be practiſed where the avenue is to be of ſome conſiderable length, for in ſhort walks this will not appear ſo ſightly as ſingle rows of trees. The avenues made by clumps are fitteſt of all for parks. The trees in each clump ſhould be planted about 30 feet aſunder; and a trench ſhould be thrown up round the whole clump, to prevent the deer from coming to the trees to bark them.

AVENZOAR, ABU MERWAN ABDALMALEC EBN ZOHR, an eminent Arabian phyſician, flouriſhed about the end of the eleventh or the beginning of the twelfth century. He was of noble deſcent, and born at Seville, the capital of Andaluſia, where he exerciſed his profeſſion with great reputation. His grandfather and father were both phyſicians. The large eſtate he inherited from his anceſtors, ſet him above practiſing altogether for gain: he therefore took no fees from the poor, or from artificers, though he refuſed not the preſents of princes and great men. His liberality was extended even to his enemies; for which reaſon he uſed to ſay, that they hated him not for any fault of his, but rather out of envy. Dr Friend writes, that he lived to the age of 135; that he began to practiſe at 40, or (as others ſay) at 20; and had the advantage of a longer experience than almoſt any one ever had, for he enjoyed perfect health to his laſt hour. He left a ſon, known alſo by the name of *Ebn Zohr*, who followed his father's profeſſion, was in great favour with Al Manzûr emperor of Morocco, and wrote ſeveral treatiſes of phyſic.

Avenzoar was cotemporary with Averroes, who, according to Leo Africanus heard the lectures of the former, and learned phyſic of him; this ſeems the more probable, becauſe Averroes more than once gives Avenzoar a very high and deſerved encomium, calling him *admirable, glorious, the treaſure of all knowledge,* and *the moſt ſupreme in phyſic from the time of Galen to his own.* Avenzoar, notwithſtanding, is by the generality of writers reckoned an empiric: But Dr Friend obſerves, that this character ſuits him leſs than any of the reſt of the Arabians. "He was bred," continues that author, "in a phyſical family, his father and grandfather being both practitioners, whom he always remembers with great gratitude and honour. We have his own teſtimony that he had a regular education; and that he not only learned what properly belongs to a phyſician, but, out of a great deſire of knowledge, every thing beſides which relates to pharmacy or ſurgery." Dr Friend afterwards obſerves, "that he was averſe to quackery, and rejects the idle ſuperſtitions of aſtrologers; and throughout all his work profeſſes himſelf

ſelf ſo much of the dogmatical or rational ſect, which was directly oppoſite to the empirical, that he has a great deal of reaſoning about the cauſes and ſymptoms of diſtempers; and as in his theory he chiefly, if not only, follows Galen, ſo he quotes him upon all occaſions, oftener than the reſt of the Arabians do. Notwithſtanding he is ſo Galenical, there are ſeveral particulars in him which ſeldom or never occur in other authors; and there are ſome caſes which he relates from his own experience, which are worth peruſing." He wrote a book entitled, *Tayaſſir fi'lmadâwât w'altadbîr*, i. e. "The method of preparing medicines and diet:" which is much eſteemed. This work was tranſlated into Hebrew, in the year of Chriſt 1280, and thence into Latin by Paravicius, whoſe verſion has had ſeveral editions. The author added a ſupplement to it, under the title of *Jâmé*, or *a Collection*. He alſo wrote a treatiſe *Fi'ladwiyat wa'laughdiyat*, i. e. "Of Medicines and Food;" wherein he treats of their qualities.

AVERAGE, in commerce, ſignifies the accidents and misfortunes which happen to ſhips and their cargoes, from the time of their loading and ſailing to their return and unloading; and is divided into three kinds. 1. The ſimple or particular average, which conſiſts in the extraordinary expences incurred for the ſhip alone, or for the merchandizes alone. Such is the loſs of anchors, maſts, and rigging, occaſioned by the common accidents at ſea; the damages which happen to merchants by ſtorm, prize, ſhipwreck, wet, or rotting; all which muſt be borne and paid by the thing which ſuffered the damage. 2. The large and common average, being thoſe expences incurred, and damages ſuſtained, for the common good and ſecurity both of the merchandizes and veſſels, conſequently to be borne by the ſhip and cargo, and to be regulated upon the whole. Of this number are the goods or money given for the ranſom of the ſhip and cargo, things thrown overboard for the ſafety of the ſhip, the expences of unloading for entering into a river or harbour, and the proviſions and hire of the ſailors when the ſhip is put under an embargo. 3. The ſmall averages, which are the expences for towing and piloting the ſhip out of or into harbours, creeks or rivers, one-third of which muſt be charged to the ſhip, and two-thirds to the cargo.

AVERAGE is more particularly uſed for a certain contribution that merchants make proportionably to their loſſes, who have had their goods caſt into the ſea in the time of a tempeſt. It alſo ſignifies a ſmall duty which thoſe merchants, who ſend goods in another man's ſhip, pay to the maſter for his care of them over and above the freight. Hence it is expreſſed in the bills of lading, paying ſo much freight for the ſaid goods, with primage and *average* accuſtomed.

AVERDUPOIS. See AVOIRDUPOIS.

AVERNUS, a lake of Campania in Italy, near Baiæ, famous among the ancients for its poiſonous qualities. It is deſcribed by Strabo as lying within the Lucrine bay, deep and darkſome, ſurrounded with ſteep banks that hang threatening over it, and only acceſſible by the narrow paſſage through which you ſail in. Black aged groves ſtretched their boughs over the watry abyſs, and with impenetrable foliage excluded almoſt every ray of wholeſome light; mephitic vapours aſcending from the hot bowels of the earth, being denied free paſſage to the upper atmoſphere, floated along the ſurface in poiſonous miſts. Theſe circumſtances produced horrors fit for ſuch gloomy deities; a colony of Cimerians, as well ſuited to the rites as the place itſelf, cut dwellings in the boſom of the ſurrounding hills, and officiated as prieſts of Tartarus. Superſtition always delighting in dark ideas, early and eagerly ſeized upon this ſpot, and hither ſhe led her trembling votaries to celebrate her diſmal orgies; here ſhe evoked the manes of departed heroes—here ſhe offered ſacrifices to the gods of hell, and attempted to dive into the ſecrets of futurity. Poets enlarged upon the popular theme, and painted its awful ſcenery with the ſtrongeſt colours of their art. Homer brings Ulyſſes to Avernus, as to the mouth of the infernal abodes; and in imitation of the Grecian bard, Virgil conducts his hero to the ſame ground. Whoever ſailed thither, firſt did ſacrifice; and endeavoured to propitiate the infernal powers, with the aſſiſtance of ſome prieſts who attended upon the place, and directed the myſtic performance. Within, a fountain of pure water broke out juſt over the ſea, which was fancied to be a vein of the river Styx; near this fountain was the oracle, and the hot waters frequent in thoſe parts were ſuppoſed to be branches of the burning Phlegethon. The poiſonous effluvia from this lake were ſaid to be ſo ſtrong, that they proved fatal to birds endeavouring to fly over it. Virgil aſcribes the exhalation not to the lake itſelf, but to the cavern near it, which is called *Avernus*, or *Cave of the Sibyl*, and through which the poets feigned a deſcent to hell. Hence the proper name of the lake is *Lacus Averni*, the "lake near the cavern," as it is called by ſome ancient authors.

The holineſs of theſe ſhades remained unimpeached for many ages: Hannibal marched his army to offer incenſe at this altar; but it may be ſuſpected he was led to this act of devotion rather by the hopes of ſurpriſing the garriſon of Puteoli, than by his piety. After a long reign of undiſturbed gloom and celebrity, a ſudden glare of light was let in upon Avernus; the horrors were diſpelled, and with them vaniſhed the ſanctity of the lake; the axe of Agrippa brought its foreſt to the ground, diſturbed its ſleepy waters with ſhips, and gave room for all its malignant effluvia to eſcape. The virulence of theſe exhalations, as deſcribed by ancient authors, has appeared ſo very extraordinary, that modern writers, who know the place in a cleared ſtate only, charge theſe accounts with exaggeration: but Mr Swinburn thinks them entitled to more reſpect; for even now, he obſerves, the air is feveriſh and dangerous, as the jaundiced faces of the vine-dreſſers, who have ſucceeded the Sibyls and the Cimmerians in the poſſeſſion of the temple, moſt ruefully teſtify. Boccaccio relates, that during his reſidence at the Neapolitan court, the ſurface of this lake was ſuddenly covered with dead fiſh, black and ſinged, as if killed by ſome ſubaqueous eruption of fire.

At preſent the lake abounds with tench; the Lucrine with eels. The change of fortune in theſe lakes, is ſingular: In the ſplendid days of imperial Rome the Lucrine was the choſen ſpot for the brilliant parties of pleaſure of a voluptuous court; now, a ſlimy bed of ruſhes covers the ſcattered pools of this once beautiful ſheet of water; while the once duſky Avernus is clear and ſerene, offering a moſt alluring ſurface and charming ſcene for ſimilar amuſements. Oppoſite to the temple is a cave uſually ſtyled the Sybil's grotto; but apparently more likely to have been the mouth of a communication between Cuma and Avernus, than the abode of a propheteſs; eſpecially as the ſybil is poſitively ſaid by hiſtorians to have dwelt in a cavern under the Cumean citadel.

AVERRHOA in botany: A genus of the decandria order, belonging to the pentagynia claſs of plants; and in the natural method ranking under the 14th order, *Gruinales* The calyx has 5 leaves, the petals are 5, opening at top; and the apple or fruit is pentagonous, and divided into 5 cells. There are 3 ſpecies, viz. the blimbi, the carambola, and the acida, all natives of the Indies.

Phil. Tranſ. vol. 75. part 2.

The ſecond of theſe, the carambola, called in Bengal the *camrue* or *camrunga*, is remarkable for poſſeſſing a power ſomewhat ſimilar to thoſe ſpecies of Mimoſa which are termed *ſenſitive plants;* its leaves, on being touched, moving very perceptibly. In the mimoſa the moving faculty extends to the branches; but from the hardneſs of the wood, this cannot be expected in the camrunga. The leaves are alternately pinnated, with an odd one; and in their moſt common poſition in the day-time are horizontal, or on the ſame plane with the branch from which they come out. On being touched, they move themſelves downward, frequently in ſo great a degree that the two oppoſite almoſt touch one another by their under ſides, and the young ones ſometimes either come into contact or even paſs each other. The whole of the leaves of one pinna move by ſtriking the branch with the nail of the finger or other hard ſubſtance; or each leaf can be moved ſingly, by making an impreſſion that ſhall not extend beyond that leaf. In this way the leaves of one ſide of the pinna may be made to move, one after another, whilſt the oppoſite continue as they were; or you may make them move alternately, or in ſhort in any order you pleaſe, by touching in a proper manner the leaf you wiſh to put in motion. But if the impreſſion, although made on a ſingle leaf, be ſtrong, all the leaves on that pinna, and ſometimes on the neighbouring ones, will be affected by it. Notwithſtanding this apparent ſenſibility of the leaf, however, large inciſions may be made in it with a pair of ſharp ſciſſars, without occaſioning the ſmalleſt motion; nay, it may even be cut almoſt entirely off, and the remaining part ſtill continue unmoved, when by touching the wounded leaf with the finger or point of the ſciſſars, motion will take place as if no injury had been offered. The reaſon of this is, that although the leaf be the oſtenſible part which moves, it is in fact entirely paſſive, and the petiolus is the ſeat both of ſenſe and action: for although the leaf may be cut in pieces, or ſqueezed with great force, provided its direction be not changed without any motion being occaſioned; yet if the impreſſion on the leaf be made in ſuch a way as to affect the petiolus, the motion will take place. When, therefore, it is wanted to confine the motion to a ſingle leaf, you either touch it ſo as only to affect its own petiolus, or without meddling with the leaf, touch the petiolus with any ſmall-pointed body, as a pin or knife. By compreſſing the univerſal petiolus near the place where a partial one comes out, the leaf moves in a few ſeconds in the ſame manner as if you had touched the partial petiolus.

Whether the impreſſion be made by puncture, percuſſion, or compreſſion, the motion does not inſtantly follow: generally ſeveral ſeconds intervene, and then it is not by a jirk, but regular and gradual. Afterwards, when the leaves return to their former ſituation, which is commonly a quarter of an hour or leſs, it is in ſo ſlow a manner as to be almoſt imperceptible.

On ſticking a pin into the univerſal petiolus at its origin, the leaf next it, which is always on the outer ſide, moves firſt; then the firſt leaf on the oppoſite ſide, next the ſecond leaf on the outer, and ſo on. But this regular progreſſion ſeldom continues throughout; for the leaves on the outer ſide of the pinna ſeem to be affected both more quickly, and with more energy, than thoſe of the inner; ſo that the fourth leaf on the outer ſide frequently moves as ſoon as the third on the inner; and ſometimes a leaf, eſpecially on the inner ſide, does not move at all, whilſt thoſe above and below it are affected in their proper time. Sometimes the leaves at the extremity of the petiolus move ſooner than ſeveral others which were nearer the place where the pin was put in. On making a compreſſion with a pair of pincers on the univerſal petiolus, between any two pair of leaves, thoſe above the compreſſed part, or nearer the extremity of the petiolus, move ſooner than thoſe under it, or nearer the origin; and frequently the motion will extend upwards to the extreme leaf, whilſt below it perhaps does not go farther than the neareſt pair. If the leaves happen to be blown by the wind againſt one another, or againſt the branches, they are frequently put in motion; but when a branch is moved gently, either by the hand or the wind, without ſtriking againſt any thing, no motion of the leaves takes place.

When left to themſelves in the day-time, ſhaded from the ſun, wind, rain, or any diſturbing cauſe, the appearance of the leaves is different from that of other pinnated plants. In the laſt a great uniformity ſubſiſts in the reſpective poſition of the leaves on the pinna; but here ſome will be ſeen on the horizontal plane, ſome raiſed above it, and others fallen under it; and in an hour or ſo, without any order or regularity which can be obſerved, all theſe will have changed their reſpective poſitions.

Cutting the bark of the branch down to the wood, and even ſeparating it about the ſpace of half an inch all around, ſo as to ſtop all communication by the veſſels of the bark, does not for the firſt day affect the leaves, either in their poſition or their aptitude for motion. In a branch, which was cut through in ſuch a manner as to leave it ſuſpended only by a little of the bark no thicker than a thread, the leaves next day did not riſe ſo high as the others; but they were green and freſh, and, on being touched, moved, but in a much leſs degree than formerly.

After-ſun-ſet the leaves go to ſleep, firſt moving down ſo as to touch one another by their under ſides; they therefore perform rather more extenſive motion at night of themſelves than they can be made to do in the day-time by external impreſſions. With a convex lens the rays of the ſun may be collected on a leaf, ſo as to burn a hole in it, without occaſioning any motion. But upon trying the experiment on the petiolus, the motion is as quick as if from ſtrong percuſſion, although the rays be not ſo much concentrated as to cauſe pain when applied in the ſame degree on the back of the hand. The leaves move very faſt from the electrical ſhock, even although a very gentle one.

AVERROES, one of the moſt ſubtile philoſophers that ever appeared among the Arabians, flouriſhed at the end of the 11th and beginning of the 12th century. He was the ſon of the high-prieſt and chief judge of Corduba in Spain: he was educated in the univerſity of Morocco; and ſtudied natural philoſophy, medicine, mathematics, law, and divinity. After the death of his father, he enjoyed his poſts; but notwithſtanding his being exceeding rich, his liberality to men of letters in neceſſity, whether they were his friends or his enemies, made him always in debt. He was afterwards ſtripped of all his poſts, and thrown into priſon, for hereſy; but the oppreſſions of the judge who ſucceeded him, cauſed him to be reſtored to his former employments.

He died at Morocco in the year 1206. He was exceſſively fat, though he eat but once a-day. He ſpent all his nights in the ſtudy of philoſophy; and when he was fatigued, amuſed himſelf with reading poetry or hiſtory. He was never ſeen to play at any game, or to partake in any diverſion. He was extremely fond of Ariſtotle's works, and wrote commentaries on them; whence he was ſtyled, *The commentator*, by way of eminence. He likewiſe wrote a work on the whole art of phyſic, and many amorous verſes; but when he grew old, he threw theſe laſt into the fire. His other poems are loſt, except a ſmall piece, in which he ſays, "That when he was young, he acted againſt his reaſon; but that when he was in years, he followed its dictates:" upon which he utters this wiſh; "Would to God I had been born old, and that in my youth I had been in a ſtate of perfection!" As to religion, his opinions were, that Chriſtianity is abſurd; Judaiſm, the religion of children; Mahometaniſm, the religion of ſwine.

AVERROISTS, a ſect of peripatetic philoſophers, who appeared in Italy ſome time before the reſtoration of learning, and attacked the immortality of the ſoul. They took their denomination from AVERROES, the celebrated interpreter of Ariſtotle (ſee the preceding article), from whom they borrowed their diſtinguiſhing doctrine.

The Averroiſts who held the ſoul was mortal, according to reaſon or philoſophy, yet pretended to ſubmit to the Chriſtan theology, which declares it immortal. But the diſtinction was held ſuſpicious; and this divorce of faith from reaſon was rejected by the doctors of that time, and condemned by the laſt council of the Lateran under Leo X.

AVERRUNCI (DEI); certain gods, whoſe buſineſs it was, according to the Pagan theology, to avert miſfortunes. Apollo and Hercules were of the number of theſe gods, among the Greeks; and Caſtor and Pollux, among the Romans.

AVERSA, a town of Italy, in the kingdom of Naples, with a biſhop's ſee. It is ſituated in a very fine plain, in E. Long. 14. 20. N. Lat. 41. 0.

AVERSION, according to Lord Kames, is oppoſed to *affection*, and not to *deſire*, as it commonly is. We have an affection to one perſon; we have an averſion to another: the former diſpoſes us to do good to its object, the latter to do ill.

AVERTI, in horſemanſhip, is applied to a regular ſtep or motion enjoined in the leſſons. In this ſenſe they ſay *pas averte*, ſometimes *pas ecouté*, and *pas d'ecole*, which all denote the ſame. The word is mere French, and ſignifies *adviſed*.

AVES, one of the Caribbee iſlands, 451 miles ſouth of Porto Rico, with a good harbour for careening of ſhips. It is ſo called from the great number of birds that frequent it. There is another of the ſame name lying to the northward of this, in N. Lat. 15. 0.; and a third near the eaſtern coaſt of Newfoundland, in N. Lat. 50. 5.

AVES, *Birds*, the name of Linnæus's ſecond claſs of animals. See ZOOLOGY, nº 8. and ORNITHOLOGY.

AVESBURY, (Robert), an Engliſh hiſtorian, of whom little more is known than that he was keeper of the regiſtry of the court of Canterbury in the reign of Edward III. and conſequently that he lived in the 14th century. He wrote, *Memorabilia geſta magnifici regis Angliæ domini Edwardi tertii poſt conqueſtum, procerumque; tactis primitus quibuſdam geſtis de tempore patris ſui domini Edwardi ſecundi, quæ in regnis Angliæ, Scotiæ, et Franciæ, ac in Aquitannia et Britannia, non humana ſed Dei potentia, contigerunt, per Robertum de Aveſbury*. This hiſtory ends with the battle of Poictiers, about the year 1356. It continued in manuſcript till the year 1720, when it was printed by the induſtrious Thomas Hearne at Oxford, from a manuſcript belonging to Sir Thomas Seabright. It is now become very ſcarce.

AVEZZANO, a town of Italy in the kingdom of Naples in the Farther Abruzzo. It is built on an almoſt imperceptible declivity, one mile from the lake of Celano, to which an avenue of poplars leads from the baronnial caſtle. This edifice ſtands at a little diſtance from the town, is ſquare, and flanked with towers; it was erected by Virginio Orſini, to which family this and many other great lordſhips belonged, before they were wreſted from them in times of civil war, and transferred to the Colonnas. Avezzano was founded in 860, and contains 2700 inhabitants, and two religious communities within its walls, which are indeed in a ruinous condition. The houſes are in general mean; but there are ſome large buildings and opulent families of the claſs of gentlemen, not poſſeſſed of fees held *in capite*.

AGUE, a territory of Normandy in France, which gives title to a viſcount. It extends from Falaiſe and Argenton as far as the ſea, between the rivers Dives, Vie, and Tougues. The arable land is ſtiff, and produces but little good corn: but they ſow ſainfoin; which ſucceeds ſo well that they have five good crops ſucceſſively: they likewiſe ſow flax and hemp; and have a vaſt quantity of apples, with which they make cyder. Horſes are bred here in great numbers; and the inhabitants fatten the oxen which come from Poictou and Brittany.

AUGEAS, in fabulous hiſtory, was king of Elis, and particularly famed for his ſtable, which contained 3000 oxen, and had not been cleaned for 30 years. Hercules was deſired to clear away the filth from this ſtable in one day; and Augeas promiſed, if he performed it, to give him a tenth part of the cattle. This taſk Hercules is ſaid to have executed by turning the courſe of the river Alpheus through the ſtable; when Augeas refuſing to ſtand by his engagement, Hercules ſlew him with his arrows, and gave his kingdom to Phyleus his ſon, who had ſhown an abhorrence of his farther's inſincerity.

AUGMENT, in grammar, an accident of certain tenſes of Greek verbs, being either the prefixing of a ſyllable, or an increaſe of the quantity of the initial vowels.

AUGMENTATION, in a general ſenſe, is the act of adding or joining ſomething to another with a deſign to render it large.

AUGMENTATION is alſo uſed for the additament or thing added.

AUGMENTATION was alſo the name of a court erected 27 Hen. VIII. ſo called from the augmentation of the revenues of the crown, by the ſuppreſſion of religious houſes; and the office ſtill remains, wherein there are many curious records, tho' the court has been diſſolved long ſince.

AUGMENTATION, in heraldry, are additional charges to a coat-armour, frequently given as particular marks of honour, and generally borne either in the eſcutcheon or a conton; as have all the baronets of England, who have borne the arms of the province of Ulſter in Ireland.

AUGRE, or AWGRE, an inſtrument uſed by carpenters and joiners to bore large round holes; and conſiſting of a wooden handle, and an iron blade terminated at bottom with a ſteel bit.

AUGSBURG, a city of Germany, capital of the circle of Suabia, ſeated near the confluence of the Ardech and Lech, in one of the moſt beautiful plains that can be imagined. It is one of the largeſt and handſomeſt cities of the empire; but the fortifications are after the old manner, and very irregular; the ſtreets are broad and ſtraight; the houſes moſtly of timber, plaſtered and whitened without, or adorned with paintings; the reſt are of free-ſtone; the churches and fountains are generally ornamented with fine figures of braſs. Many of the churches are ſtately, and adorned within with curious workmanſhip and paintings. That part of the city erected by the noble family of the Fuggers, who are lords of the adjacent country, conſiſts of ſeveral ſtreets croſs-wiſe, containing 106 houſes: the poor people that inhabit them are maintained by an annual penſion. Its magnificent town-houſe is little inferior to that of Amſterdam, it being a vaſt ſquare ſtone-building, with a marble portico; at the top of the front, within the pediment, is a large ſpread eagle, holding a ſceptre and globe in its talons, of braſs, gilt, ſaid to weigh 2200 weight; the great portal is of a very beautiful reddiſh marble; over which is a balcony of the ſame colour, ſupported by two pillars of white marble; over the gate there are two large griffins of braſs; moſt of the rooms are wainſcotted and ceiled with very fine timber: the great hall is very magnificent, and paved with marble; it is 110 feet long, 58 broad, and 52 high, and its roof is ſupported by eight columns of red marble; the ceiling of the upper wall is of very curious workmanſhip of poliſhed aſh, conſiſting of compartments, the ſquares and pannels of which are enriched with gilded ſculptures, and filled with pictures and other ornaments; this is likewiſe ſupported by eight pillars with baſes and chapiters of braſs: the other rooms are handſomely adorned with very fine paintings.

In the ſquare, near the town-houſe, is the fountain of Auguſtus, which is a marble baſon, ſurrounded with iron balluſtrados finely wrought: at the four corners are four braſs ſtatues as big as the life, two of which are women and two men; in the middle of the baſon is a pedeſtal, at the foot of which are four large ſphinxes ſquirting water out of their breaſts; a little above theſe are four infants holding four dolphins in their arms, which pour water out of their mouths; and over theſe infants are feſtoons of pine-apples all of braſs; upon the pedeſtal is the ſtatue of Auguſtus as large as the life. The fountain moſt remarkable next to this is that of Hercules, which is a hexagon baſon with ſeveral braſs figures, particularly Hercules engaging the hydra. Another curioſity is the ſecret gate, which was contrived to let in perſons ſafely in time of war: it has ſo many engines and diviſions with gates and keys, and apartments for guards at ſome diſtance from each other, where paſſengers are examined, that it is impoſſible for the town to be ſurpriſed this way; the gates are bolted and unbolted, opened and ſhut, by unſeen operators, inſomuch that it looks like enchantment. The water-towers are alſo very curious, of which there are three ſeated on a branch of the river Lech, which runs through the city in ſuch a torrent as to drive many mills, which work a number of pumps that raiſe the water in large leaden pipes to the top of the towers; one of theſe ſends water to the public fountains, and the reſt to near 1000 houſes in the city.

The Lutherans have a college here, which is a vaſt ſquare building, with a fine clock on the top of the front. In this there are ſeven different claſſes, a hall for public diſputations, and a theatre for dramatic repreſentation. The cathedral is a large, gloomy, Gothic building, with two ſpire ſteeples; it is adorned with paintings upon whimſical ſubjects, and has a great gate all of braſs, over which are ſeveral ſcripture paſſages well repreſented in baſſo relievo. The Jeſuits had a ſplendid college here, with a church full of gilding, painting, and carving; and a fine library. Tho' half the inhabitants are Lutherans, there are a great many Popiſh proceſſions. There are no Jews in the town, nor are they ſuffered to lie there; but they inhabit a village at about a league diſtance, and pay ſo much an hour for the liberty of trading in the daytime. The Benedictine abbey is a vaſt Gothic building, the ceiling of which is ſaid to be the higheſt in Germany, and overlooks all the reſt of the churches; it is adorned with ſeveral ſtatues, and has one very grand altar. The church of St Croix is one the handſomeſt in Augſburg for architecture, painting, ſculpture, gilding, and a fine ſpire.

The inhabitants look upon Auguſtus Cæſar as the founder of the town: it is true, that that emperor ſent a colony there; but the town was already founded, though he gave it the name of *Auguſta Vindelicorum.* Augſburg, indeed, is one of the oldeſt towns in Germany, and one of the moſt remarkable of them, as it is there and at Nuremberg that you meet with the oldeſt marks of German art and induſtry. In the 14th and 15th centuries, the commerce of this town was the moſt extenſive of any part of ſouth Germany, and contributed much to the civilization of the country by the works of art and variety of neceſſaries to the comfort and convenience of life which it was the means of introducing. Many things originated in this town which have had a great influence on the happineſs of mankind. Not to mention the many important diets of the empire held here; here, in 952, did a council confirm the order for the celibacy of prieſts; here, in 1530, was the confeſſion of faith of the Proteſtants laid before the emperor and other eſtates of Germany; and here, in 1555, was ſigned the famous treaty of peace, by which religious liberty was ſecured to Germany.

Though the Proteſtants were very powerful at Augſburg, they could not keep their ground; for the Bavarians drove them from thence: but Guſtavus Adolphus reſtored them again in 1632; ſince which time they have continued there, and ſhare the government with the Catholics. In 1703, the elector of Bavaria took the city after a ſiege of ſeven days, and demoliſhed the fortifications: however, the battle of Hochſted reſtored their liberty, which they yet enjoy under the government of their own magiſtrates, the biſhop having no temporal dominion in the city. The chapter is compoſed of perſons of quality, who are to bring proofs of their nobility. The canons have a right of electing their own biſhop, who is a ſovereign, in the ſame manner as ſeveral other of the German biſhops.

The police of the place is very good; and though the town has no territory, it has no debts. Augſburg is, however, no longer what it was. It no longer has a Fugger and a Welſer in it to lend the emperor millions. In this large and handſome town, formerly one of the greateſt trading towns in Germany, there are no merchants at preſent to be found who have capitals of more than L. 20,000. The others, moſt of whom muſt have their coaches, go creeping on with capitals of L. 3,000 or L. 4,000, and do the buſineſs of brokers and commiſſioners. Some houſes, however, carry on a little banking trade; and the way through Tyrol and Graubundten occaſions ſome little exchange between this place and Germany. After theſe brokers and doers of buſineſs by commiſſion, the engravers, ſtatuaries, and painters, are the moſt reputable of the labouring part of the city. Their productions, like the toys of Nuremberg, go every where. There are always ſome people of genius amongſt them; but the ſmall demand for their art affords them ſo little encouragement, that to prevent ſtarving they are moſtly confined to the ſmall religious works which are done elſewhere by Capuchin monks. They furniſh all Germany with little pictures for prayer books, and to hang in the citizens houſes. There is an academy of arts inſtituted here under the protection of the magiſtrates: the principle aim of which is to produce good mechanics, and preſerve the manufactures of the city.

This town, which is 9¼ miles in circumference, contains, according to Mr Rieſbeck, hardly 30,000 inhabitants; but Mr Nicolai makes them about 35,000 and ſays there are 28,000 houſes.

The city has its drinking water from the river Lech, which runs at ſome diſtance from it; and the aqueducts which convey the water are much to be admired. As the court of Bavaria has it in its power to cut off this indiſpenſable neceſſary, by threatening the town with doing ſo, it often lays it under contribution. But as it has, beſides this, other means of keeping the high council in a ſtate of dependance, to ſecure itſelf from this oppreſſion, the city ſeeks the emperor's protection, upon whom it makes itſelf as dependant on the other ſide, ſo as to be indeed only a ball which both courts play with. The emperor's miniſter to the circle of Suabia generally reſides here, and by ſo doing ſecures to his court a perpetual influence. There are always Auſtrian and Pruſſian recruiting parties quartered here, and the partiality of the government to the former is very remarkable. In the war of 1756, the citizens were divided into equal parties for the two courts. The Catholics conſidered the emperor as their god, and the Proteſtants did the ſame by the king of Pruſſia. The flame of religion had almoſt kindled a bloody civil war amongſt them.—The biſhop takes his name from this town, but reſides at Dillingen. He has an income of about L. 20,000 *per annum*. As a proof of the catholiciſm of this place, the Pope throughout his whole progreſs met no where with ſuch honours as he did here. This he owed to his friends the Jeſuits, who have ſtill great influence. E. Long. 10. 58. N. Lat. 48. 24.

Augsburg Confeſſion, denotes a celebrated confeſſion of faith drawn up by Luther and Melancthon, on behalf of themſelves and other ancient reformers, and preſented in 1530 to the emperor Charles V. at the diet of Auguſta or Augſburg, in the name of the evangelic body. This confeſſion contains 28 chapters; of which the greateſt part is employed in repreſenting, with perſpicuity and truth, the religious opinions of the Proteſtants, and the reſt in pointing out the errors and abuſes that occaſioned their ſeparation from the church of Rome.

AUGUR, an officer among the Romans appointed to foretel future events, by the chattering, flight, and feeding, of birds. There was a college or community of them, conſiſting originally of three members with reſpect to the three Luceres, Rhamnenſes, and Tatienſes: afterwards the number was increaſed to nine, four of whom were patricians and five plebeians. They bore an augural ſtaff or wand, as the enſign of their authority; and their dignity was ſo much reſpected, that they were never depoſed, nor any ſubſtituted in their place, though they ſhould be convicted of the moſt enormous crimes. See Augury.

AUGURAL, ſomething relating to the augurs.—The augural inſtruments are repreſented on ſeveral ancient medals.

Augural Supper, that given by a prieſt on his firſt admiſſion into the order, called alſo by Varro *Adjicialis*.

Augural Books, thoſe wherein the diſcipline and rules of augury were laid down.

AUGURALE, the place in a camp where the general took auſpicia. This anſwered to the *Auguratorium* in the city.

Augurale is alſo uſed in Seneca for the enſign or badge of an augur, as the *lituus*.

AUGURATORIUM, a building on the Palatine mount where public auguries were taken.

AUGURY, in its proper ſenſe, the art of foretelling future events by obſervations taken from the chattering, ſinging, feeding, and flight of birds; though it was uſed by ſome writers in a more general ſignification, as compriſing all the different kinds of divination.

Augury was a very ancient ſuperſtition. We know from Heſiod, that huſbandry was in part regulated by the coming or going of birds; and moſt probably it had been in uſe long before his time, as aſtronomy was then in its infancy. In proceſs of time, theſe animals ſeem to have gained a greater and very wonderful authority, till at laſt no affair of conſequence, either of public or private concern, was undertaken without conſulting them. They were looked upon as the interpreters of the gods; and thoſe who were qualified to underſtand their oracles were held among the chief men in the Greek and Roman ſtates, and became the aſſeſſors of kings, and even of Jupiter himſelf. However abſurd ſuch an inſtitution as a college of Augurs may appear in our eyes, yet, like all other extravagant inſtitutions, it had in part its origin from nature. When men conſidered the wonderful migration of birds, how they diſappeared at once, and appeared again at ſtated times, and could give no gueſs where they went, it was almoſt natural to ſuppoſe, that they retired ſomewhere out of the ſphere of this earth, and perhaps approached the ethereal regions, where they might converſe with the gods, and thence be enabled to predict events. It was almoſt natural for a ſuperſtitious people to imagine this; at leaſt to believe it, as ſoon as ſome impoſtor was impudent enough to aſſert it. Add to this, that the diſpoſition in ſome birds to imitate the human voice, muſt contribute much to the confirmation of ſuch a doctrine. This inſtitution of augury ſeems to have been much more ancient than that of aruſpicy; for we find many inſtances of the former in Homer, but not a ſingle one of the latter, tho' frequent mention is made of ſacrifices in that author. From the whole of what has been obſerved, it ſeems probable, that natural augury gave riſe to religious augury, and this to aruſpicy, as the mind of man makes a very eaſy tranſition from a little truth to a great deal of error.

Stillingfleet's *Calendar of Flora.*

A paſſage in Ariſtophanes gave the hint for theſe obſervations. In the Comedy of the Birds, he makes one of them ſay this: ‘The greateſt bleſſings which can happen to you, mortals, are derived from us; firſt, we ſhow you the ſeaſons, viz. Spring, Winter, Autumn. The crane points out the time for ſowing, when ſhe flies with her warning notes into Egypt; ſhe bids the ſailor hang up his rudder and take his reſt, and every prudent man provide himſelf with winter-garments. Next the kite appearing, proclaims another ſeaſon, *viz.* when it is time to ſhear his ſheep. After that the ſwallow informs you when it is time to put on ſummer clothes. We are to you, (adds the chorus), Ammon, Dodona, Apollo: for, after conſulting us, you undertake every thing; merchandize, purchaſes, marriages, &c.’ Now, it ſeems not improbable, that the ſame tranſition was made in the ſpeculations of men which appears in the poet's words; and that they were eaſily induced to think, that the ſurpriſing foreſight of birds, as to the time of migration, indicated ſomething of a divine nature in them; which opinion Virgil, as an Epicurean, thinks fit to enter his proteſt againſt, when he ſays,

Haud equidem credo, quia ſit divinitus illis
Ingenium.

But to return to Ariſtophanes. The firſt part of the chorus, from whence the fore-cited paſſage is taken, ſeems, with all its wildneſs, to contain the fabulous cant, which the augurs made uſe of in order to account for their impudent impoſitions on mankind. It ſets out with a coſmogony; and ſays, That in the beginning were Chaos and Night, and Erebus and Tartarus: That there was neither water, nor air, nor ſky: That Night laid an egg, from whence, after a time, Love aroſe: That Love, in conjunction with Erebus, produced a third kind; and that they were the firſt of the immortal race, &c.

AUGUST, (*Auguſtus*), in a general ſenſe, ſomething majeſtic, venerable, or ſacred. The appellation was firſt conferred by the Roman ſenate upon Octavius, after his being confirmed by them in the ſovereign power. It was conceived as expreſſing ſomething divine, or elevated above the pitch of mankind, being derived from the verb *augeo*, "I increaſe," *tanquam ſupra humanam ſortam auctus.* See AUGUSTUS.

AUGUST, in chronology, the eighth month of our year, containing 31 days. Auguſt was dedicated to the honour of Auguſtus Cæſar, becauſe, in the ſame month, he was created conſul, thrice triumphed in Rome, ſubdued Egypt to the Roman empire, and made an end of civil wars: being before called *Sexatilis*, or the ſixth month from March.

AUGUSTA, the capital of the ſtate of Georgia, in North America, on the river Savannah, 134 miles from the ſea, ſeated on a fine plain, it contains about 200 houſes, and from the advantage of its central ſituation between the upper and lower counties is riſing faſt into importance.

AUGUSTA, or *Auſta*, an iſland in the Adriatic ſea, on the coaſt of Dalmatia, near Raguſa, ſubject to Venice. E. Long. 17. 50. N. Lat. 42. 35.

AUGUSTA Auſciorum, a town of Aquitania. In the middle age, it took the name of the people, *Auſci*; and is now called *Auch*, the capital of Gaſcony.

AUGUSTA Emerita, a town of Luſitania on the river Anas, the capital of the province; a colony of the Emeriti, or ſuch ſoldiers as had ſerved out their legal time, were men of experience, or had received marks of favour. The colony was founded by Auguſtus; and is now called *Merida*, a city of Spain, in Eſtremadura, on the river Guadiana. See MERIDAN.

AUGUSTA Prætoria, a town and colony of Gallia Ciſalpina, and capital of the Salaſſi; ſeated at the foot of the Alps Graiæ on the Duria. Now *Aouſte* in Piedmont. See AOUSTE.

AUGUSTA Rauracorum, a town of Gallia Belgica; now a ſmall village called *Auguſt*, at the bend of the Rhine northwards, but from the ruins, which are ſtill to be ſeen, appears to have been a conſiderable colony, at the diſtance of ſix miles from Baſil to the eaſt.

AUGUSTA Sueſſonum, a town of Gallia Belgica on the Axona. Now *Soiſſons*, on the river Aiſne, in the Iſle of France. See SOISSONS.

AUGUSTA Taurinorum, a town of the Taurini at the foot of the Alps where the Duria Minor falls into the Po; now *Turin*, the capital of Piedmont.

AUGUSTA Treba, a town of the Æqui, near the ſprings of the river Anio in Italy; now *Trevi*, in Umbria, or in the eaſt of the Campagna di Roma.

Augusta Trevirorum, a town of the Treviri, a people inhabiting between the Rhine and the Meuſe, but eſpecially about the Moſelle; now *Triers*, or *Treves*, in the circle of the Lower Rhine on the Moſelle.

Augusta Vindelicorum, a town of the Licates on the Licus; called by Tacitus a noble colony of *Rhætia*; now *Augſburg*, capital of Suabia.

Augusta Hiſtoria, is the hiſtory of the Roman emperors from the time of Adrian to Carinus, that is, from the year of our Lord 157 to 285, compoſed by ſix Latin writers, Æl. Spartianus, Julius Capitolinus, Æl. Lampridius, Vulcatius Gallicanus, Trebellius Pollio, and Flavius Vopiſcus.

AUGUSTALES, in Roman antiquity, an epithet given to the flamens or prieſts appointed to ſacrifice to Auguſtus after his deification; and alſo to the ludi or games celebrated in honour of the ſame prince on the fourth of the ides of October.

AUGUSTALIA, a feſtival inſtituted by the Romans in honour of Auguſtus Cæſar, on his return to Rome, after having ſettling peace in Sicily, Greece, Syria, Aſia, and Parthia; on which occaſion they likewiſe built an altar to him, inſcribed *Fortunæ reduci*.

AUGUSTALIS PRÆFECTUS, a title peculiar to a Roman magiſtrate who governed Egypt, with a power much like that of a proconſul in other provinces.

AUGUSTAN CONFESSION. See AUGSBURG *Confeſſion*.

AUGUSTIN, or AUSTIN, (St), the firſt archbiſhop of Canterbury, was originally a monk in the convent of St Andrew at Rome, and educated under St Gregory, afterwards Pope Gregory I. by whom he was diſpatched into Britain with 40 other monks of the ſame order, about the year 596, to convert the Engliſh Saxons to Chriſtianity. They landed in the iſle of Thanet; and having ſent ſome French interpreters to king Ethelbert with an account of their errand, the king gave them leave to convert as many of his ſubjects as they could, and aſſigned their place of reſidence at Dorovernum, ſince called *Canterbury*; to which they were confined till the king himſelf was converted, whoſe example had a powerful influence in promoting the converſion of his ſubjects; but though he was extremely pleaſed at their becoming Chriſtians, he never attempted to compel them. He diſpatched a prieſt and a monk to Rome, to acquaint the pope with the ſucceſs of his miſſion, and to deſire his reſolution of certain queſtions. Theſe men brought back with them a pall, and ſeveral books, veſtments, utenſils, and ornaments for the churches. His holineſs, by the ſame meſſengers, gave Auguſtin directions concerning the ſettling of epiſcopal ſees in Britain; and ordered him not to pull down the idol-temples, but to convert them into Chriſtian churches; only deſtroying the idols, and ſprinkling the place with holy water, that the natives, by frequenting the temples they had been always accuſtomed to, might be the leſs ſhocked at their entrance into Chriſtianity. Auguſtin reſided principally at Canterbury, which thus became the metropolitan church of England; and having eſtabliſhed biſhops in ſeveral of the cities, he died on the 26th of May, 607. The Popiſh writers aſcribe ſeveral miracles to him. The obſervation of the feſtival of St Auguſtin was firſt injoined in a ſynod held under Cuthbert archbiſhop of Canterbury, and afterwards by the pope's bull in the reign of king Edward III.

AUGUSTINE (St), an illuſtrious father of the church, was born at Thagaſte, a city Numidia, on the 13th of November 354. His father, a burgeſs of that city, was called *Patricius*; and his mother, *Monica*, who being a woman of great virtue, inſtructed him in the principles of the Chriſtian religion. In his early youth he was in the rank of the catechumens; and falling dangerouſly ill, earneſtly deſired to be baptized; but the violence of the diſtemper ceaſing, his baptiſm was delayed. His father, who was not yet baptized, made him ſtudy at Thagaſte, Madaura, and afterwards at Carthage. Auguſtine having read Cicero's books of philoſophy, began to entertain a love for wiſdom, and applied himſelf to the ſtudy of the holy ſcriptures; nevertheleſs, he ſuffered himſelf to be ſeduced by the Manicheans. At the age of 19, he returned to Thagaſte, and taught grammar, and alſo frequented the bar; he afterwards taught rhetoric at Carthage with applauſe. The inſolence of the ſcholars at Carthage made him take a reſolution to go to Rome, tho' againſt his mother's will. Here alſo he had many ſcholars; but diſliking them, he quitted Rome, and ſettled at Milan, and was choſen public profeſſor of rhetoric in that city. Here he had opportunities of hearing the ſermons of St Ambroſe, which, together with the ſtudy of St Paul's epiſtles, and the converſion of two of his friends, determined him to retract his errors, and quit the ſect of the Manicheans; this was in the 32d year of his age. In the vacation of the year 386, he retired to the houſe of a friend of his, named *Verecundus*, where he ſeriouſly applied himſelf to the ſtudy of the Chriſtian religion, in order to prepare himſelf for baptiſm, which he received at Eaſter, in the year 387. Soon after this, his mother came to ſee him at Milan, and invite him back to Carthage; but at Oſtia, whether he went to embark in order to his return, ſhe died. He arrived in Africa about the end of the year 388; and having obtained a garden-plot without the walls of the city of Hippo, he aſſociated himſelf with 11 other perſons of eminent ſanctity, who diſtinguiſhed themſelves by wearing leathern girdles, and lived there in a monaſtic way for the ſpace of three years, exerciſing themſelves in faſting, praying, ſtudy, and meditation, day and night: from hence ſprung up the Auguſtine friars, or eremites of St Auguſtine, being the firſt order of mendicants; thoſe of St Jerome, the Carmelites, and others, being but branches of this of St Auguſtine. About this time, or before, Valerius biſhop of Hippo, againſt his will, ordained him prieſt: nevertheleſs, he continued to reſide in his little monaſtery, with his brethren, who, renouncing all property, poſſeſſed their goods in common. Valerius, who had appointed St Auguſtine to preach in his place, allowed him to do it in his preſence, contrary to the cuſtom of the churches in Africa. He explained the creed, in a general council of Africa, held in 393. Two years after, Valerius, fearing he might be preferred to be biſhop of another church, appointed him his coadjutor or colleague, and cauſed him to be ordained biſhop of Hippo, by Megalus biſhop of Calame, then primate of Numidia. St Auguſtine died the 28th day of Auguſt, 430, aged 76 years, having had the misfortune to ſee his country invaded by the

Vandals, and the city where he was biſhop beſieged for ſeven months.

The works of St Auguſtine make ten volumes; the beſt edition of them is that of Maurin, printed at Antwerp, in 1700. They are but little read at this time, except by the clergy of the Greek church and in the Spaniſh univerſities. The bookſellers of London receive frequent commiſſions for them, and indeed for the moſt of the fathers, from Ruſſia, and alſo from Spain.

AUGUSTINE (St) a fort of North America, on the eaſt coaſt of Cape Florida, ſituated in W. Long. 81. 10. N. Lat. 30. 0. This fort was built by the Spaniards; who were ſcarce well eſtabliſhed there when they were attacked by Sir Francis Drake in 1586, who reduced and pillaged the fort and town adjacent. In 1665, it underwent a ſimilar fate, being attacked by Captain Davis at the head of a conſiderable company of bucaneers. In 1702 an attempt was made by Colonel More to annex St Auguſtine to the Britiſh dominions. He inveſted it with only 500 Engliſh and 700 Indians; which ſmall force, however, would have been ſufficient to reduce the place, had not ſuccours arrived when it was on the point of ſurrendering. Even then, it is thought that he might have defeated the reinforcement which arrived; but he choſe to raiſe the ſiege, and retire with precipitation. In 1740, another unſucceſsful attempt was made on this fort by general Oglethorpe: it was, however, together with the whole country of Florida, ceded to Great Britain by the treaty of Paris in 1763; but has ſince been reſtored to Spain by the treaty of peace 1783.

AUGUSTINE, a cape of South America. W. Long. 35. 4. S. Lat. 8. 30.

AUGUSTINS, or AUGUSTINIANS, an order of religious; thus called from St Auguſtin, whoſe rule they obſerve. The Auguſtins, popularly alſo called Auſtin friers, were originally hermits, whom pope Alexander IV. firſt congregated into one body, under their general Lanfranc, in 1256. Soon after their inſtitution, this order was brought into England, where they had about thirty-two houſes at the time of their ſuppreſſion.

The Auguſtins are clothed in black, and make one of the four orders of mendicants. From theſe aroſe a reform, under the denomination of *bare-foot Auguſtins*, or *Minorites*, or *Friers minor*.

There are alſo canons regular of St Auguſtin, who are clothed in white, excepting their cope, which is black. At Paris they are known under the denomination of *religious of* GENEVIEVE; that abbey being the chief of the order. There are alſo nuns and canoneſſes, who obſerve the rules of St Auguſtin.

AUGUSTINIANS are alſo thoſe divines who maintain, on the authority of St Auguſtin, that GRACE is effectual from its nature, abſolutely and morally, and not relatively and gradually. They are divided into rigid and relaxed.

AUGUSTOBONA, a city of the Tricaſſers in ancient Gaul, from whom it was afterwards called *Tricaſſes*, and *Trecaſſæ*; and ſtill further corrupted to *Thracæ or Treci*; whence the modern name *Troyes*, in Champaigne on the Seyne. See TROYES.

AUGUSTODUNUM, the capital of the Ædui, where there was a famous academy or ſchool for the education of youth; now Auſtun, or *Autun*, in the duchy of Burgundy on the Arroux. See AUTUN.

AUGUSTOMAGUS, an ancient town of Gallia Belgica; now *Senlis*, in the Iſle of France. E. Long. 2. 30. N. Lat. 49. 10.

AUGUSTORITUM (anc. geog.), according to ſome authors the capital of the Pictones, afterwards called *Pictavi*; now *Poictiers*. But by Antonine's Itinerary from Burdigala to Argantomagus (or Argenton, as it is interpreted by many), it can be no other but the capital of the Lemovices, now *Limoges*, ſituate between Veſunna of the Petrocorii, or Perigueux, and Argantomagus. E. Long. 1. 22. Lat. 45. 52.

AUGUSTOW, a ſmall but ſtrong town of Poland, in the duchy and Palatinate of Polakia, ſeated on the river Narieu. E. Long. 24. 2. N. Lat. 53. 25.

AUGUSTUS (Fort), a ſmall fortreſs ſeated on a plain at the head of Lochneſs in Scotland, between the rivers Taarf and Orich; the laſt is a conſiderable ſtream, and has over it a ſtone bridge of three arches. The fort conſiſts of four baſtions; within is the governor's houſe, and barracks for 400 men: it was taken by the rebels in 1746, who immediately deſerted it, after demoliſhing what they could. The name of this fort in Erſe is *Kill chuimin*, or *the burial place of the Cummins*. It lies on the road to the Iſle of Sky, which is about 52 miles off; but on the whole way there is not a place fit for the reception of man or horſe.

AUGUSTUS, the appellation conferred upon Cæſar Octavianus, the firſt Roman emperor. See OCTAVIANUS and ROME.

The obſcure name of *Octavianus*, Mr Gibbon obſerves, he derived from a mean family, in the little town of Aricia. It was ſtained with the blood of the proſcription; and he was deſirous, had it been poſſible, to eraſe all memory of his former life. The illuſtrious ſurname of *Cæſar* he had aſſumed, as the adopted ſon of the dictator; but he had too much good ſenſe either to hope to be confounded or to wiſh to be compared with that extraordinary man. It was propoſed in the ſenate, to dignify their miniſter with a new appellation; and after a very ſerious diſcuſſion, that of *Auguſtus* was choſen among ſeveral others, as being the moſt expreſſive of the character of peace and ſanctity, which he uniformly affected. *Auguſtus* was therefore a perſonal, *Cæſar* a family, diſtinction. The former ſhould naturally have expired with the prince on whom it was beſtowed; and however the latter was diffuſed by adoption and female alliance, Nero was the laſt prince who could alledge any hereditary claim to the honours of the Julian line. But at the time of his death, the practice of a century had inſeparably connected thoſe appellations with the imperial dignity, and they have been preſerved by a long ſucceſſion of emperors, Romans, Greeks, Franks, and Germans, from the fall of the republic to the preſent time. A diſtinction was, however, ſoon introduced. The ſacred title of *Auguſtus* was always reſerved for the monarch; the name of *Cæſar* was more freely communicated to his relations; and from the reign of Hadrian at leaſt, was appropriated to the ſecond perſon in the ſtate, who was conſidered as the preſumptive heir of the empire.

AVIARY, a place ſet apart for feeding and propagating birds. It ſhould be ſo large as to give the birds ſome freedom of flight; and turfed, to avoid the appearance of foulneſs on the floor.

Avicena.

AVICENA, or AVICENES, the prince of Arabian philoſophers and phyſicians, was born at Aſſena, a village in the neighbourthood of Bokhara. His father was from Balkh in Perſia, and had married at Bokhara. The firſt years of Avicenes were devoted to the ſtudy of the Koran and the Belle Lettres. He ſoon ſhowed what he was likely to become afterwards; and the progreſs he made was ſo rapid, that when he was but ten years old, he was perfectly intelligent in the moſt hidden ſenſes of the Koran.

Abou-Abdoullah, a native of Napoulous in Syria, at that time profeſſed philoſophy at Bokhara with the greateſt reputation. Avicènes ſtudied under him the principles of logic; but ſoon diſguſted with the ſlow manner of the ſchools, he ſet about ſtudying alone, and read all the authors that had written on philoſophy, without any other help than that of their commentators. Mathematics had no fewer charms for him; and after reading the firſt ſix propoſitions of Euclid, he got alone to the laſt, having made himſelf perfect maſter of them, and treaſured up all of them equally in his memory.

Poſſeſſed with an extreme avidity to be acquainted with all ſorts of ſciences, he likewiſe devoted himſelf to the ſtudy of medicine. Perſuaded that this divine art conſiſts as much in practice as in theory, he ſought all opportunities of ſeeing the ſick; and afterwards confeſſed, that he had learned more from experience than from all the books he had read. He was now in his 16th year, and already was celebrated for being the light of his age. He reſolved at this age to reſume his ſtudies of philoſophy, which medicine had made him neglect: and he ſpent a year and a half in this painful labour, without ever ſleeping all this time a whole night together. If he felt himſelf oppreſſed by ſleep, or exhauſted by ſtudy, a glaſs of wine refreſhed his waſted ſpirits, and gave him new vigour for ſtudy; if in ſpite of him his eyes for a few minutes ſhut out the light, it then happened to him to recollect and meditate upon all the things that had occupied his thoughts before ſleep. At the the age of 21, he conceived the bold deſign of incorporating, in one work, all the objects of human knowledge; and carried it into execution in an Encyclopedie of 20 volumes, to which he gave the title of the *Utility of Utilities*.

Several great princes had been taken dangerouſly ill, and Avicènes was the only one that could know their ailments and cure them. His reputation increaſed daily, and all the kings of Aſia deſired to retain him in their families.

Mahmud, the ſon of Sabektekin, the firſt ſultan of the Dynaſty of the Samanides, was then the moſt powerful prince of the eaſt. Imagining that an implicit obedience ſhould be paid by all manner of perſons to the injunctions of his will, he wrote a haughty letter to Mamun ſultan of Kharazm, ordering him to ſend Avicènes to him, who was at his court, with ſeveral other learned men. Philoſophy, the friend of liberty and independence, looks down with ſcorn on the ſhackles of compulſion and reſtraint. Avicènes, accuſtomed to the moſt flattering diſtinctions among the great, could not endure the imperious manner of Mahmud's inviting him to his court, and refuſed to go there. But the ſultan of Kharazm, who dreaded his reſentment, obliged the philoſopher to depart with others whom that prince had demanded to be ſent to him.

Avicènes pretended to obey; but inſtead of repairing to Gazna, he took the rout of Giorgian. Mahmud, who had gloried in the thoughts of keeping him at his palace, was greatly irritated at his flight. He diſpatched portraits done in crayons of this philoſopher to all the princes of Aſia, with orders to have him conducted to Gazna, if he appeared in their courts. But Avicènes had fortunately eſcaped the moſt diligent ſearch after him. He arrived in the capital of Giorgian, where under a diſguiſed name he performed many admirable cures.

Cabous then reigned in that country. A nephew, whom he was extremely fond of, being fallen ſick, the moſt able phyſicians were called in, and none of them were able to know his ailment, or give him any eaſe. Avicènes was at laſt conſulted. So ſoon as he had felt the young prince's pulſe, he was confident with himſelf, that his illneſs proceeded from a violent love, which he dared not to declare. Avicènes commanded the perſon who had the care of the different apartments in the palace, to name them all in their reſpective order. A more lively motion in the prince's pulſe, at hearing mentioned one of theſe apartments, betrayed a part of his ſecret. The keeper then had orders to name all the ſlaves that inhabited that apartment. At the name of one of theſe beauties, the young Cabous could not contain himſelf; an extraordinary beating of his pulſe compleated the diſcovery of what he in vain deſired to keep concealed. Avicènes, now fully aſſured that this ſlave was the cauſe of this prince's illneſs, declared, that ſhe alone had the power to cure him.

The Sultan's conſent was neceſſary, and he of courſe was curious to ſee his nephew's phyſician. He had ſcarce looked at him, when he knew in his features thoſe of the crayoned portrait ſent him by Mahmud; but Cabous, far from forcing Avicènes to repair to Gazna, retained him for ſome time with him, and heaped honours and preſents on him.

This philoſopher paſſed afterwards into the court of Nedjmeddevle, Sultan of the race of the Bouides. Being appointed firſt phyſician to that prince, he found means to gain his confidence to ſo great a degree, that he raiſed him to the poſt of Grand Viſir. But he did not long enjoy that illuſtrious dignity. Too great an attachment for pleaſures, eſpecially thoſe of love and the table, made him loſe at the ſame time his poſt and his maſter's favour. From that time Avicènes felt all the rigours of adverſity, which he had brought upon himſelf by his ill conduct. He wandered about as a fugitive, and was often obliged to ſhift the place of his habitation to ſecure his life from danger. He died at Hamadan, aged 58 years, in the 428th year of the Hegira, and of Chriſt 1036.

The perfect knowledge he had of phyſic did not ſecure him from the ailments that afflict human nature. He was attacked by ſeveral maladies in the courſe of his life, and particularly was very ſubject to the colic. His exceſſes in pleaſure, and his infirmities, made a poet ſay, who wrote his epitaph, that the profound ſtudy of philoſophy had not taught him good morals, nor that of medicine the art of preſerving his own health.

No one compoſed with greater facility than Avicènes, writing, when he ſat down to it, 50 pages generally in a day, without fatiguing himſelf. The doctors of Chiras, having made a collection of objections againſt one of his metaphyſical works, ſent it to him at Iſpahan by Caſem. This learned man, not arriving till towards evening, came to Avicènes's houſe, with whom he ſat diſcourſing till midnight. When Caſem was retired, he wrote an anſwer to the objections of the Chirazians, and finiſhed it before ſun-riſe. He immediately delivered it to Caſem, telling him, that he had made all poſſible diſpatch in order not to detain him any longer at Iſpahan.

Avicènes, after his death, enjoyed ſo great a reputation, that till the 12th century he was preferred for the ſtudy of philoſophy and medicine to all his predeceſſors. His works were the only writings in vogue in ſchools, even in Europe. The following are the titles. 1. Of the Utility and Advantage of Sciences, XX books. 2. Of Innocence and Criminality, II books. 3. Of Health and Remedies, XVIII books. 4. On the Means of preſerving Health, III books. 5. Canons of Phyſic, XIV books. 6. On Aſtronomical Obſervations, I book. 7. On Mathematical Sciences. 8. Of Theorems, or Mathematical and Theological Demonſtrations, I book. 9. On the Arabic Language, and its Proprieties, X books. 10. On the Laſt Judgment. 11. On the Origin of the Soul, and the Reſurrection of Bodies. 12. Of the End we ſhould propoſe to ourſelves in Harangues and Philoſophical Argumentation. 13. Demonſtration of the collateral Lines in the Sphere. 14. Abridgment of Euclid. 15. On Finity and Infinity. 16. On Phyſics and Metaphyſics. 17. On Animals and Vegetables, &c. 18. Encyclopedie, 20 volumes.—Some, however, charge him with having ſtolen what he publiſhed, from a celebrated phyſician who had been his maſter. This man had acquired ſo much honour and wealth, that he was ſolicited by many to take their ſons to be his ſcholars, or even his ſervants; but being reſolved not to diſcover the ſecrets of his art, he would receive none of them. Avicènes's mother formed the following ſtratagem: ſhe offered him her ſon as a ſervant, pretending he was naturally deaf and dumb; and the youth, by his mother's inſtructions, counterfeited theſe defects ſo well, that the phyſician, after making ſeveral trials to diſcover the reality of them, took the boy into his ſervice, and by degrees truſted him ſo far as to leave his writings open in his room when he went abroad: Avicènes took that opportunity to tranſcribe them, and carried the copies to his mother; and after the death of his maſter he publiſhed them under his own name. Indeed if we reflect that he lived but 58 years, that he was a wanderer and a fugitive, and that he was much addicted to his pleaſures, we ſhall have ſome difficulty to conceive how he could find time to compoſe ſo many works. Phyſic, however, is indebted to him for the diſcovery of caſſia, rhubarb, mirabolans, tamarinds; and from him alſo, it is ſaid, came to us the art of making ſugar.

AVICENIA, Eastern Anacardium: A genus of the angioſpermia order, belonging to the didynamia claſs of plants; and in the natural method ranking under the 40th order, *Perſonatæ*. The calyx is quinquepartite; the corolla is bilabiated, the upper lip ſquared; the capſule is leathery, romb-like, and monoſpermous. There are two ſpecies; the tomentoſa or downy, and the nitida or ſhining. The ſeeds of the firſt are ſaid to be the Malacca beans formerly kept in the ſhops (though this is doubtful), the kernels of which were eaten as almonds. The plant producing the Malacca bean, as it is called, is rather thought to be the Bontia *Germinans*.

AVIGATO pear. See Laurus.

AVIGLIANO, a ſmall town of Piedmont in Italy. E. Long. 7. 5. N. Lat. 44. 40.

AVIGNON, a city of Provence in France, the capital of the county of Venaiſſin, and ſeated on the banks of the Rhone. It is an archbiſhop's ſee, and the reſidence of ſeveral popes at this place for 70 years has rendered it conſiderable. It ſtill belongs and is ſubject to the pope, who ſends a vice-legate every three years, who in ſome ſenſe is the governor: and Mr Swinburn is of opinion the eccleſiaſtical government here is more for the benefit of the people than if they were ſubject to the king of France. Near the Rhone there is a large rock, within the circumference of the walls, upon which is a platform, from whence may be had a proſpect of the whole city and the places about it. This city is about three miles and two furlongs in circumference, and is in general ill built, irregular, and devoid of beauty. But it is ſurrounded by handſome battlemented walls and turrets, not unlike thoſe of Rome; and its public edifices are large, ſolid, and grand as the taſte of the fourteenth century could make them. Several popes and anti-popes, who during their lives ſhook the Romiſh church with violence and mutual altercation, repoſe quietly near each other in the various monaſteries of the place. The church of the Cordeliers contains, in an obſcure corner, the almoſt defaced tomb of Petrarch's Laura and her huſband Hugh de Sade; and nearly oppoſite is the tomb of the brave Gullon, ſo well known for his invincible courage as well as for his inviolable attachment to his ſovereign Henry IV. Many productions of Reré of Anjou are to be ſeen in the city; whoſe inhabitants amount to above 30,000, of which 1000 are eccleſiaſtics and ſome hundreds of Jews. The palace of the vice-legate is compoſed of ſeveral large ſquare towers, and he gives audience in a great hall which is full of fine paintings, as is alſo the chapel and the apartments. The arſenal is near the palace.

The church of Notre Dame is ancient, but not large, and is one of the beſt adorned in the city. After having aſcended about 50 ſteps, you come to a very ancient portico, which ſuſtains a great tower; as you enter the church on the left hand, you ſee paintings which equal the fineſt in Italy. The great altar is very magnificent, and is adorned with a ſhrine that contains the relics of we know not how many ſaints. The treaſure of the ſacriſty is worthy of the curioſity of the traveller. The little palace where the archbiſhop reſides is formed of three bodies of lodgings, accompanied with courts and ſmall pavilions. It overlooks the Rhone, the city, and the fields. Theſe buildings and the mint adorn a large ſquare, which is the common walk of the inhabitants.

In Avignon they reckon ſeven gates, ſeven palaces, ſeven colleges, ſeven hoſpitals, ſeven monaſteries, ſeven nunneries, and ſeven popes who have lived there in 70 years. The ſteeples are numerous, and the bells are never at reſt; one of ſilver is rung only on the death of a pope. The church of the Celeſtines is very magnificent, and full of fine monuments, and the reſt are not without their curioſities. The univerſity has four colleges; and the place where the Jews live is a diſtinct quarter, from whence the Jews, who pay tribute, dare not ſtir out without yellow hats, and the women muſt have ſomething yellow about their heads, to diſtinguiſh them from the Chriſtians. Their number is very conſiderable in a very confined place, where the only way of enlarging their abodes is by building their houſes higher. Their ſynagogue is ſo dark, that they are obliged to light lamps. However, they are forced to hear a monk preach a ſermon every week. Acroſs the Rhone, here, extend the ruinous and decayed arches of that bridge againſt which Madame de Grignan was ſo near being loſt, and of which Madame de Sevigné makes terrified mention. It was demoliſhed in 1699 by one of the inundations common to the Rhone. When entire, it was not leſs than a quarter of a mile in length; but being ſo narrow as not to permit two carriages to paſs in any part, it had previouſly become almoſt uſeleſs; and motives of policy prevent the conſtruction of a new bridge, while Avignon belongs to the papal ſee. The curious that travel this way go to ſee the fountain of Vaucluſe, where the river Sorgues, which paſſes through this city, has its ſource; and whither Petrarch ſo often retired to indulge his grief and hopeleſs love. It is ſituated in a valley five miles diſtant from the city. The ſides of the river are ſkirted by meadows of the moſt lively green; above which riſe abrupt and lofty rocks, that ſeem deſigned to ſeclude it from human view. The valley becomes gradually narrower toward the extremity, and winding continually deſcribes the figure of a horſeſhoe. The view is at length terminated by an enormous maſs of rock, forming a barrier acroſs it, of a prodigious height, and abſolutely perpendicular. Through its vaſt receſſes run the ſtreams which ſupply the fountain of Vaucluſe, and at its foot appears a baſon of water, ſeveral hundred feet in circumference, ſtretched like an expanſe, ſilent and quiet. The ſides are very ſteep, and it is ſaid that in the middle no bottom can be diſcovered, though attempts have been often made for that purpoſe; a circumſtance probably reſulting from the violence with which the ſprings bubble up, which prevents any weight from deſcending beyond a certain depth. Though the fountain is clearer in itſelf than cryſtal, yet the incumbent rock caſts a continual ſhade, approaching to black, over its ſurface. The water eſcaping from this ſtate of inaction by a narrow paſſage, is immediately precipitated in a caſcade down a rocky channel, where it foams over a number of vaſt detached ſtones, which intercept and impede its progreſs. They are covered with a deep green moſs of many ages, and have probably tumbled from the mountains that overhang the torrent. The rocks themſelves, which ſurround and inveſt this romantic ſpot, are worn by time and the inclemency of the weather into a thouſand extraordinary and fantaſtic forms, to which imagination gives ſhape and figure. On one of the pointed extremities, and in a ſituation which appears almoſt inacceeſſible, are ſeen the remains of an ancient caſtle, projecting over the water. The peaſants call it *Il caſtelle di Petrarca*, and add, with great ſimplicity, that Laura lived upon the oppoſite ſide of the river, under the bed of which was a ſubterranean paſſage by which the two lovers viſited each other. Nothing is however more certain than that theſe are the ruins of the chateau belonging to the Lords or Seigneurs of Avignon; and the biſhop of Cavaillon reſided in it during the frequent viſits which he uſed to make to Petrarch.—The poet's dwelling was much lower down, and nearer to the bank of the Sorgues, as evidently appears from his minute deſcription of it, and the relation he gives of his quarrel with the Naiads of the ſtream, who encroached during the winter on his little adjoining territory. No remains of it are now to be diſcerned. Below the bridge there is an iſland where the Sorgues joins the Rhone, in which are ſeveral houſes of pleaſure. E. Long. 4. 59. N. Lat. 43. 57.

Avignon-Berry, the fruit of a ſpecies of lycium; growing plentifully near Avignon and in other parts of France. The berry is ſomewhat leſs than a pea; its colour is green, approaching towards a yellow; and is of an aſtringent and bitter taſte.—It is much uſed by the dyers, who ſtain a yellow colour with it, and by the painters, who alſo make a fine golden yellow of it.

AVILA, a city of Old Caſtile, in Spain, ſeated on an eminence on the banks of the river Adaja, and in ſight of the mountains of Pico. It is fortified both by nature and art, having a wall 9075 feet in circumference, adorned with 26 lofty towers, and 10 handſome gates. There are 17 principal ſtreets, the houſes in which are generally good, and ſome of them ſtately. It hath nine ſquares, 2000 houſes, nine pariſhes, as many monaſteries, ſeven nunneries, two colleges, nine hoſpitals, 18 chapels, and an allowance of 10,000 ducats yearly for the maintenance of orphans and other poor people. It has an univerſity, and a conſiderable biſhopric; beſides a noble cathedral, which has eight dignitaries, 20 canons, and the ſame number of minor canons. It ſtands in the middle of a fine large plain, ſurrounded with mountains, and covered with fruit-trees and vineyards. There is likewiſe a manufacture of cloth. W. Long. 4. 13. N. Lat. 40. 35.

AVIS, a ſmall town of Alentejo in Portugal, ſeated on an eminence, with a caſtle, near the river Avis. Hence the military order of the knights of Avis have their name. W. Long. 7. 0. N. Lat. 38 40.

Avis *(Knights d'Avis)*, an order of knighthood in Portugal eſtabliſhed about the year 1162. When the city of Evora was taken from the Moors, in the reign of the firſt king of Portugal, it was garriſoned by ſeveral perſons who aſſumed the title of knights of St Mary of Evora, which was ſoon after changed for that of knights d'Avis, which the king gave them, and whither they removed from Evora. The badge of the order is a green croſs flory, and they obſerve the rule of St Benedict.

AVISO, a term chiefly uſed in matters of commerce to denote an advertiſement, an advice, or piece of intelligence.

AVISON (Charles), organiſt of Newcaſtle, and a diſciple of Geminiani, was the author of an eſſay on muſical expreſſion, publiſhed in the year 1752, in which are ſome judicious reflections on muſic in general, but his diviſion of the modern authors into claſſes is rather fanciful than juſt. Throughout his book he celebrates Marcello and Geminiani; the latter frequently in prejudice to Mr. Handel. In the year 1753 came out remarks on Mr. Aviſon's eſſay on muſical expreſſion, the author whereof firſt points out ſundry errors againſt the rules of compoſition in the works of Aviſon. In the ſame year Aviſon republiſhed his eſſay, with a reply to the author of the remarks; and a letter, containing a number of looſe particulars relating to muſic collected in a courſe of various reading, unqueſtionably written by Dr Jortin. Aviſon promoted and aſſiſted in the publication of Marcello's muſic to the pſalms adapted to Engliſh words. Of his own compoſition there are extant five collections of concertos for violins, 44 in number; and two ſets of ſonatas for the harpſichord and two violins, a ſpecies of compoſition little known in England till his time. The muſic of Aviſon is light and elegant, but it wants originality; a neceſſary conſequence of his too cloſe attachment to the ſtyle of Geminiani, which in a few particulars only he was able to imitate.

AUK, in ornithology. See Alca.

Bishop's AUKLAND, a town in the biſhopric of Durham in England, ſituated on the river Were. It is a ſanctuary for debtors; and here the biſhop has a princely palace and a noble park. W. Long. 0. 57. N. Lat. 54. 44.

AULA, is uſed for a court baron, by Spelman; by ſome old eccleſiaſtical writers, for the nave of a church, and ſometimes for a court-yard.

Aula Regia or *Regis*, a court eſtabliſhed by William the Conqueror in his own hall, compoſed of the king's great officers of ſtate, who reſided in his palace, and were uſually attendant on his perſon. This court was regulated by the article which forms the eleventh chapter of Magna Charta, and eſtabliſhed in Weſtminſter-hall, where it hath ever ſince continued. See *King's Bench*.

AULCESTER, a town of Warwickſhire in England. W. Long. 1. 47. N. Lat. 52. 15.

AULETES, in antiquity, denotes a flute-player. One of the Ptolemies, kings of Egypt, father of Cleopatra, bore the ſurname or denomination of *Auletes*.

AULIC, an epithet given to certain officers of the empire, who compoſe a court which decides, without appeal, in all proceſſes entered in it. Thus we ſay, *aulic council*, *aulic chamber*, *aulic counſellor*.

The aulic council is compoſed of a preſident, who is a catholic; of a vice-chancellor, preſented by the archbiſhop of Mentz; and of 18 counſellors, nine of whom are proteſtants and nine catholics. They are divided into a bench of lawyers, and always follow the emperor's court; for which reaſon they are called *juſtitium imperatoris*, the emperor's juſtice, and aulic council. The aulic court ceaſes at the death of the emperor; whereas the imperial chamber of Spire is perpetual, repreſenting not only the deceaſed emperor, but the whole Germanic body, which is reputed never to die.

Aulic, in the Sorbonne and foreign univerſities, is an act which a young divine maintains upon being admitted a doctor in divinity. It begins by an harangue of the chancellor, addreſſed to the young doctor, after which he receives the cap, and preſides at the aulic, or diſputation.

AULIS (anc. geog.), a town of Bœotia, over againſt Chalcis of Eubœa, on the Euripus, where that ſtrait is narroweſt; and which were ſometimes joined together by a mole or cauſeway, (Diodorus Siculus): a craggy ſituation, (Homer, Nonnus); and a village of the Tanagraei, (Strabo), diſtant from Chalcis three miles: A harbour famous for the rendezvous of a thouſand ſhips under Agamemnon, previous to the Trojan expedition, (Livy, Virgil, Pliny). Now entirely deſtroyed.

AULNEGER. See Alnager.

AULON, anciently a town and dock or ſtation for ſhips in Illyricum, on the Adriatic; now *Valona*, or *Volana*, a port-town in the duchy of Ferara on one of the mouths of the Po, on the gulf of Venice. E. Long. 13. Lat. 44. 50.

Aulon, or *Aulona*, anciently a town of Elis, in Peloponneſus, on the confines of Meſſenia. Here ſtood a temple of Æſculapius; hence the epithet *Aulonius* given that divinity, (Pauſanias).

AULOS, a Grecian long meaſure, the ſame with ſtadium.

AULPS, a town of Provence in France, in the dioceſe of Trejus, with the title of a Vigueria. E. Long. 6. 25. N. Lat. 43. 40.

AULUS gellius. See Gellius.

AUMBRY, a country-word denoting a cup-board.

AUME, a Dutch meaſure for Rheniſh wine, containing 40 Engliſh gallons.

AUNCEL-weight, an ancient kind of balance now out of uſe, being prohibited by ſeveral ſtatutes, on account of the many deceits practiſed by it. It conſiſted of ſcales hanging on hooks, faſtened at each end of a beam, which a man lifted up on his hand. In many parts of England, auncel-weight ſignifies meat ſold by the hand, without ſcales.

AUNE, a long meaſure uſed in France to meaſure cloths, ſtuffs, ribbons, &c. At Rouen, it is equal to one Engliſh ell; at Calais, to 1.52; at Lyons, to 1.061; and at Paris, to 0.95

AUNGERVYLE (Richard), commonly known by the name of *Richard de Bury*, was born in 1281 at St Edmund's Bury in Suffolk, and educated at the univerſity of Oxford: After which he entered into the order of Benedictine monks, and became tutor to Edward prince of Wales, afterwards king Edward III. Upon the acceſſion of his royal pupil to the throne he was firſt appointed cofferer, then treaſurer of the wardrobe, archdeacon of Northampton, prebendary of Lincoln, Sarum, and Litchfield, keeper of the privy ſeal, dean of Wells, and laſt of all was promoted to the biſhoprick of Durham. He likewiſe enjoyed the offices of lord high chancellor, and treaſurer of England; and diſcharged two important embaſſies at the court of France. Learned himſelf, and a patron of the learned, he maintained a correſpondence with ſome of the greateſt geniuſes of the age, particularly with the celebrated Italian poet Petrarch. He was alſo of a moſt humane and benevolent temper, and performed many ſignal acts of charity. Every week he made eight quarters of wheat into bread, and gave it to the poor. Whenever he travelled between Durham and Newcaſtle, he diſtributed eight pounds ſterling in alms; between Durham and Stockton five pounds, between Durham and Aukland five marks, and between Durham and

Middleham five pounds. He founded a public library at Oxford, for the uſe of the ſtudents, which he furniſhed with the beſt collection of books then in England; and appointed five keepers, to whom he granted yearly ſalaries. At the diſſolution of religious houſes in the reign of Henry VIII. Durham college, where he fixed the library, being diſſolved among the reſt, ſome of the books were removed to the public library, ſome to Baliol college, and ſome came into the hands of Dr George Owen, a phyſician of Godſtow, who bought that college of king Edward VI. Biſhop Aungervyle died at his manor of Aukland, April 24, 1345, and was buried in the ſouth part of the croſs iſle of the cathedral church of Durham, to which he had been a benefactor. He wrote, 1. *Philobiblos*, containing directions for the management of his library at Oxford, and a great deal in praiſe of learning, in bad Latin. 2. *Epiſtolæ familiarium*; ſome of which are written to the famous Petrarch. 3. *Orationes ad principes*; mentioned by Bale and Pitts.

AUNIS, the ſmalleſt province in France, bounded on the north by Poictou, on the weſt by the ocean, on the eaſt and ſouth by Saintogne, of which it was formerly a part. It is watered by the rivers Seure and Sarente, the former of which has its ſource at Seure in Poictou. The coaſt of this ſmall diſtrict has the advantage of ſeveral ports, the moſt remarkable of which are Rochefort, Rochelle, Brouge, St Martin de Re, Tremblade, Tonnai, and Charente. The ſoil of this country is dry, yet produces good corn and plenty of wine. The marſhes feed a great number of cattle, and the ſalt marſhes yield the beſt ſalt in Europe.

AVOCADO, or AVIGATO, *Pear*. See LAURUS.

AVOCATORIA, a mandate of the emperor of Germany, addreſſed to ſome prince, in order to ſtop his unlawful proceedings in any cauſe appealed to him.

AVOIDANCE, in the canon law, is when a benefice becomes void of an incumbent; which happens either in fact, as by the death of the perſon; or in law, as by ceſſion, deprivation, reſignation, &c. In the firſt of theſe caſes, the patron muſt take notice of the avoidance at his peril; but in avoidance by law, the ordinary is obliged to give notice to the patron, in order to prevent a lapſe.

AVOIRDUPOIS. This is the weight for the larger and coarſer commodities, ſuch as groceries, cheeſe, wool, lead, &c. Bakers, who live not in corporation towns, are to make their bread by avoirdupois weight, thoſe in corporations by troy weight. Apothecaries buy by avoirdupois weight, but ſell by troy. The proportion of a pound avoirdupois to a pound troy is as 17 to 14.

AVOSETTA, in ornithology. See RECURVIROSTRA.

AVOWEE, one who has a right to preſent to a benefice. He is thus called in contradiſtinction to thoſe who only have the lands to which the advowſon belongs for a term of years, or by virtue of intruſion or diſſeiſin.

AVOWRY, in law, is where a perſon diſtrained ſues out a replevin; for then the diſtrainer muſt vow, and juſtify his plea, which is called his *avowry*.

AURA, among phyſiologiſts, an airy exhalation or vapour. The word is Latin, derived from the Greek, *αυρα, gentle wind.*

AURACH, a town of Germany with a good caſtle, in the ſouth part of Suabia, in the duchy of Wirtemberg. It is the uſual reſidence of the youngeſt ſons of the houſe of Wirtemberg, and is ſeated at the foot of a mountain on the rivulet Ermſt. E. Long. 9. 20. N. Lat. 48. 25.

AURÆ, in mythology, a name given by the Romans to the nymphs of the air. They are moſtly to be found in the ancient paintings of ceilings; where they are repreſented as light and airy, generally with long robes and flying veils of ſome lively colour or other, and fluttering about in the rare and pleaſing element aſſigned to them. They are characteriſed as ſportive and happy in themſelves, and well-wiſhers to mankind.

AURANCHES, the capital of a territory called *Auranchin*, about 30 miles in length, in Lower Normandy in France. The city is mean; but its ſituation very fine, being on an eminence, near which the river See runs, about a mile and a half from the ocean. The cathedral ſtands on a hill, which terminates abruptly; the front of the church extending to the extreme verge of it, and overhanging the precipice. It bears the marks of high antiquity; but the towers are decayed in many places, though its original conſtruction has been wonderfully ſtrong. Here, you are told, the Engliſh Henry II. received abſolution from the Papal nuncio for the murder of St Thomas-a-Becket in 1172; and the ſtone on which he knelt during the performance of that ceremony is ſhown to ſtrangers. Its length is about 30 inches, and the breadth 12. It ſtands before the north portal, and on it is engraved a chalice in commemoration of the event.—The ruins of the caſtle of Auranches are very extenſive, and beneath lies a rich extent of country, abounding in grain and covered with orchards, from the fruit of which is made the beſt cyder in Normandy. W. Long. 1. 20. N. Lat. 48. 51.

AURANTIUM, in botany. See CITRUS.

AURAY, a ſmall ſeaport town of Lower Brittany in France, ſituated in the gulph called *Morbian*. It is nothing, properly ſpeaking, but a large quay, and a handſome ſtreet, being chiefly known for its trade. W. Long. 2. 25. N. Lat. 47. 48.

AURELIA, in natural hiſtory, the ſame with what is more uſually called *chryſalis*, and ſometimes *nymph*. See CHRYSALIS.

AURELIANUS (Lucius Domitius), emperor of Rome, was one of the greateſt generals of antiquity, and commanded the armies of the emperor Claudius with ſuch glory, that after the death of that emperor all the legions agreed to place him on the throne: this happened in the year 270. He carried the war from the eaſt to the weſt, with as much facility, ſays a modern writer, as a body of troops marches from Alſace into Flanders. He defeated the Goths, Sarmatians, Marcomanni, the Perſians, Egyptians, and Vandals; conquered Zenobia queen of the Palmyrenians, and Tetricus general of the Gauls; both of whom were made to grace his triumph, in the year 274. He was killed by one of his generals in Thrace in the year 275, when he was preparing to enter Perſia with a great army. See ROME.

AURELIUS VICTOR. See VICTOR.

AURENGABAD, a city in the Eaſt Indies, capital of the province of Balagate, in the dominions of the Great Mogul. It is furniſhed with handſome moſques and caravanſeras. The buildings are chiefly of free-ſtone, and pretty high, and the ſtreets planted on each ſide with trees. They have large gardens well ſtocked with fruit-trees and vines. The ſoil about it is alſo very fertile, and the ſheep fed in its neighbourhood are remarkably large and ſtrong. E. Long. 75. 30. N. Lat. 19. 10.

AURENG-ZEBE, the Great Mogul. See INDOSTAN.

AUREOLA, in its original ſignification, ſignifies a jewel, which is propoſed as a reward of victory in ſome public diſpute. Hence the Roman ſchoolmen applied it to denote the reward beſtowed on martyrs, virgins, and doctors, on account of their works of ſupererogation; and painters uſe it to ſignify the crown of glory with which they adorn the heads of ſaints, confeſſors, &c.

AUREUS, a Roman gold coin, equal in value to 25 denarii.—According to Ainſworth, the aureus of the higher empire weighed near five pennyweights; and in the lower empire, little more than half that weight. We learn from Suetonius, that it was cuſtomary to give aurei to the victors in the chariot-races.

AUREUS MONS (anc. geog.), a mountain in the north-weſt of Corſica, whoſe ridge runs out to the north-eaſt and ſouth-eaſt, forming an elbow—Another mountain of Moeſia Superior, or Servia (Peutinger), to the ſouth of the Danube, with a cognominal town at its foot on the ſame river. The emperor Probus planted this mountain with vines (Eutropius).

AURICK, a city of Germany; in Eaſt Frieſland, in the circle of Weſtphalia; to which the king of Pruſſia claims a right. It is ſituated in a plain ſurrounded with foreſts full of game. E. Long. 6. 50. N. Lat. 53. 28.

AURICLE, in anatomy, that part of the ear which is prominent from the head, called by many authors *auris externa*.

AURICLES are likewiſe two muſcular bags ſituated at the baſis of the heart, and intended as diverticula for the blood during the diaſtole.

AURICULA, in botany. See PRIMULA.

AURIFLAMMA, in the French hiſtory, properly denotes a flag or ſtandard belonging to the abbey of St Dennis, ſuſpended over the tomb of that ſaint, which the religious, on occaſion of any war in defence of their lands or rights, took down, with great ceremony, and gave it to their protector or advocate, to be borne at the head of their forces.

AURIFLAMMA is alſo ſometimes uſed to denote the chief flag or ſtandard in any army.

AURIGA, *the* WAGGONER, in aſtronomy, a conſtellation of the northern hemiſphere, conſiſting of 23 ſtars, according to Tycho; 40, according to Hevelius; and 68, in the Britannic catalogue.

AURILLAC, a town of France in the Lower Auvergne, ſeated on a ſmall river call *Jordane*. It is one of the moſt conſiderable towns of the province, has ſix gates, is very populous, and yet has but one pariſh. The caſtle is very high, and commands the town. The abbot is lord of Aurillac, and has epiſcopal juriſdiction; he is alſo chief juſtice of the town. This place is remarkable for having produced ſeveral great men. E. Long. 2. 33. N. Lat. 44. 55.

AURIPIGMENTUM, ORPIMENT, in natural hiſtory. See ORPIMENT.

AURISCALPIUM, an inſtrument to clean the ears, and ſerving alſo for other operations in diſorders of that part.

AURORA, the morning twilight, or that faint light which appears in the morning when the ſun is within 18 degrees of the horizon.

AURORA, the goddeſs of the morning, according to the Pagan mythology. She was the daughter of Hyperion and Theia, according to Heſiod; but of Titan and Terra, according to others. It was under this name that the ancients deified the light which foreruns the riſing of the ſun above our hemiſphere. The poets repreſent her as riſing out of the ocean, in a chariot, with roſy fingers dropping gentle dew. Virgil deſcribes her aſcending in a flame-coloured chariot with four horſes.

AURORA, one of the New Hebrides iſlands in the South Sea, in which Mr Forſter ſuppoſes the *Peak d'Etoile* mentioned by Mr Bouganville to be ſituated. The iſland is inhabited; but none of its inhabitants came off to viſit Captain Cook. The country is woody, and the vegetation ſeemed to be exceſſively luxuriant. It is about 12 leagues long, but not above five miles broad in any part; lying nearly north and ſouth. The middle lies in S. Lat. 15. 6. E. Long. 168. 24.

AURORA BOREALIS, NORTHERN TWILIGHT, or *Streamers*; a kind of meteor appearing in the northern part of the heavens, moſtly in the winter-time, and in froſty weather. It is now ſo generally known, that no deſcription is requiſite of the appearance which it uſually makes in this country. But it is in the arctic regions that it appears in perfection, particularly during the ſolſtice. In the Schetland iſlands, the *merry dancers*, as they are there called, are the conſtant attendants of clear evenings, and prove great reliefs amidſt the gloom of the long winter-nights. They commonly appear at twilight near the horizon, of a dun colour, approaching to yellow; ſometimes continuing in that ſtate for ſeveral hours without any ſenſible motion; after which they break out into ſtreams of ſtronger light ſpreading into columns, and altering ſlowly into ten thouſand different ſhapes, varying their colours from all the tints of yellow to the obſcureſt ruſſet. They often cover the whole hemiſphere, and then make the moſt brilliant appearance. Their motions at theſe times are moſt amazingly quick; and they aſtoniſh the ſpectator with the rapid change of their form. They break out in places where none were ſeen before, ſkimming briſkly along the heavens; are ſuddenly extinguiſhed, and leave behind an uniform duſky tract. This again is brilliantly illuminated in the ſame manner, and as ſuddenly left a dull blank. In certain nights they aſſume the appearance of vaſt columns, on one ſide of the deepeſt yellow, on the other declining away till it becomes undiſtinguiſhed from the ſky. They have generally a ſtrong tremulous motion from end to end, which continues till the whole vaniſhes. In a word, we, who only ſee the extremities of theſe northern phenomena, have but a faint ideas of their ſplendor and their motions. According to the ſtate of the atmoſphere, they differ in colours. They often put on the colour of blood, and make a moſt dreadful appearance. The ruſtic ſages become prophetic, and terrify the gazing ſpectators with the dread of war, peſtilence, and famine. This ſuperſtition was not peculiar to the northern iſlands; nor are theſe appearances of recent date. The ancients called them *Chaſmata*, and *Trabes*, and *Bolides*, according to their forms or colours.

In old times they were extremely rare, and on that account were the more taken notice of. From the days of Plutarch to thoſe of our ſage hiſtorian Sir Richard Baker, they were ſuppoſed to have been portentous of great events, and timid imaginations ſhaped them into aerial conflicts:

> Fierce fiery warriors fight upon the clouds
> In ranks and ſquadrons and right form of war.

1 This meteor formerly very rare.

Dr Halley tells us, that when he ſaw a great aurora borealis in 1716, he had begun to deſpair of ever ſeeing one at all; none having appeared, at leaſt in any conſiderable degree, from the time he was born till then. Notwithſtanding this long interval, however, it ſeems that in ſome periods the aurora borealis had been ſeen much more frequently; and perhaps this, as well as other natural phenomena, may have ſome ſtated times of returning.

2 Hiſtory by Dr Halley.

The only thing that reſembles a diſtinct hiſtory of this phenomenon, is what we have from the learned Dr Halley, Phil. Tranſ. n° 347. The firſt account he gives, is of the appearance of what is called by the author *burning ſpears*, and was ſeen at London on January 30th, 1560. This account is taken from a book intitled, *A deſcription of Meteors*, by *W. F.* D. D. and reprinted at London in 1654. The next appearance, on the teſtimony of Stow, was on October 7th, 1564. In 1574 alſo, according to Camden, and Stow abovementioned, an aurora borealis was obſerved two nights ſucceſſively, *viz.* on the 14th and 15th of November, with much the ſame appearance as deſciribed by Dr Halley in 1715-16, and which we now ſo frequently obſerve. Again, the ſame was twice ſeen in Brabant, in the year 1575; *viz.* on the 13th of February and 28th of September. Its appearances at both theſe times were deſcribed by Cornelius Gemma, profeſſor of medicine in the univerſity of Lovain, who compares them to ſpears, fortified cities, and armies fighting in the air. After this, Michael Mæſtlin, tutor to the great Kepler, aſſures us, that at Baknang in the county of Wurtemberg in Germany, theſe phenomena, which he ſtyles *chaſmata*, were ſeen by himſelf no leſs than ſeven times in 1580. In 1581, they again appeared in an extraordinary manner in April and September, and in a leſs degree at ſome other times of the ſame year. In 1621, September 2d, this phenomenon was obſerved all over France, and deſcribed by Gaſſendus, who gave it the name of *aurora borealis*: yet neither this, nor any ſimilar appearances poſterior to 1574, are deſcribed by Engliſh writers till the year 1707; which, as Dr Halley obſerves, ſhows the prodigious neglect of curious matters which at that time prevailed. From 1621 to 1707, indeed, there is no mention made of an aurora borealis being ſeen by any body: and conſidering the number of aſtronomers who during that period were in a manner continually poring on the heavens, we may very reaſonably conclude that no ſuch thing did make its appearance till after an interval of 86 years. In 1707, a ſmall one was ſeen in November; and during that year and the next, the ſame appearances were repeated five times. The next, on record is that mentioned by Dr Halley in March 1715-16, the brilliancy of which attracted univerſal attention, and by the vulgar was conſidered as marking the introduction of a foreign race of princes. Since that time thoſe meteors have been ſo common, that no accounts have been kept of them.

3 Mr Forſter's account of ſimilar appearances in the ſouthern hemiſphere.

It was for a long time a matter of doubt whether this meteor made its appearance only in the northern hemiſphere, or whether it was alſo to be obſerved near the ſouth pole. This is now aſcertained by Mr Forſter; who in his late voyage round the world along with Captain Cook, aſſures us, that he obſerved them in the high ſouthern latitudes, though with phenomena ſomewhat different from thoſe which are ſeen here. On Feb. 17, 1773, as they were in Lat. 58° ſouth, "A beautiful phenomenon (ſays he) was obſerved during the preceding night, which appeared again this and ſeveral following nights. It conſiſted of long columns of a clear white light, ſhooting up from the horizon to the eaſtward, almoſt to the zenith, and gradually ſpreading on the whole ſouthern part of the ſky. Theſe columns were ſometimes bent ſideways at their upper extremities; and though in moſt reſpects ſimilar to the northern lights *(aurora borealis)* of our hemiſphere, yet differed from them in being always of a whitiſh colour, whereas ours aſſume various tints, eſpecially thoſe of a fiery and purple hue. The ſky was generally clear when they appeared, and the air ſharp and cold, the thermometer ſtanding at the freezing-point."

4 Riſes very high.

Dr Halley obſerved that the aurora borealis deſcribed by him aroſe to a prodigious height, it being ſeen from the weſt of Ireland to the confines of Ruſſia and Poland on the eaſt; nor did he know how much farther it might have been viſible; ſo that it extended at leaſt 30 degrees in longitude, and from lat. 50° north it was ſeen all over the northern part of Europe; and what was very ſurpriſing, in all thoſe places where it was viſible, the ſame appearances were exhibited which Dr Halley obſerved at London. He obſerves, with ſeeming regret, that he could by no means determine its height for want of obſervations made at different places; otherwiſe he might as eaſily have calculated the height of this aurora borealis, as he did of the fiery globe in 1719*. To other philoſophers, however, he gives the following exhortation. "When therefore for the future any ſuch thing ſhall happen, all thoſe that are curious in aſtronomical matters are hereby *admoniſhed* and *intreated* to ſet their clocks to the apparent time at London, for example, by allowing ſo many minutes as is the difference of meridians; and then to note, at the end of every half hour preciſely, the exact ſituation of what at that time appears remarkable in the ſky; and particularly the azimuths of thoſe very tall pyramids ſo eminent above the reſt, and therefore likely to be ſeen furtheſt: to the intent that, by comparing theſe obſervations taken at the ſame moment in diſtant places, the difference of their azimuths may ſerve to determine how far theſe pyramids are diſtant from us." This advice of Dr Halley ſeems to have been totally neglected by all the philoſophical people in Britain. In other countries, however, they have been more induſtrious. Father Boſcovich has determined the height of an aurora borealis, obſerved on the 16th of December 1737 by the Marquis of Poleni, to have been 825 miles high; the celebrated Mr Bergman, from a mean of 30 computations, makes the average height of the aurora borealis to be 70 Swediſh, or upwards of 460 Engliſh miles. Euler ſuppoſes it to be ſeveral thouſands of miles high; and Mairan alſo aſſigns them a very elevated region. In the 74th volume of the philoſophical tranſactions, Dr Blagden, when ſpeaking of the height of ſome fiery meteors, tells us, that the "aurora borealis appears to occupy as high, if not a higher region above the ſurface of the earth, as may be judged from the very diſtant countries to which it has been viſible at the ſame time." The height of theſe meteors, however, none of which appear to have exceeded or even arrived at the height of a hundred miles, muſt appear trifling in compariſon of the vaſt elevations abovementioned. But theſe enormous heights, varying ſo exceedingly, ſhow that the calculators have not had proper data to proceed upon; and indeed the immenſe extent of ſpace occupied by the aurora borealis itſelf, with its conſtant motion, muſt make it infinitely more difficult to determine the height of it than of a fiery globe, which occupies but a ſmall portion of the viſible heavens. The moſt certain method of making a compariſon betwixt the aurora borealis and the meteors already mentioned, would be, if a ball of fire ſhould happen to paſs through the ſame part of the heavens where an aurora borealis was; when the comparative height of both could eaſily be aſcertained. One inſtance of this only has come under our obſervation, where one of the ſmall meteors, called *falling ſtars*, was evidently obſcured by an aurora borealis; and therefore muſt have been higher than the lower part of the latter at leaſt. A ſingularity in this meteor was, that it did not proceed in a ſtraight line through the heavens, as is uſual with falling ſtars, but deſcribed a very conſiderable arch of a circle, riſing in the northweſt, and proceeding ſouthward a conſiderable way in the arch of a circle, and diſappearing in the north. Its edges were ill defined, and five or ſix corruſcations ſeemed to iſſue from it like the rays painted as iſſuing from ſtars. The aurora borealis was not in motion, but had degenerated into a crepuſculum in the northern part of the hemiſphere. Indeed in ſome caſes this kind of crepuſculum appears ſo plainly to be connected with the clouds, that we can ſcarcely avoid ſuppoſing it to proceed from them. We cannot, however, argue from this to the height of the aurora borealis when it moves with great velocity, becauſe it then may, and very probably does, aſcend much higher. Dr Blagden, indeed, informs us, that inſtances are recorded, where the northern lights have been ſeen to join, and form luminous balls, darting about with great velocity, and even leaving a train like the common fire-balls. It would ſeem therefore, that the higheſt regions of the aurora borealis are the ſame with thoſe in which fireballs move.

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* See *Atmoſphere*.

5
Conjectures concerning the cauſe of this meteor.

With regard to the cauſe of the aurora borealis, many conjectures have been formed. The firſt which naturally occurred was, that it was occaſioned by the aſcent of inflammable ſulphureous vapours from the earth. To this ſuppoſition Dr Halley objects the immenſe extent of ſuch phenomena, and that they are conſtantly obſerved to proceed from north to ſouth, but never from ſouth to north. This made him very reaſonably conclude, that there was ſome connection between the poles of the earth and the aurora borealis; but being unacquainted with the electric power, he ſuppoſed, that this earth was hollow, having within it a magnetical ſphere, which correſponded in virtue with all the natural and artificial magnets on the ſurface; and the magnetic effluvia paſſing through the earth, from one pole of the central magnet to another, might ſometimes become viſible, in their courſe, which he thought was from north to ſouth, and thus exhibit the beautiful corruſcations of the aurora borealis. Had Dr Halley, however, known that a ſtroke of electricity would give polarity to a needle that had it not, or reverſe the poles of one that had it before, he would undoubtedly have concluded the electric and magnetic effluvia to be the ſame, and that the aurora borealis was this fluid performing its circulation from one pole of the earth to the other. In fact, this very hypotheſis is adapted by S. Beccaria; and by the ſuppoſed circulation of the electric fluid he accounts for the phenomena of magnetiſm and the aurora borealis in a manner perfectly ſimilar to that of Dr Halley, only changing the phraſe *magnetic effluvia* for *electric fluid*. The following is the account given us by Dr Prieſtley of Beccaria's ſentiments on this matter.

"Since a ſudden ſtroke of lightning gives polarity to magnets, he conjectures, that a regular and conſtant circulation of the whole maſs of the fluid from north to ſouth may be the original cauſe of magnetiſm in general.

"That this etherial current is inſenſible to us is no proof of its non-exiſtence, ſince we ourſelves are involved in it. He had ſeen birds fly ſo near a thunder-cloud, as he was ſure they would not have done had they been affected by its atmoſphere.

"This current he would not ſuppoſe to ariſe from one ſource, but from ſeveral, in the northern hemiſphere of the earth; and he thinks that the aurora borealis may be in this electric matter performing its circulation in ſuch a ſtate of the atmoſphere as renders it viſible, or approaching the earth nearer than uſual. Accordingly very vivid appearances of this kind have been obſerved to occaſion a fluctuation in the magnetic needle.

A direct diſproof of this circulation, however, is furniſhed by the obſervation of Mr Forſter already mentioned; with which, though neither Dr Halley nor S. Beccaria could be acquainted, they might have thought of it as a final proof either of the truth or falſehood of their hypotheſis.—If the aurora borealis is no other than the electric fluid performing the abovementioned circulation, it ought to dart from the horizon towards the zenith in the northern hemiſphere, and from the zenith to the horizon in the ſouthern one: but Mr Forſter plainly tells us, that the columns ſhot up from the horizon towards the zenith as well in the ſouthern hemiſphere as in the northern; ſo that if the aurora borealis is to be reckoned the flaſhings of electric matter, its courſe is plainly directed from both poles towards the equator, and not from one pole to the other.

Concerning the cauſe of this phenomenon, Mr Canton has the following query: "Is not the aurora borealis the flaſhing of electrical fire from poſitive towards negative clouds at a great diſtance, through the upper part of the atmoſphere where the reſiſtance is leaſt?" But to this we muſt reply in the negative; for in this caſe it would flaſh in evey direction according to the poſition of the clouds, as well as from north to ſouth. Beſides this query, he conjectures, that when the needle is diſturbed by the aurora borealis, that phenomenon proceeds from the electricity of the heated air; and ſuppoſes the air to have the property of becoming electric by heat, like the tourmalin. But neither does this hypotheſis appear at all probable; becauſe, in ſuch a caſe, the aurora borealis ought to be moſt frequent in ſummer when the air is moſt heated, whereas it is found to be the reverſe.——Laſtly, with theſe electrical hypotheſes we ſhall contraſt that of Mr Mairan, who imagined this phenomenon to proceed from the atmoſphere of the ſun, particles of which were thrown off by its centrifugal force acquired by his rotation on his axis; and that theſe particles falling upon the atmoſphere of the earth near its equatorial parts, were from thence propelled by the diurnal motion of the earth towards the polar regions, where they formed the aurora borealis. This hypotheſis, beſides its being a mere ſuppoſition unſupported by one ſingle appearance in nature, is liable to the objection already mentioned; for in this caſe the light ſhould dart from the equator to the poles, and not from the poles to the equator: or if we ſhould ſuppoſe this matter to be gradually accumulated at each of the poles, we muſt then make other ſuppoſitions equally vague and ill founded, concerning its getting back with ſuch ſurpriſing rapidity in direct oppoſition to the power which once brought it thither.

The firſt perſon that ſeems to have endeavoured to find any poſitive proof for the electrical quality of the aurora borealis, is Dr Hamilton of Dublin. He obſerves, that though this phenomenon is commonly ſuppoſed to be electrical, yet he had not ſeen any attempt to prove that it is ſo: but the only proof he himſelf brings is an experiment of Mr Hawkſbee, by which the electric fluid is ſhown to put on appearances ſomewhat like the aurora borealis, when it paſſes through a vacuum. He obſerved, that when the air was moſt perfectly exhauſted, the ſtreams of electric matter were then quite white; but when a ſmall quantity of air was let in, the light aſſumed more of a purple colour. The flaſhing of this light therefore from the denſe regions of the atmoſphere into ſuch as are more rare, and the tranſitions through mediums of different denſity, he reckons the cauſe of the aurora borealis, and of the different colours it aſſumes.

Dr Hamilton's proof, then, of the electricity of the aurora borealis, conſiſts entirely in the reſemblance the two lights bear to one another; and if to this we add, that, during the time of an aurora borealis, the magnetic needle hath been diſturbed, electric fire obtained from the atmoſphere in plenty, and at ſome times different kinds of rumbling and hiſſing ſounds heard, we have the ſum of all the poſitive evidence in favour of the electric hypotheſis.

Was the aurora borealis the firſt natural phenomenon the ſolution of which had been attempted by electricity, no doubt the proofs juſt now adduced would be very inſufficient: but when it is conſidered, that we have indiſputable evidence of the identity of the phenomena of thunder and of electricity; when we alſo conſider, that the higher parts of our atmoſphere are continually in a ſtrongly electrified ſtate; the analogy becomes ſo ſtrong, that we can ſcarce doubt of the aurora borealis ariſing from the ſame cauſe. The only difficulty is, to give a good reaſon why the electricity of the atmoſphere ſhould be conſtantly found to direct its courſe from the poles towards the equator, and not from the equator to the poles; and this we think may be done in the following manner.

1. It is found that all electric bodies, when conſiderably heated, become conductors of electricity; thus hot air, hot glaſs, melted roſin, ſealing wax, &c. are all conductors, till their heat is diſſipated, and then they again become electrics.

See *Electricity* paſſim.

2. As the converſe of every true propoſition ought alſo to be true, it follows from the above one, that if electrics when heated become conductors, then non-electrics when ſubjected to violent degrees of cold ought to become electric. In one inſtance this has been verified by experience; water, which is a conductor when warm or not violently cooled, is found to become electric when cooled to 20° below 0 of Fahrenheit's thermometer. With regard to metallic ſubſtances, indeed, no experiments have as yet been made to determine whether their conducting power is affected by cold or not. Very probably we might not be able to produce ſuch a degree of cold as ſenſibly to leſſen their conducting power; but ſtill the analogy will hold; and, as we are by no means able to produce the greateſt degree of cold poſſible, reaſon will always ſuggeſt to us, that if a certain degree of cold changes one conductor into an electric, a ſufficient degree of it will alſo change all others into electrics.

3. If cold is ſufficient to change conducting ſubſtances into electrics, it muſt alſo increaſe the electric power of ſuch ſubſtances as are already electric; that is to ſay, very cold air, glaſs, roſin, &c. provided they are dry, will be more electric than when they are warmer. With regard to air, which is moſt to our preſent purpoſe, this is rendered extremely probable, by conſidering that clear froſty weather is of all others the moſt favourable for electric experiments. They may be made indeed to equal advantage almoſt in any ſtate of the atmoſphere, provided ſufficient pains is uſed, but in dry hard froſts they will ſucceed much more eaſily that at any other time.

Theſe three axioms being allowed, the cauſe of the aurora borealis is eaſily deduced from them. The air, all round the globe, at a certain height above its ſurface, is found to be exceedingly cold, and, as far as experiments have yet determined, exceedingly electrical alſo. The inferior parts of the atmoſphere between the tropics, are violently heated during the day-time by the reflection of the ſun's rays from the earth. Such air will therefore be a kind of conductor, and much more readily part with its electricity to the clouds and vapours floating in it, than the colder air towards the north and ſouth poles. Hence the prodigious appearances of electricity in theſe regions, ſhowing itſelf in thunder and other tempeſts of the moſt terrible kind. Immenſe quantities of the electric fluid are thus communicated to the earth, and the inferior warm atmoſphere having once exhauſted itſelf, muſt neceſſarily be recruited from the upper and colder region. This becomes very probable from what the French mathematicians obſerved when on the top of one of the Andes. They were often involved in clouds, which, ſinking down into the warmer air, appeared there to be highly electrified, and diſcharged themſelves in violent tempeſts of thunder and lightning; while, in the mean time, on the top of the mountain, they enjoyed a calm and ſerene ſky. In the temperate and frigid zones, the inferior parts of the atmoſphere never being ſo ſtrongly heated, do not part with their electricity ſo eaſily as in the torrid zone, and conſequently do not require ſuch recruits from the upper regions; but notwithſtanding the difference of heat obſerved in different parts of the earth near the ſurface, it is very probable that at conſiderable heights the degree of cold is nearly equal all round it. Were there a like equality in the heat of the under part, there could never be any conſiderable loſs of equilibrium in the electricity of the atmoſphere: but as the hot air of the torrid zone is perpetually bringing down vaſt quantities of electric matter from the cold air that lies directly above it; and as the inferior parts of the atmoſphere lying towards the north and ſouth poles do not conduct in any great degree; it thence follows, that the upper parts of the atmoſphere lying over the torrid zone will continually require a ſupply from the northern and ſouthern regions. This eaſily ſhows the neceſſity of an electric current in the upper parts of the atmoſphere from each pole towards the equator: and thus we are alſo furniſhed with a reaſon why the aurora borealis appears more frequently in winter than in ſummer; namely, becauſe at that time the electric power of the inferior atmoſphere is greater on account of the cold than in ſummer; and conſequently the abundant electricity of the upper regions muſt go almoſt wholly off to the equatorial parts, it being impoſſible for it to get down to the earth: hence alſo the aurora borealis appears very frequent and bright in the frigid zones, the degree of cold in the upper and under regions of the atmoſphere being much more nearly equal in theſe parts than in any other. In ſome parts of Siberia particularly, this meteor appears conſtantly from October to Chriſtmas, and its corruſcations are ſaid to be very terrifying. Travellers agree, that here the aurora borealis appears in greateſt perfection; and it is to be remarked, that Siberia is the coldeſt country on earth. In confirmation of this, it may alſo be obſerved, that, from the experiments hitherto made with the electrical kite, the air appears conſiderably more electrical in winter than in ſummer, though the clouds are known to be often moſt violently electrified in the ſummer time; a proof, that the electricity naturally belonging to the air is in ſummer much more powerfully drawn off by the clouds than in the winter, owing to the exceſs of heat in ſummer, as already obſerved.

A conſiderable difficulty, however, ſtill remains, from the upright poſition which the ſtreams of the aurora borealis are generally obſerved to have; whereas, according to the hypotheſis abovementioned, they ought rather to run directly from north to ſouth. This difficulty occured to Dr Halley: but he anſwers it by ſuppoſing his magnetic effluvia to paſs from one pole to another in arches of great circles, ariſing to a vaſt height above the earth, and conſequently darting from the places whence they aroſe almoſt like the radii of a circle; in which caſe, being ſent off in a direction nearly perpendicular to the ſurface of the earth, they muſt neceſſarily appear erect to thoſe who ſee them from any part of the ſurface, as is demonſtrated by mathematicians. It is alſo reaſonable to think that they will take this direction rather than any other, on account of their meeting with leſs reſiſtance in the very high regions of the air than in ſuch as are lower.

But the greateſt difficulty ſtill remains: for we have ſuppoſed the equilibrium of the atmoſphere to be broken in the day-time, and reſtored only the night; whereas, conſidering the immenſe velocity with which the electric fluid moves, the equilibrium ought to be reſtored in all parts almoſt inſtantaneouſly; yet the aurora borealis never appears except in the night, although its brightneſs is ſuch as muſt ſometimes make it viſible to us did it really exiſt in the day-time.

In anſwer to this it muſt be obſerved, that though the paſſage of electricity through a good conductor is inſtantaneous, yet through a bad conductor it is obſerved to take ſome time in paſſing. As our atmoſphere therefore, unleſs very violently heated, is but a bad conductor of electricity; though the equilibrium in it is broken, it can by no means be inſtantaneouſly reſtored. Add to this, that as it is the action of the ſun which breaks the equilibrium, ſo the ſame action, extending over half the globe, prevents almoſt any attempt to reſtore it till night; when flaſhes ariſe from various parts of the atmoſphere, gradually extending themſelves with a variety of undulations towards the equator.

It now remains to explain only one particularity of the aurora borealis, namely, that its ſtreams do not always move with rapidity, ſometimes appearing quite ſtationary for a conſiderable time, and ſometimes being carried in different directions with a ſlow motion. To this indeed we can give no other reply, than that weak electric lights have been ſometimes obſerved to put on the ſame appearance at the ſurface of the earth; and much more may we ſuppoſe them capable of doing ſo at great heights above it, where the conductors are both fewer in number and much more imperfect. When M. de Romans was making experiments with an electric kite in Italy, a cylinder of blue light about four or five inches diameter was obſerved ſurrounding the ſtring. This was in the day-time; but had it been night, he imagined it muſt have been four or five feet in diameter; and as the ſtring was 780 feet long, it would probably have ſeemed pyramidal, pointing upwards like one of the ſtreams of the aurora borealis. A ſtill more remarkable appearance, Dr Prieſtly tells us, was obſerved by Mr Hartman. He had been making electrical experiments for four or five hours together in a very ſmall room; and upon going out of it, and returning with a light in his hand, walking pretty quick, he perceived a ſmall flame following him at about three feet diſtance. Being alarmed at this appearance, he ſtopped to examine it, upon which it vaniſhed. This laſt inſtance is very remarkable, and ſingular in its kind: from both, however, we are ſufficiently warranted to conclude, that ſmall portions of our atmoſphere may by various cauſes be ſo much electrified as to ſhine, and likewiſe be moved from one place to another without parting with the electricity they have received, for a conſiderable time.

The corona, or circle, which is often formed near the zenith by the aurora borealis, is eaſily accounted for in the ſame manner. As this corona is commonly ſtationary for ſome time, we imagine it would be a very proper mark whereby to determine the diſtance of the meteor itſelf. If an aurora borealis, for inſtance, was obſerved by two perſons, one at London, and the other at Edinburgh; by noting the ſtars among which the corona was obſerved at each place, its true altitude from the ſurface of the earth could eaſily be determined by trigonometry.

Under the article ATMOSPHERE it was ſuggeſted, that no good proof had been as yet brought for the extreme rarity of the air uſually ſuppoſed to take place at no very great heights above the earth. The brightneſs of the meteor there mentioned at 70 miles perpendicular from the ſurface, as alſo its figure, ſeemed to prove the air conſiderably denſer at that diſtance from the earth. Though the height of the aurora borealis has never been determined, we can ſcarce imagine it to be greater than that of this meteor, or indeed ſo great: but although its ſtreams reſemble the paſſage of electric light through a vacuum, it cannot be from thence inferred, that the air is at all in a ſtate ſimilar to the vacuum of an air-pump in thoſe places where the aurora borealis is produced; ſeeing we have inſtances of ſimilar appearances being produced in very denſe air. The plate of an electrophorus is often ſo highly electrified, as to throw out flaſhes from different parts as ſoon as it is lifted up, and by proper management it may be always made to emit long and broad flaſhes which ſhall ſcarcely be felt by the finger, inſtead of ſmall, denſe, and pungent ſparks; ſo that, though long flaſhes may be produced in rarefied air, it by no means follows that the ſame may not alſo be produced in denſer air. As little can we infer any thing from the colours; for we obſerve the electric ſpark ſometimes white, ſometimes blue, and ſometimes purple, in the very ſame ſtate of the atmoſphere, and from the ſame ſubſtance.

The aurora borealis is ſaid to be attended with a peculiar hiſſing noiſe in ſome very cold climates; Gmelin ſpeaks of it in the moſt pointed terms, as frequent and very loud in the north-eaſtern parts of Siberia; and other travellers have related ſimilar facts. Gmelin's account is very remarkable. "Theſe northern lights (ſays he) begin with ſingle bright pillars, riſing in the N. and almoſt at the ſame time in the N. E. which gradually increaſing comprehend a large ſpace of the heavens, ruſh about from place to place with incredible velocity, and finally almoſt cover the whole ſky up to the zenith. The ſtreams are then ſeen meeting together in the zenith, and produce an appearance as if a vaſt tent was expended in the heavens, glittering with gold, rubies, and ſaphire. A more beautiful ſpectacle cannot be painted; but whoever ſhould ſee ſuch a northern light for the firſt time, could not behold it without terror. For however fine the illumination may be, it is attended, as I have learned from the relation of many perſons, with ſuch a hiſſing, cracking, and ruſhing noiſe throughout the air, as if the largeſt fireworks were playing off. To deſcribe what they then hear, they make uſe of the expreſſion, *Spolochi chodjat*, that is, the ranging hoſt is paſſing. The hunters who purſue the white and blue foxes in the confines of the Icy Sea, are often overtaken in their courſe by theſe northern lights. Their dogs are then ſo much frightened, that they will not move, but lie obſtinately on the ground till the noiſe has paſſed. Commonly clear and calm weather follows this kind of northern lights. I have heard this account, not from one perſon only, but confirmed by the uniform teſtimony of many, who have ſpent part of ſeveral years in theſe very northern regions, and inhabited different countries from the Yeneſei to the Lena; ſo that no doubt of its truth can remain. This ſeems indeed to be the real birth-place of the *aurora borealis*."

The hiſſing or ruſhing noiſe above deſcribed, Dr Blagden is inclined to attribute to ſmall ſtreams of electric matter running off to the earth from the maſſes or accumulations of electricity by which the northern lights are ſuppoſed to be produced.

6
Aurora borealis ſucceeded by ſouth-weſt winds.

We ſhall conclude this article with an account of a paper preſented to the Royal Society by Mr Winn, in 1772, wherein he ſays that the appearance of an aurora borealis, is a certain ſign of an hard gale of wind from the ſouth to ſouth-weſt. This he never found to fail in 23 inſtances; and even thinks, that from the ſplendor of the meteor, ſome judgment may be formed concerning the enſuing tempeſt. If the aurora is very bright, the gale will come on within twenty-four hours, but will be of no long duration; if the light is faint and dull, the gale will be leſs violent, and longer in coming on, but will alſo laſt longer. His obſervations were made in the Engliſh channel, where ſuch winds are very dangerous; and by attending to the auroræ, he ſays he often got eaſily out of it, when others narrowly eſcaped being wrecked. This is an exceeding uſeful obſervation for ſailors: but it cannot be expected that the winds ſucceeding theſe meteors ſhould in all places blow from the ſouth-weſt; though no doubt a careful obſervation of what winds ſucceed the aurora borealis, and other meteors, in different parts of the world, might contribute in ſome meaſure to leſſen the dangers of navigation.

7
Conjecture concerning the reaſon.

That the aurora borealis ought to be ſucceeded by winds, may be eaſily deduced from the hypotheſis laſt mentioned. If this phenomenon is occaſioned by the vaſt quantity of electric matter conveyed to the equatorial parts of the earth, it is certain that the earth cannot receive any great quantity of this matter at one place without emitting it at another. The electricity, therefore, which is conſtantly received at the equator, muſt be emitted nearer the poles, in order to perform its courſe, otherwiſe there could not be a conſtant ſupply of it for the common operations of nature. It is obſerved, that electrified bodies are always ſurrounded by a blaſt of air, which is ſent forth from them in all directions; hence, if the electric matter find a more ready paſſage through one part of the earth than another, a wind will be found to blow from that quarter. If therefore one of theſe places happens to be in the Atlantic ocean near the coaſt of France, or in the bay of Biſcay, the electric matter which has been received at the equator during an aurora borealis will be diſcharged there ſome time after, and conſequently a wind will blow from that quarter, which will be from the ſouth-weſt to thoſe ſhips which are in the Engliſh channel. It cannot be imagined, however, that all the matter can be diſcharged from one place; and therefore according to the different ſituations of thoſe electrical vents, winds may blow in different directions; and thus the ſame aurora borealis may produce a ſouth-weſt wind in the Engliſh channel, and a north-weſt one in Scotland.

AURUM. See Gold, Chemistry, and Metallurgy.

This metal was introduced into medicine by the Arabians, who eſteemed it one of the greateſt cordials and comforters of the nerves. From them Europe received it without any diminution of its character; in foreign pharmacopœias it is ſtill retained, and even mixed with the ingredients from which ſimple waters are to be diſtilled. But no one, it is preſumed, at this time expects any ſingular virtues from it, ſince it certainly is not alterable in the human body. Mr Geoffroy, though unwilling to reject it from the cordial preparations, honeſtly acknowledges that he has no other reaſon for retaining it than complaiſance to the Arabian ſchools. The chemiſts have endeavoured, by many elaborate proceſſes, to extract what they call a ſulphur or anima of gold: but no method is as yet known of ſeparating the component parts of this metal; all the tinctures of it, and aurum potabile, which have hitherto appeared, are real ſolutions of it in aqua regia, diluted with ſpirit of wine or other liquors, and prove injurious to the body rather than beneficial. A place, however, is now given in ſome of the foreign pharmacopœias to the aurum fulminans; and it has of late been recommended as a remedy in ſome convulſive diſeaſes, particularly in the chorea ſancti viti.

Aurum Fulminans. See Chemistry-*Index*.

Aurum Moſaicum. See Chemistry-*Index*.

AURUNCI (anc. geog.), a people of Latium, towards Campania; the ſame with the Auſones, at leaſt ſo intermixed as not to be eaſily diſtinguiſhable, though Pliny ſeparates them.

AUSA, a town of Terraconenſis, in the middle age called *Auſona*; now *Vich de Oſona*, a town of Catalonia in Spain. E. Long. 2. N. Lat. 41. 50.

AUSCH. See Auch.

AUSI, an ancient and very ſavage people of Libya. Herodotus tells us that they were unacquainted with marriage, and had all their women in common. The children were brought up by their mothers till they were able to walk: after which they were introduced to an aſſembly of the men, who met every three months; and the man to whom any child firſt ſpoke, acknowledged himſelf its father. They celebrated annually a feaſt in honour of Minerva, in which the girls divided into two companies, fought with ſticks and ſtones, and thoſe who died of their wounds were concluded not to have been virgins.

AUSIMUM, or Auximum, an ancient Roman colony in the Picenum; now *Oſimo* or *Oſmo*, in the March of Ancona in Italy. E. Long. 15. N. Lat. 43. 20.

AUSITÆ, or Æsitæ, a tribe of ancient Arabs, ſuppoſed by Bochart to have inhabited the land of Uz mentioned in ſcripture.

AUSONA (anc. geog.), a town of the Auſones, a people who anciently occupied all the Lower Italy, from the Promontorium Circæum down to the ſtraits of Sicily (Livy), but were afterwards reduced to a much narrower compaſs; namely, between the Montes Circæi and Maſſici: nor did they occupy the whole of this, but other people were intermixed. Concerning Auſona or its remains there is nothing particular recorded.

AUSONIA, the ancient name of Italy, from its moſt ancient inhabitants the Auſones, (Virgil, Servius).

AUSONEUM mare (anc. geog.), a part of the Ionian ſea, extending ſouthwards from the promontory Japygium to Sicily, which it waſhes on the eaſt, as it does the Brutii and Magna Græcia on the ſouth and eaſt. It is ſeparated from the Tuſcan ſea by the ſtrait of Meſſina.

AUSONIUS (in Latin *Decius*, or rather *Decimus*, Magnus Auſonius), one of the beſt poets of the fourth century, was the ſon of an eminent phyſician, and born at Bordeaux. Great care was taken of his education, the whole family intereſting themſelves in it, either becauſe his genius was very promiſing, or that the ſcheme of his nativity, which had been caſt by his grandfather on the mother's ſide, made them imagine that he would riſe to great honour. He made an uncommon progreſs in claſſical learning, and at the age of 30 was choſen to teach grammar at Bourdeax. He was promoted ſome time after to be profeſſor of rhetoric; in which office he acquired ſo great a reputation, that he was ſent for to court to be preceptor to Gratian the emperor Valentinian's ſon. The rewards and honours conferred on him for the faithful diſcharge of his office prove the truth of Juvenal's maxim, that when fortune pleaſes ſhe can raiſe a man from a rhetorician to the dignity of a conſul. He was actually appointed conſul by the emperor Gratian, in the year 379, after having filled other conſiderable poſts; for beſides the dignity of queſtor, to which he had been nominated by Valentinian, he was made prefect of the Prætorium in Italy and Gaul after that prince's death. His ſpeech returning thanks to Gratian on his promotion to the conſulſhip is highly commended. The time of his death is uncertain; he was ſtill living in 392, and lived to a great age. The emperor Theodoſius had a great eſteem for Auſonius, and preſſed him to publiſh his poems. There is a great inequality in his works; and in his manners and his ſtyle there is a harſhneſs which was perhaps rather the defect of the times he lived in than of his genius. Had he lived in Auguſtus's reign, his verſes, according to good judges, would have equalled the moſt finiſhed of that age. He is generally ſuppoſed to have been a Chriſtian: ſome ingenious authors indeed think otherwiſe, but, according to Mr Bayle, without juſt reaſon. The beſt edition of his poems is that of Amſterdam in 1671.

AUSPEX, a name originally given to thoſe who were afterwards denominated *augurs*. In which ſenſe the word is ſuppoſed to be formed from *avis*, "bird," and *inſpicere*, "to inſpect;" *auſpices*, q. d. *aviſpices*. Some will therefore have auſpices properly to denote thoſe who foretold future events from the ſight of birds.

AUSPICIUM, Auspicy, the ſame with augury.

AUSTER, one of the four cardinal winds, as Servius calls them blowing from the ſouth, (Pliny, Ovid, Manilius).

AUSTERE, rough, aſtringent. Thus an auſtere taſte is ſuch a one as conſtringes the mouth and tongue; as that of unripefruits, harſh wines, &c.

AUSTERITY, among moral writers, implies ſeverity and rigour. Thus we ſay *Auſterity of manners*, *auſterities of the monaſtic life*, *&c.*

AUSTIN, (St). See *St* AUGUSTIN.

AUSTRAL, AUSTRALIS, the ſame with ſouthern. The word is derived from *auſter*, "ſouth wind." Thus auſtral ſigns are the ſix laſt ſigns of the zodiac; ſo called becauſe they are on the ſouth ſide of the equinoctial.

AUSTRALIS PISCES, the SOUTHERN FISH, is a conſtellation of the ſouthern hemiſphere, not viſible in our latitude; whoſe ſtars in Ptolemy's catalogue are 18, and in the Britannic catalogue 24.

AUSTRIA, one of the principle provinces of the empire of Germany towards the eaſt; from which ſituation is takes its name *Ooſt-ryck*, in the German language ſignifying the *Eaſt Country*. It is bounded on the north by Moravia; on the eaſt by Hungary; on the ſouth by Stiria; and on the weſt by Bavaria. It is divided into *Upper* and *Lower*. Upper Auſtria is ſituated on the ſouth, and Lower Auſtria on the north, ſide of the Danube. Vienna the capital is in the Upper Auſtria, which contains ſeveral other very conſiderable towns. The country is very fertile, has a great many mines, and produces vaſt quantities of ſulphur.

In the ninth and tenth centuries, Auſtria was the frontier of the empire againſt the barbarians. In 928, the emperor Henry the Fowler, perceiving that it was of great importance to ſettle ſome perſon in Auſtria who might oppoſe theſe incurſions, inveſted Leopold, ſurnamed the *Illuſtrious*, with that country. Otho I. erected Auſtria into a marquiſate in favour of his brother-in-law Leopold, whoſe deſcendant Henry II. was created duke of Auſtria by the emperor Frederic Barbaroſſa. His poſterity became extinct in 1240, the ſtates of the country, in order to defend themſelves from the incurſions of the Bavarians and Hungarians, reſolved to put themſelves under the protection of Henry marquis of Miſnia; but Othogar II. king of Bohemia, being likewiſe invited by a party in the duchy took poſſeſſion of it, alledging not only the invitation of the ſtates, but alſo the right of his wife, heireſs of Frederic the laſt duke. The emperor Rodolphus I. pretending a right to this duchy, refuſed to give Othogar the inveſtiture of it; and afterwards killing him in battle, procured the right of it to his own family. From this Rodolphus the preſent houſe of Auſtria is deſcended, which for ſeveral centuries paſt has rendered itſelf ſo famous and ſo powerful, having given 14 emperors to Germany, and ſix kings to Spain.

In 1477, Auſtria was erected into an archduchy by the emperor Frederic the Pacific, for his ſon Maximilian, with theſe privileges: That theſe ſhall be judged to have obtained the inveſtiture of the ſtates, if they do not receive it after having demanded it three times; that if they receive it from the emperor, or the imperial ambaſſadors, they are to be on horſeback, clad in a royal mantle, having in their hand a ſtaff of command, and upon their head a ducal crown of two points, and ſurrounded with a croſs like that of the imperial crown. The arch-duke is born privy-counſellor to the emperor, and his ſtates cannot be put to the ban of the empire. All attempts againſt his perſon are puniſhed as crimes of leſemajeſty, in the ſame manner as thoſe againſt the king of the Romans, or Electors. No one dared to challenge him to ſingle combat. It is in his choice to aſſiſt at the aſſemblies, or to be abſent; and he has the privilege of being exempt from contributions and public taxes, excepting 12 ſoldiers which he is obliged to maintain againſt the Turk for one month. He has rank immediately after the electors; and exerciſes juſtice in his ſtates without appeal, by virtue of a privilege granted by Charles V. His ſubjects cannot even be ſummoned out of his province upon account of law-ſuits, to give witneſs, or to receive the inveſtiture of fiefs. Any of the lands of the empire may be alienated in his favour, even thoſe that are feudal; and he has a right to create counts, barons, gentlemen, *poets*, and notaries. In the ſucceſſion to his ſtates, the right of birth takes place; and, failing males, the females ſucceed according to the lineal right; and if no heir be found, they may diſpoſe of their lands as they pleaſe.

Upper Auſtria, properly ſo called, has throughout the appearance of a happy country; here are no ſigns of the ſtriking contraſt betwixt poverty and riches which offends ſo much in Hungary. All the inhabitants, thoſe of the capital only excepted, enjoy that happy mediocrity which is the conſequence of a gentle and wiſe adminiſtration. The farmer has property; and the rights of the nobility, who enjoy a kind of lower judicial power, are well defined. The ſouth and ſouth-weſt parts of the country are bounded by a ridge of hills, the inhabitants of which enjoy a ſhare of proſperity unknown to thoſe of the interior parts of France. There are many villages and market-towns, the inhabitants of which have bought themſelves off from vaſſalage, are now their own governors, and belong ſome of them to the eſtates of the country. The cloiſters, the prelates of which belong to the eſtates of the country, are the richeſt in Germany, after the immediate prelacies and abbacies of the empire. One of the great convents of Benedictines is worth upwards of 4000 millions of French livres, half of which goes to the exchequer of the country.

Lower Auſtria yearly exports more than two millions worth of guilders of wine to Moravia, Bohemia, Upper Auſtria, Bavaria, Saltzburg, and part of Stiria and Carinthia. This wine is ſour, but has a great deal of ſtrength, and may be carried all over the world without danger; when it is ten or twenty years old it is very good. This country is very well peopled. Mr Schloſſer, in his political journal, which contains an account of the population of Auſtria, eſtimates that of this country at 2,100,000 men. The revenue of this country is about 14,000,000 florins; of which the city of Vienna contributes about five, as one man in the capital earns as much as three in the country.

The ſouthern parts of Auſtria are covered with hills, which riſe gradually from the banks of the Danube to the borders of Stiria, and are covered with woods. They loſe themſelves in the maſs of mountains which run to the ſouth of Germany, and ſtretch through all Stiria, Carniola, Carinthia, and Tyrol, to the Swiſs Alps; and are probably, after Savoy and Switzerland, the higheſt part of the earth. The inhabitants of this extenſive ridge of mountains are all very much alike; they are a ſtrong, large, and, the GOITRES excepted, a very handſome people.

The characteriſtic of the inhabitants of all this country is ſtriking bigotry, united with ſtriking ſenſuality. You need only ſee what is going forwards here to be convinced that the religion taught by the monks is as ruinous for the morals as it is repugnant to Chriſtianity. The Ciciſbeos accompany the married women from their bed to church, and lead them to the very confeſſional. The bigotry of the public in the interior parts of Auſtria, which from the mixture of gallantry with it, is ſtill to be found even amongſt people of rank, degenerates amongſt the common people into the groſſeſt and moſt abominable buffoonery. The Windes, who are mixed with the Germans in theſe countries, diſtinguiſh themſelves by a ſuperſtitious cuſtom that does little honour to the human underſtanding, and would be incredible if we had not the moſt unequivocal proofs of the fact before our eyes. Many years ago, they ſet out in company with ſome Hungarian enthuſiaſts to Cologne on the Rhine, which is about 120 German miles diſtant, to cut off the beard of a crucifix there. Every ſeven years this operation is repeated, as in this ſpace of time the beard grows again to its former length. The rich perſons of the aſſociation ſend the poorer ones as their deputies, and the magiſtrates of Cologne receive them as embaſſadors from a foreign prince. They are entertained at the expence of the ſtate, and a counſellor ſhews them the moſt remarkable things in the town. This farce brings in large ſums of money at ſtated times, and may therefore deſerve political encouragement; but ſtill, however, it is the moſt miſerable and meaneſt way of gain that can be imagined. Theſe Windes have alone the right to ſhave our Saviour, and the beard grows only for them. They firmly believe, that if they did not do this ſervice to the crucifix, the earth would be ſhut to them for the next ſeven years, and there would be no harveſts. For this reaſon they are obliged to carry the hair home with them, as the proof of having fulfilled their commiſſion, the returns of which are diſtributed amongſt the different communities, and preſerved as holy reliques. The Imperial court has for a long time endeavoured in vain to prevent this emigration, which deprives agriculture of ſo many uſeful hands. When the Windes could not go openly, they would go clandeſtinely. At length the court thought of the expedient of forbidding the regency of Cologne to let them enter the town. This happened ſix years ago, and the numerous embaſſy was obliged to beg its way back again without the wonderful beard; which without doubt the Capuchins, to whom the crucifix belonged, uſed to put together from their own. The trade which the monks carry on with holy ſalves, oils, &c. is ſtill very conſiderable; a prohibition of the court, lately publiſhed has rather leſſened it, but it cannot be entirely ſuppreſſed till next generation. It is now carried on ſecretly, but perhaps to nearly as great an amount as formerly.

AUSTROMANCY, AUSTROMANTIA, properly denotes ſoothſaying, or a vain method of predicting futurity, from obſervations of the winds.

AUTERFOITS ACQUIT.
AUTERFOITS Attaint.
AUTERFOITS Convict.
See the article *PLEA* to *Indictment.*

AUTHENTIC, ſomething of acknowledged and received authority. In law, it ſignifies ſomething clothed in all its formalities, and atteſted by perſons to whom credit has been regularly given. Thus we ſay, *authentic papers, authentic inſtruments.*

AUTHOR, properly ſignifies one who created or produced any thing. Thus God, by way of eminence, is called the *Author of nature*, the *Author of the univerſe.*

AUTHOR, in matters of literature, a perſon who has compoſed ſome book or writing.

AUTHORITY, in a general ſenſe, ſignifies a right to command, and make one's ſelf obeyed. In which ſenſe, we ſay, *the royal authority, the epiſcopal authority, the authority of a father*, &c. It denotes alſo the teſtimony of an author, ſome apophthegm or ſentence of an eminent perſon quoted in a diſcourſe by way of proof.

Authority is repreſented, in painting, like a grave matron ſitting in a chair of ſtate, richly clothed in a garment embroidered with gold, holding in her right-hand a ſword, and in her left a ſceptre. By her ſide is a double trophy of books and arms.

AUTOCHTHONES, an appellation aſſumed by ſome nations, importing that they ſprung, or were produced, from the ſame ſoil which they ſtill inhabited. In this ſenſe, *Autochthones* amounts to the ſame with *Aborigines.* The Athenians valued themſelves on their being Autochthones, *ſelf-born*, or γηγενεις, *earth-born;* it being the prevailing opinion among the ancients, that, in the beginning, the earth, by ſome prolific power, produced men, as it ſtill does plants. The proper Autochthones were thoſe primitive men who had no other parent beſides the earth. But the name was alſo aſſumed by the deſcendants of theſe men, provided they never changed their ancient ſeat, nor ſuffered other nations to mix with them. In this ſenſe it was that the Greeks, and eſpecially the Athenians, pretended to be Autochthones; and, as a badge thereof, wore a gold graſshopper woven in their hair, an inſect ſuppoſed to have the ſame origin.

AUTOCRATER, a perſon veſted with an abſolute independent power, by which he is rendered unaccountable to any other for his actions. The power of the Athenian generals, or commanders, was uſually limited; ſo that at the expiration of their office, they were liable to render an account of their adminiſtration. But, on ſome extraordinary occaſions, they were exempted from this reſtraint, and ſent with a full and uncontroulable authority: in which caſe they were ſtyled Αυτοκρατορες. The ſame people alſo applied the name to ſome of their ambaſſadors, who were veſted with a full power of determining matters according to their own diſcretion. Theſe were denominated Πρεσβεις Αυτοκρατορες, and reſembled our plenipotentiaries.

AUTO DA FE, act of faith. See ACT *of Faith.*

AUTODIDACTUS, a perſon ſelf-taught, or who has had no maſter, or aſſiſtant of his ſtudies, beſides himſelf.

AUTOGRAPH, denotes a perſon's hand-writing, or the original manuſcript of any book, &c.

AUTOLITHOTOMUS, he who cuts himſelf for the ſtone. Of this we have a very extraordinary inſtance given by Reiſelius, in the Ephemerides of the Academy *Naturæ Curioſorum*, dec. 1. an. 3. obſ. 192.

AUTOMATE, called alſo *Hiera*, one of the Cyclades, an iſland to the north of Crete (Pliny), ſaid to have emerged out of the ſea, between the iſlands Thera and Theraſia, in the fifth year of the emperor Claudius; in extent thirty ſtadia, (Oroſius).

AUTOMATON (from *αυτος*, *ipſe* and *μαομαι excitor*), a ſelf-moving machine, or one ſo conſtructed, by means of weights, levers, pullies, &c. as to move for a conſiderable time, as though endued with animal life. According to this deſcription, clocks, watches, and all machines of that kind, are automata.

Under the article ANDROIDES, we obſerved that the higheſt perfection to which automata could be carried was to imitate exactly the motions and actions of living creatures, eſpecially of mankind, which are more difficultly imitated than thoſe of other animals. Very ſurpriſing imitations, however, have been made of other creatures. So long ago as 400 years before Chriſt, Archytas of Tarentum is ſaid to have made a wooden pigeon that could fly; nor will this appear at all incredible, when we conſider the flute-player made by M. Vaucanſon, and the cheſs-player by M. Kempell. Dr Hook is alſo ſaid to have made the model of a flying chariot, capable of ſupporting itſelf in the air. But M. Vaucanſon abovementioned hath diſtinguiſhed himſelf ſtill more eminently. That gentleman, encouraged by the favourable reception of his flute-player, made a duck, which was capable of eating, drinking, and imitating exactly the voice of a natural one. Nay, what is ſtill more ſurpriſing, the food it ſwallowed was evacuated in a digeſted ſtate; not that it was really in a ſtate of natural excrement, but only conſiderably altered from what it was when ſwallowed; and this digeſtion was performed on the principles of ſolution, not of trituration. The wings, viſcera, and bones, of this artificial duck, were alſo formed ſo as very ſtrongly to reſemble thoſe of a living animal. Even in the actions of eating and drinking, this reſemblance was preſerved; the artificial duck ſwallowed with avidity and vaſtly quick motions of the head and throat; and likewiſe muddled the water with his bill, exactly like a natural one.

M. Le Droz of La Chaux de Fonds in the county of Neufchattel, hath alſo executed ſome very curious pieces of mechaniſm, which well deſerve to be ranked with thoſe already mentioned. One was a clock, which was preſented to his Spaniſh majeſty; and had, among other curioſities, a ſheep, which imitated the bleating of a natural one; and a dog watching a baſket of fruit: when any one attempted to purloin the fruit, the dog gnaſhed his teeth and barked; and if it was actually taken away, he never ceaſed barking till it was reſtored. Beſides this, he made a variety of human figures, which exhibited motions truly ſurpriſing; but all inferior to Mr Kempell's cheſs-player, which may juſtly be looked upon as the greateſt maſter-piece in mechanics that ever appeared. See ANDROIDES.

AUTONOMIA, a power of living or being governed by our own laws and magiſtrates. The liberty of the cities which lived under the faith and protection of the Romans, conſiſted in their autonomia, *i. e.* they were allowed to make their own laws, and elect their own magiſtrates; by whom juſtice was to be adminiſtered, and not by Roman preſidents or judges, as was done in other places which were not indulged the autonomia.

AUTOPYROS, from *αυτος*, and *πυρος*, *wheat*; in the *Ancient diet*, an epithet given to a ſpecies of bread, wherein the whole ſubſtance of the wheat was retained, without retrenching any part of the bran. Galen deſcribes it otherwiſe, viz. as bread where only the coarſer bran was taken out.—And thus it was a medium between the fineſt bread, called *ſimilagineus*, and the coarſeſt called *furfuraceus*. This was alſo called *autopyrites* and *ſyncomiſtus*.

AUTRE-EGLISE, a village of Brabant, in the Auſtrian Netherlands; to which the left wing of the French army extended, when the confederates obtained the victory at Ramillies, in 1706. E. Long. 4. 50. N. Lat. 50. 40.

AUTRICUM, the capital of the Carnutas, a people of Gallia Celtica; afterwards called *Carnotena*, *Carnotenus*, and *Civitas Carnotenum*: Now *Chartres*, in the Orleanois on the Eure. E. Long. 1. 32. N. Lat. 48. 47.

AUTUMN, the third ſeaſon of the year, when the harveſt and fruits are gathered in. Autumn is repreſented, in painting, by a man at perfect age, clothed like the vernal, and likewiſe girded with a ſtarry girdle; holding in one hand a pair of ſcales equally poiſed, with a globe in each; in the other hand, a bunch of divers fruits and grapes. His age denotes the perfection of this ſeaſon; and the balance, that ſign of the zodiac which the ſun enters when our autumn begins.

Autumn begins on the day when the ſun's meridian diſtance from the zenith, being on the decreaſe, is a mean between the greateſt and the leaſt; which in theſe countries is ſuppoſed to happen when the ſun enters Libra. Its end coincides with the beginning of winter. Several nations have computed the years by autumns: the Engliſh Saxons, by winters. Tacitus tells us, the ancient Germans were acquainted with all the other ſeaſons of the year, but had no notion of Autumn. Lidyat obſerves of the beginning of the ſeveral ſeaſons of the year, that

Dat Clemens hyemem, dat Petres ver cathedratus,
Æſtuat Urbanus, autumnat *Bartholomæus.*

Autumn has always been reputed an unhealthy ſeaſon, Tetullian calls it *tentator valetudinum*: and the ſatyriſt ſpeaks of it in the ſame light, *Autumnus Libitinæ quæſtus acerbæ*.

AUTUMNAL POINT, is that part of the equinox from which the ſun begins to deſcend towards the ſouth pole.

AUTUMNAL Signs, in aſtronomy, are the ſigns Libra, Scorpio, Sagittarius, through which the ſun paſſes during the autumn.

AUTUMNAL Equinox, that time when the ſun enters the autumnal point.

AUTUN, an ancient city of France in the duchy of Burgundy, the capital of the Autonois, with a biſhop's ſee. The length of this city is about three quarters of a mile, and its breadth nearly equal. The river Arroux waſhes its ancient walls, whoſe ruins are ſo firm, and the ſtones ſo cloſely united, that they ſeem almoſt to be cut out of the ſolid rock. In this city are the ruins of three ancient temples, one of which was dedicated to Janus, and another to Diana. Here are likewiſe a theatre and a pyramid, which laſt is probably a tomb; it ſtands in a place called the *field of urns*, becauſe ſeveral urns had been found there. Here are alſo two antique gates of great beauty. The city lies at the foot of three great mountains, in E. Long. 4. 15. N. Lat. 45. 50.

AUTURA, or AUDURA, a river of Gallia Celtica, only mentioned in the lives of the ſaints. Now the *Eure*, which falls into the Seine, on the left-hand or ſouth ſide.

AUVERGNE, a province of France, about 100 miles in length and 75 in breadth. It is bounded on the north, by the Bourbonnois; on the eaſt, by Torez and Velay; on the weſt, by Limoſin, Quercy, and La Marche; and on the ſouth, by Rovergne and the Cevennes. It is divided into upper and lower; the latter, otherwiſe called *Limagne*, is one of the fineſt countries in the world. The mountains of Higher Auvergne render it leſs fruitful; but they afford good paſture, which feeds great numbers of cattle, which are the riches of that country. Auvergne ſupplies Lyons and Paris with fat cattle, makes a large quantity of cheeſe, and has manufactures of ſeveral kinds. The capital of the whole province is Clermont.

AUVERNAS, a very deep-coloured heady wine, made of black raiſins ſo called, which comes from Orleans. It is not fit to drink before it is above a year old; but if kept two or three years, it becomes excellent.

AUXERRE, an ancient town of France in the duchy of Burgundy, and capital of the Auxerrois, with a biſhop's ſee. The epiſcopal palace is one of the fineſt in France, and the churches are alſo very beautiful. This town is advantageouſly ſituated for trade with Paris, on the river Yone. E. Long. 3. 35. N. Lat. 47. 54

AUXESIS, in mythology, a goddeſs worſhipped by the inhabitants of Egina, and mentioned by Herodotus and Pauſanias.

AUXESIS, in rhetoric, a figure whereby any thing is magnified too much.

AUXILIARY, whatever is aiding or helping to another.

AUXILIARY Verbs, in grammar, are ſuch as help to form or conjugate others; that is, are prefixed to them, to form or denote the moods or tenſes thereof: as, *to have* and *to be*, in the Engliſh; *etre* and *avoir*, in the French; *ho* and *ſono* in the Italian, &c. In the Engliſh language, the auxiliary verb *am* ſupplies the want of paſſive verbs.

AUXO, in mythology, the name of one of two Graces worſhipped by the Athenians. See HEGEMONE.

AUXONNE, a ſmall fortified town of France, in the duchy of Burgundy; ſeated on the river Saone, over which there is a bridge of 23 arches, to facilitate the running off of the waters after the overflowing of the river. At the end of the bridge is a cauſway 2250 paces long. E. Long. 5. 22. N. Lat. 47. 11.

AUXY; the French give the name of *auxy wool* to that which is ſpun in the neighbourhood of Abbeville, by thoſe workmen who are called *houpiers*. It is a very fine and beautiful wool, which is commonly uſed to make the fineſt ſtockings.

AWARD, in law, the judgment of an arbitrator, or of one who is not appointed by the law a judge, but choſen by the parties themſelves for terminating their differences. See ARBITER and ARBITRATION.

AWL, among ſhoemakers, an inſtrument wherewith holes are bored through the leather, to facilitate the ſtitching or ſewing the ſame. The blade of the awl is uſually a little flat and bended, and the point ground to an acute angle.

AWLAN, a ſmall imperial town of Germany, in the circle of Suabia, ſeated on the river Kochen. E. Long. 11. 15 N. Lat. 48. 52.

AWME, or AUME, a Dutch liquid meaſure containing eight ſteckans, or 20 verges or verteels, equal to the tierce in England, or to one-ſixth of a ton of France.

AWN, in botany. See ARISTA.

AWNING, in the ſea-language, is the hanging a ſail, tarpawling, or the like, over any part of the ſhip, to keep off the ſun, rain or wind.

AX, a carpenter's inſtrument, ſerving to hew wood. The ax differs from the joiner's hatchet, in that it is made larger and heavier, as ſerving to hew large ſtuff; and its edge tapering into the middle of its blade. It is furniſhed with a long handle or helve, as being to be uſed with both hands.

Battle-Ax. See CELT.

AXAMENTA, in antiquity, a denomination given to the verſes or ſongs of the *ſalii*, which they ſung in honour of all men. The word is formed, according to ſome, from *axare*, q. d. *nominare*. Others will have the *carmina ſaliaria* to have been denominated *axamenta*, on account of their having been written in *axibus*, or on wooden tables.

The *axamenta* were not compoſed, as ſome have aſſerted, but only ſung by the *ſalii*. The author of them was Numa Pompilius; and as the ſtyle might not be altered, they grew in time ſo obſcure, that the *ſalii* themſelves did not underſtand them. Varro ſays they were 700 years old. Quint. Inſt. Or. lib. i. c. 11.

AXAMENTA, or *Aſſamenta*, in ancient muſic, hymns or ſongs performed wholly with human voices.

AXAYACATL, the name of a ſpecies of fly, common in Mexico, about the Lake; the eggs of which being depoſited in immenſe quantities, upon the ruſhes and corn-flags, form large maſſes, which are taken up by fiſhermen and carried to market for ſale. This caviare, called *ahuauhtli*, which has much the ſame taſte with the caviare of fiſh, uſed to be eat by the Mexicans, and is now a common diſh among the Spaniards. The Mexicans eat not only the eggs, but the flies themſelves, made up together into a maſs, and prepared with ſaltpetre.

AXATI, a town of ancient Bætica, in the Bœtis; now *Lora*, a ſmall city of Andaluſia, in Spain, ſeated on the Guadalquivir. W. Long. 5. 20. N. Lat. 37. 20.

AXBRIDGE, a town of Somerſetſhire in England, conſiſting of one long narrow ſtreet. W. Long. 2. 20 N. Lat. 51. 30.

AXEL, a ſmall fortified town in Dutch Flanders. E. Long. 3. 40. N. Lat. 51. 17.

AXHOLM, an iſland in the north-weſt part of Lincolnſhire in England. It is formed by the rivers Trent, Idel, and Dan; and is about ten miles long and five broad. The lower part is marſhy, but produces an odoriferous ſhrub called *gall;* the middle is rich and fruitful, yielding flax in great abundance, as alſo alabaſter which is uſed for making lime. The principal town is called *Axey,* and is now thinly inhabited.

AXIACE, an ancient town of Sarmatia Europea; now *Oxakow,* the capital of Budziac Tartary. E. Long. 32. 30. N. Lat. 46. 0.

AXILLA, in anatomy, the arm-pit, or the cavity under the upper part of the arm.

Axilla, in botany, is the ſpace comprehended between the ſtems of plants and their leaves. Hence we ſay thoſe flowers grow in the axillæ of the leaves; *i.e.* at the baſe of the leaves, or juſt within the angle of their pedicles.

AXILLARY, ſomething belonging to or lying near the axilla. Thus, *axillary artery* is that part of the ſubclavian branches of the aſcending trunk of the aorta which paſſeth under the arm-pits; *axillary glands* are ſituated under the arm-pits, enveloped in fat, and lie cloſe by the axillary veſſels; and *axillary vein* is one of the ſubclavians which paſſes under the arm-pit, dividing itſelf into ſeveral branches, which are ſpread over the arm.

AXIM, a ſmall territory on the gold-coaſt in Africa. The climate here is ſo exceſſively moiſt, that it is proverbially ſaid to rain 11 months and 29 days of the year. This exceſſive moiſture renders it very unhealthy; but it produces great quantities of rice, water melons, lemons, oranges, &c. Here are alſo produced vaſt numbers of black cattle, goats, ſheep, tame pigeons, &c. The whole country is filled with beautiful and populous villages, and the intermediate lands well cultivated; beſides which, the natives are very wealthy, from the conſtant traffic carried on with them by the Europeans for their gold. The capital which is alſo called *Axim,* by ſome *Achombone,* ſtands under the cannon of the Dutch fort St Antonio. Behind, it is ſecured by a thick wood that covers over the whole declivity of a neighbouring hill. Between the town and the ſea runs an even and ſpacious ſhore of beautiful white ſand. All the houſes are ſeparated by groves of cocoa and other fruit trees, planted in parallel lines, each of an equal width, and forming an elegant viſta. The little river Axim croſſes the town; and the coaſt is defended by a number of ſmall pointed rocks, which project from the ſhore, and render all acceſs to it dangerous. The capital is ſituated in W. Long. 24. 0. N. Lat. 5.0. This canton is a kind of republic, the government being divided between the Caboceroes or chief men, and Manaceroes or young men. It muſt be obſerved, however, that in their courts there is not even a pretence of juſtice: whoever makes the moſt valuable preſents to the judges is ſure to gain his cauſe, the judges themſelves alledging the gratitude due for the bribes received as a reaſon: and if both parties happen to make preſents of nearly equal value, they abſolutely refuſe to give the cauſe a hearing.

AXINOMANCY, Axinomantia, from αξινη, *ſecuris,* and μαντεια, *divinatio;* an ancient ſpecies of divination, or a method of foretelling future events by means of an ax or hatchet.—This art was in conſiderable repute among the ancients; and was performed, according to ſome, by laying an agate-ſtone on a red-hot hatchet; and alſo by fixing a hatchet on a round ſtake ſo as to be exactly poiſed; then the names of thoſe that were ſuſpected were repeated, and he at whoſe name the hatchet moved was pronounced guilty.

AXIOM, Axioma (from αξιοω, *I am worthy);* a ſelf-evident truth, or a propoſition whoſe truth every perſon receives at firſt ſight. Thus, that the whole is greater than a part; that a thing cannot be and not be at the ſame time; and that from nothing, nothing can ariſe; are axioms.

Axiom is alſo an eſtabliſhed principle in ſome art or ſcience. Thus, it is an axiom in phyſics, that nature does nothing in vain; that effects are proportional to their cauſes, &c. So it is an axiom in geometry, that things equal to the ſame thing are alſo equal to one another; that if to equal things you add equals, the ſums will be equal, &c. It is an axiom in optics, that the angle of incidence is equal to the angle of reflection, &c.

AXIOPOLIS, a town of the Triballi in Mæſia Inferior; now *Axiopoli,* in Bulgaria. E. Long. 34. 0. N. Lat. 55. 40.

AXIS, in geometry, the ſtraight line in a plain figure, about which it revolves, to produce or generate a ſolid. Thus, if a ſemicircle be moved round its diameter at reſt, it will generate a ſphere, the axis of which is that diameter.

Axis, in aſtronomy, is an imaginary right line ſuppoſed to paſs through the centre of the earth and the heavenly bodies, about which they perform their diurnal revolutions.

Axis, in conic-ſections, a right line dividing the ſection into two equal parts, and cutting all its ordinates at right angles.

Axis, in mechanics. The axis of a balance is that line about which it moves, or rather turns about. *Axis of oſcillation,* is a right line parallel to the horizon, paſſing through the centre about which a pendulum vibrates.

Axis in Peritrochio, one of the ſix mechanical powers, conſiſting of a peritrochium or wheel concentric with the baſe of a cylinder, and moveable together with it about its axis.

Axis, in optics, is that particular ray of light coming from any object which falls perpendicularly on the eye.

Axis, in architecture. *Spiral axis,* is the axis of a twiſted column drawn ſpirally in order to trace the circumvolutions without. *Axis of the Ionic capital,* is a line paſſing perpendicularly through the middle of the eye of the volute.

Axis of a Veſſel, is an imaginary right line paſſing through the middle of it perpendicularly to its baſe, and equally diſtant from its ſides.

Axis, in botany, is a taper column placed in the centre of ſome flowers or catkins, about which the other parts are diſpoſed.

Axis, in anatomy, the name of the ſecond vertebra of the neck; it hath a tooth which goes into the firſt vertebra, and this tooth is by ſome called the *axis.*

AXMINSTER, a town of Devonſhire, ſituated on the river Ax, in the great road between London and Exeter in W. Long. 3. 15. N. Lat. 50. 40. It was a place of ſome note in the time of the Saxons, but now contains only about 200 houſes. Here is a ſmall manufactory of broad and narrow cloths, and ſome carpets are alſo manufactured after the Turky manner.

AXOLOTLF. See LACERTA.

AXUMA, formerly a large city, and capital of the whole kingdom of Abyſſinia in Africa, but now reduced to a miſerable village ſcarce containing 100 inhabitants. E. Long. 36. 4. N. Lat. 14. 13.

AXUNGIA, in a general ſenſe, denotes old lard, or the drieſt and hardeſt of any fat in the bodies of animals: but more properly it ſignifies only hog's lard.

AXUNGIA Vitri, *Sandiver*, or *Salt of Glaſs*, a kind of ſalt which ſeparates from the glaſs while it is in fuſion. It is of an acrimonious and biting taſte. The farriers uſe it for cleanſing the eyes of horſes. It is alſo made uſe of for cleanſing the teeth; and it is ſometimes applied to running ulcers, the herpes, or the itch, by way of deſiccative.

AXYRIS: A genus of the triandria order, belonging to the monœcia claſs of plants; and in the natural method ranking under the 12th order, *Holoraceæ*. The calyx of the male is tripartite; it has no corolla. The calyx of the female conſiſts of two leaves; it has two ſtyli and one ſeed. The ſpecies are four, none of them natives of Britain.

AY, a town of France in Champagne, near the river Mame, remarkable for its excellent wines. E. Long. 2. 15. N. Lat. 49. 4.

AYAMONTE, a ſea-port town of Andaluſia in Spain, with a ſtrong caſtle built on a rock; ſeatedon the mouth of the river Guadiana. It has a commodious harbour, fruitful vineyards, and excellent wine. W. Long. 8. 5. N. Lat. 37. 9.

AYENIA, in botany: A genus of the pentandria order, belonging to the gynandria claſs of plants; and in the natural method ranking under the 37th order, *Columniferæ*. The calyx has two leaves; the petals are in the form of a ſtar, with long ungues; and the capſule has five cells. There are three ſpecies, all natives of the Weſt-Indies.

AYLESBURY. See AILESBURY. This place gave title of Earl to the noble family of Bruce, now to a branch of the Brudenals by ſucceſſion.

AYLMER (John), biſhop of London, in the reign of Queen Elizabeth, was born in the year 1521, at Aylmer-hall in the pariſh of Tilney, in the county of Norfolk. Whilſt a boy, he was diſtinguiſhed for his quick parts by the Marquis of Dorſet afterwards Duke of Suffolk; who ſent him to Cambridge, made him his chaplain, and tutor to his children. One of theſe children was the unfortunate Lady Jane Gray, who ſoon became perfectly acquainted with the Latin and Greek languages. His firſt preferment was to the Archdeaconry of Stow in the dioceſe of Lincoln, which gave him a ſeat in the convocation held in the firſt year of Queen Mary, where he reſolutely oppoſed the return to Popery, to which the generality of the clergy were inclined. He was ſoon after obliged to fly his country, and take ſhelter among the Proteſtants in Switzerland. On the acceſſion of Queen Elizabeth, he returned to England. In 1562, he obtained the archdeaconry of Lincoln; and was a member of the famous ſynod of that year, which reformed and ſettled the doctrine and diſcipline of the church of England. In the year 1576, he was conſecrated biſhop of London. He died in the year 1594, aged 73; and was buried in St Paul's. He was a learned man, a zealous father of the church, and a bitter enemy to the Puritans. He publiſhed a piece intitled, *An harbrowe for faithful and trewe ſubjects againſt the late blowne blaſte concerning the government of wemen*, &c. This was written whilſt he was abroad in anſwer to Knox, who publiſhed a book at Geneva under this title, *The firſt blaſt againſt the monſtrous regiment and empire of women.* He is by Strype ſuppoſed to have publiſhed Lady Jane Gray's letter to Harding. He alſo aſſiſted Fox in tranſlating his Hiſtory of Martyrs into Latin.

AYRY, or AERY, *of Hawks*, a neſt or company of hawks; ſo called from the old French word *aire*, which ſignified the ſame.

AYSCUE (Sir George), a gallant Engliſh admiral, deſcended from a good family in Lincolnſhire. He obtained the honour of knighthood from King Charles I. which, however, did not with-hold him from adhering to the parliament in the civil war: he was by them conſtituted admiral of the Iriſh ſeas, where he is ſaid to have done great ſervice to the Proteſtant intereſt, and to have contributed much to the reduction of the whole iſland. In 1651 he reduced Barbadoes and Virginia, then held for the king, to the obedience of the parliament; and ſoon after the reſtoration behaved with great honour in the war with the Dutch. In the famous engagement in the beginning of June 1666, when Sir George was admiral of the white ſquadron, his ſhip the Royal Prince ran upon the Gallop-ſand; where being ſurrounded with enemies, his men obliged him to ſtrike. He went no more to ſea after this, but ſpent the reſt of his days in retirement.

AYMOUTH. See EYMOUTH.

AYTONIA, in botany: A genus of the monadelphia order, belonging to the pentandria claſs of plants; the characters of which are: The calyx is quinquepartite; the corolla conſiſts of four petals; the berry is dry, quadrangular, unilocular, and many-ſeeded. There is but one ſpecies, the capenſis, a native of the Cape, but of which we have found no particular deſcription.

AZAB, in the Turkiſh armies, a diſtinct body of ſoldiery, who are great rivals of the Janiſſaries.

AZAI, a town of Touraine in France, ſeated on the river Indre. E. Long. 10. 35. N. Lat. 47. 18.

AZALEA, AMERICAN UPRIGHT HONEYSUCKLE: A genus of the monogynia order, belonging to the pentandria claſs of plants: and in the natural method ranking under the 18th order, *Bicornes*. The corolla is bell-ſhaped; the ſtamina are inſerted into the receptacle; and the capſule has five cells. There are ſix ſpecies, of which the moſt remarkable are the following. 1. The viſcoſa, with a white flower, is a low ſhrub, ariſing with ſeveral ſtems to the height of two or three feet. The leaves come out in cluſters without any order at the end of the ſhoots, and their edges are ſet with very ſhort teeth which are rough. The flowers come out in cluſters between the leaves, have much the appearance of honeyſuckle, and are as well-ſcented. 2. The nudiflora, or red American upright honeyſuckle, grows taller than the firſt; and in its native country will ſometimes arrive at the height of 12 feet, but in Britain never riſes to above half that height. It hath ſeveral ſtems with oblong ſmooth leaves. The flower-ſtalks ariſe from the diviſion of the branches, which are long and naked,

naked, ſupporting a cluſter of red flowers: theſe are divided at the top into five equal ſegments which ſpread open. Another ſpecies with bright red flowers was found by Mr Lightfoot upon the tops of many mountains in the Highlands of Scotland.—The firſt two ſpecies require a moiſt ſoil and a ſandy ſituation, and can only be propagated from ſlips, as they never produce good ſeeds in Britain. The autumn is the beſt time to remove the plants, and their roots ought to be covered in winter. They are moſt beautiful plants, and well worth cultivating.

AZAMOR, a ſmall ſea-port town of the kingdom of Morocco in Africa. It is ſituated on the river Morbeya, in the province of Duguella, at ſome conſiderable diſtance from its mouth. This town, though formerly very conſiderable, is not proper for maritime commerce, becauſe the entrance of the river is dangerous. It was unſucceſsfully beſieged by the Portugueſe in 1508; it was taken, however, in 1513 by the Duke of Braganza, but abandoned about the end of the 16th century. W. Long. 7. 0. N. Lat. 32. 50.

AZARAKITES, a ſect of Mahometan Arabs. See Arabia, n° 143, *et ſeq.*

AZARIAH, or Uzziah, king of Judah, ſucceeded his father Amaziah, 810 years before Chriſt. He aſſembled an army of above 300,000 men, with which he conquered the Philiſtines, and demoliſhed the walls of Gath, Jabniel, and Aſhdod; built up the walls of Jeruſalem; furniſhed the city with conduits; and planted gardens and vineyards: but at laſt, being elated with his proſperity, and reſolving to uſurp the office of high prieſt, he was ſtruck with a leproſy, which obliged him to remain ſhut up in his palace for the reſt of his days. He died about 759 years before the Chriſtian æra, and was ſucceeded by Jonathan his ſon.—There are ſeveral other perſons of this name mentioned in the ſacred Scriptures.

AZAZEL. The word relates to the ſcape-goat, under the Jewiſh religion. Some call the goat itſelf by this name, as St. Jerom and Theodoret. Dr Spencer ſays, the ſcape-goat was to be ſent to Azazel; by which is meant the devil. M. le Clerc tranſlates it *præcipitium*, making it to be that ſteep and inacceſſible place to which the goat was ſent, and where it was ſuppoſed to periſh.

AZEKA, (anc. geog.) a city of the Amorrhites, in the lot of Judah; ſituated between Eleutheropolis and Aelia, (Jerome); where the five kings of the Amorrhites and their army were deſtroyed by hailſtones from heaven, (Joſhua).

AZEM, Asem, Assam, or Achem, a country of Aſia to the north of Ava, but which is very little known to Europeans. It is ſaid to be very fertile, and to contain mines of gold, ſilver, iron, and lead, all which belong to the king, who, in conſequence of enjoying the produce, requires no taxes from his people. They have alſo great quantities of gum lac, and coarſe ſilk. It is alſo thought that the inhabitants of Azem were long ago the inventors of cannon and gun-powder; and that from them the invention paſſed to the inhabitants of Pegu, and from thence to the Chineſe.

AZIMUTH, in aſtronomy, an arch of the horizon, intercepted between the meridian of the place and the azimuth, or vertical circle paſſing through the centre of the object, which is equal to the angle of the zenith, formed by the meridian and vertical circle: or it is found by this proportion. As the radius to the tangent of the latitude of the place, ſo is the tangent of the ſun's or ſtar's altitude, for inſtance, to the coſine of the azimuth from the ſouth, at the time of the equinox.

Magnetical Azimuth, an arch of the horizon intercepted between the azimuth, or vertical circle, paſſing through the centre of any heavenly body, and the magnetical meridian. This is found by obſerving the object with an azimuth-compaſs.

Azimuth-Compaſs, an inſtrument for finding either the magnetical azimuth or amplitude of an heavenly object.

The learned Dr Knight invented ſome time ſince a very accurate and uſeful ſea-compaſs, which is at preſent uſed in the navy, and will be deſcribed under the article Compass. This inſtrument, with the following contrivance added by the ingenious Mr Smeaton, anſwers the purpoſes of an azimuth and amplitude compaſs.

The cover of the wooden box being taken off, the compaſs is in a condition to be made uſe of in the binnacle, when the weather is moderate; but if the ſea runs high, as the inner box is hung very free upon its centre (the better to anſwer its other purpoſes), it will be neceſſary to ſlacken the milled nut, placed upon one of the axes that ſupport the ring, and to lighten the nut on the outſide that correſponds to it. By this means, the inner box and ring will be lifted up from the edges, upon which they reſt, when free; and the friction will be increaſed, and that to any degree neceſſary, to prevent the too great vibrations, which otherwiſe would be occaſioned by the motion of the ſhip.

To make the compaſs uſeful in taking the magnetic azimuth or amplitude of the ſun and ſtars, as alſo the bearings of headlands, ſhips, and other objects at a diſtance, the braſs edge deſigned at firſt to ſupport the card, and throw the weight thereof as near the circumference as poſſible, is itſelf divided into degrees and halves; which may be eaſily eſtimated into ſmaller parts, if neceſſary. The diviſions are determined by means of a catgut line, ſtretched perpendicularly with the box, as near the braſs edge as may be, that the parallax, ariſing from a different poſition of the obſerver, may be as little as poſſible.

Underneath the card are two ſmall weights, ſliding on two wires, placed at right angles to each other; which being moved nearer to, or farther from, the centre, counterbalance the dipping of the card in different latitudes, or reſtore the equilibrium of it, where it happens by any other means to be got too much out of level.

There is alſo added an index at the top of the inner box, which may be put on and taken off at pleaſure; and ſerves for all altitudes of the object. It conſiſts of a bar equal in length to the diameter of the inner box, each end being furniſhed with a perpendicular ſtile, with a ſlit parallel to the ſides thereof: one of the ſlits is narrow, to which the eye is applied; and the other is wider, with a ſmall catgut ſtretched up the middle of it, and from thence continued horizontally from the top of one ſtile to the top of the other. There is alſo a line drawn along the upper ſurface of the bar. Theſe four, viz. the narrow ſlit, the horizontal catgut thread, the perpendicular one, and the line on the bar, are in the ſame plane, which diſpoſes itſelf perpendicular to the horizon, when the inner box is at reſt, and hangs free. This index does not move round, but is always placed on, ſo as to anſwer the ſame ſide of the box.

When the ſun's azimuth is deſired, and his rays are ſtrong enough to caſt a ſhadow, turn about the wooden box, till the ſhadow of the horizontal thread, or (if the ſun be too low) till that of the perpendicular thread, in one ſtile, or the light through the ſlit on the other, falls upon the line in the index bar, or vibrates to an equal diſtance on each ſide of it, gently touching the box, if it vibrates too far: obſerve, at the ſame time, the degree marked upon the braſs edge by the catgut line. In counting the degree for the azimuth, or any other angle that is reckoned from the meridian, make uſe of the outward circle of figures upon the braſs edge; and the ſituation of the index bar, with regard to the card and needle, will always direct upon what quarter of the compaſs the object is placed.

But if the ſun does not ſhine out ſufficiently ſtrong, place the eye behind the narrow ſlit in one of the ſtiles, and turn the wooden box about, till ſome part of the horizontal or perpendicular thread appears to interſect the centre of the ſun, or vibrate to an equal diſtance on each ſide of it, uſing ſmoked glaſs next the eye, if the ſun's light is too ſtrong. In this method, another obſerver will be generally neceſſary, to note the degree cut by the nonius, at the ſame time that the firſt gives notice that the thread appears to ſplit the object.

From what has been ſaid, the other obſervations will be eaſily performed; only, in caſe of the ſun's amplitude, take care to number the degree by the help of the inner circle of figures on the card, which are the complements of the outer to 90″; and, conſequently, ſhow the diſtance from eaſt to weſt.

The azimuth of the ſtars may alſo be obſerved by night; a proper light ſerving equally for one obſerver to ſee the thread, and the other the degree upon the card.

It may not be amiſs to remark farther, that, in caſe the inner box ſhould loſe its equilibrium, and, conſequently, the index be out of the plane of a vertical circle, an accurate obſervation may ſtill be made, provided the ſun's ſhadow is diſtinct; for, by obſerving firſt with one end of the index towards the ſun, and then the other, a mean of the two obſervations will be the truth.

Plate LXXVII. is a perſpective view of the compaſs, when in order for obſervation; the point of view being the centre of the card, and the diſtance of the eye two feet. A B is the wooden box. C and D are two milled nuts; by means whereof the axis of the inner box and ring are taken from their edges, on which they move, and the friction increaſed, when neceſſary. E F is the ring that ſupports the inner box. G H is the inner box; and I is one of its axes, by which it is ſuſpended on the ring E F. The magnet or needle appears paſſing through the centure, together with a ſmall brace of ivory, that confines the cap to its place. The card is a ſingle varniſhed paper, reaching as far as the outer circle of figures, which is a circle of thin braſs; the edge whereof is turned down at right angles to the plane of the card, to make it more ſtiff. O is a catgut line, drawn down the inſide of the box for determining the degree upon the braſs edge. P Q R S is the index bar, with its two ſtiles and catgut threads; which being taken off from the top of the box is placed in two peices, T and V, notched properly to receive it. W is a place cut out in the wood ſerving as an handle.

AZIMUTH Circles, called alſo *azimuths* or *vertical circles*, are great circles of the ſphere interſecting each other in the zenith and nadir, and cutting the horizon at right angles. Theſe azimuths are repreſented by the rhumbs on common ſea-charts, and on the globe they are repreſented by the quadrant of altitude, when ſcrewed in the zenith. On theſe azimuths is reckoned the height of the ſtars and the ſun when not in the meridian.

AZMER, a town of the Eaſt Indies in the dominions of the Great Mogul, capital of a province of the ſame name, with a very ſtrong caſtle. It is pretty large, and is ſometimes viſited by the Mogul himſelf. It is about 62 leagues diſtant from Agra. The principal trade of this province is in ſaltpetre.

AZOGA SHIPS, are thoſe Spaniſh ſhips commonly called the *quickſilver ſhips*, from their carrying quickſilver to the Spaniſh Weſt Indies, in order to extract the ſilver out of the mines of Mexico and Peru. Theſe ſhips, ſtrictly ſpeaking, are not to carry any goods unleſs for the king of Spain's account.

AZONI, in ancient mythology, a name applied by the Greeks to ſuch of the gods as were deities at large, not appropriated to the worſhip of any particular town or country; but acknowledged in general by all countries, and worſhipped by every nation. Theſe the Latins called *dii communes*. Of this ſort were the Sun, Mars, Luna, &c.

AZORES, iſlands in the Atlantic ocean, lying between 25 and 33 degrees of weſt longitude, and between 36 and 40 degrees of north latitude. They belong to the Portugueſe, and are alſo called the *weſtern iſles*, on account of their ſituation. They were diſcovered by the Flemings in the 15th century. They are ſeven in number, viz. Tercera, St Michael's, St Mary's, Gracioſa, St George's Iſland, Pico, and Fayal.

AZOTH, in ancient chemiſtry, the firſt matter of metals, or the mercury of a metal; more particularly that which they call the *mercury of philoſophers*, which they pretended to draw from all ſorts of metallic bodies.

AZOTUS, AZOTH, or ASHDOD, one of the five cities of the Philiſtines, and a celebrated ſea-port on the Mediterranean, ſituated about 14 or 15 miles ſouth of Ekron, between that and Aſcalon. It was in this city that the idol Dagon fell down before the ark; and ſo ſtrong a place it was, if we may believe Herodotus, that it ſuſtained a ſiege of 29 years by Pſammiticus king of Egypt. It was, however, taken by the Maccabees in a much ſhorter time; who burnt both city and temple, and with them about 8000 men. The town is now called by the Arabs *Haſuneyun*. It is but thinly inhabited, though the ſituation is very pleaſant: with regard to the houſes, thoſe that were built in the time of Chriſtianity, and which are now inhabited by Mahometans, ſtill preſerve ſome claim to admiration; but the modern buildings, tho' generally of ſtone, have nothing in them which can attract the notice of a traveller. The ſtreets are pretty broad, the inhabitants moſtly Mahometans, with a few Chriſtians of the Greek communion, who have a church under the juriſdiction of the archbiſhop of Gaza. The town is about a mile and a half in circumference; and has in it a moſque, a public bath, a market-place, and two inns. The number of the inhabitants is between two and three thouſand. The moſt remarkable things in this place are an old ſtructure with fine marble pillars, which the inhabitants ſay was the houſe that Sampſon pulled down; and to the ſouth-eaſt, juſt out of the town, the water in which the eunuch of Candace was baptized by the apoſtle Philip: beſides theſe two, there are ſeveral ancient buildings, with capitals and pillars ſtanding.

AZURE, in a general ſenſe, the blue colour of the ſky. See Sky and Blue.

Azure, among painters. This word, which at preſent ſignifies in general a fine blue colour, was formerly appropriated to *Lapis Lazuli*, called *azure ſtone*, and to the blue prepared from it. But ſince a blue has been extracted from cobalt, cuſtom has applied to it the name of *azure*, although it differs conſiderably from the former, and is incapable of being uſed for the ſame purpoſes, and particularly for painting in oil. The former at preſent is called *lapis lazuli*; or only *lapis*; and the blue prepared from it for painting in oil, is called *ultramarine*.—The name *azure* is generally applied to the blue glaſs made from the earth of cobalt and vitrifiable matters. This glaſs, which is called *ſmalt* when in maſſes, is called *azure* only when it is reduced to a fine powder. Several kinds of azure are diſtinguiſhed, according to its degrees of beauty, by the names of *fine azure*, *powdered azure*, and *azure of four fires*. In general, the more intenſe the colour, and the finer the powder, the more beautiful and dear it is. Azure is employed to colour ſtarch; hence it has alſo been called *ſtarch-blue*. It is uſed for painting with colours, and for a blue enamel.

Azure, in heraldry, the blue colours in the arms of any perſon below the rank of a baron. In the eſcutcheon of a nobleman, it is called *ſapphire*; and in that of a ſovereign prince, *Jupiter*. In engraving this colour is expreſſed by lines or ſtrokes drawn horizontally. —This colour may ſignify Juſtice, Perſeverance, and Vigilance; but according to G. Leigh, if it is compounded with

Or	it ſignifies	Chearfulneſs.
Arg.		Vigilance.
Gul.		Readineſs.
Ver.		Enterprize.
Pur.		Goodneſs.
Sab.		Mournfulneſs.

French Heralds, *M. Upton*, and his followers, rank this colour before gules.

AZYGOS, in anatomy, a vein riſing within the thorax, on the right ſide, having no fellow on the left; whence it is called *azygos*, or *vena ſine pari*.

AZYMITES, in church-hiſtory, Chriſtians who adminiſter the euchariſt with unleavened bread. The word is formed from the Greek, α priv. and ζυμη *ferment*.—This appellation is given to the Latin by the Greek church, becauſe the members of the former uſe fermented bread in the celebration of the euchariſt. They alſo call the Armenians and Maronites by the ſame name, and for the ſame reaſon.

AZYMOUS, ſomething unfermented, or made without leaven; as unleavened bread. Sea-biſket is of this kind; and therefore, according to Galen, leſs wholeſome than bread that has been fermented.

B.

B, THE ſecond letter of the Engliſh and moſt other alphabets. It is the firſt conſonant, and firſt mute, and in its pronunciation is ſuppoſed to reſemble the bleating of a ſheep; upon which account Pierius tells us in his hieroglyphics, that the Egyptians repreſented the ſound of this letter by the figure of that animal.

B is alſo one of thoſe letters which the eaſtern grammarians call *labial*, becauſe the principal organs employed in its pronounciation are the lips. It is pronounced by preſſing the whole length of them together, and forcing them open with a ſtrong breath. It has a near affinity with the other labials P and V, and is often uſed for P both by the Armenians and other orientals, as in *Betrus* for *Petrus*, *apſens* for *abſens*, &c.; and by the Romans for V, as in *amabit* for *amavit*, *berna* for *verna*, &c. whence aroſe that jeſt of Aurelian on the emperor Bonoſus, *Non ut vivat natus eſt, ſed ut bibat.*

Plutarch obſerves, that the Macedonians changed Φ into B, and pronounced *Bilip*, *Berenice*, &c. for *Philip*, *Pherenice*, &c.; and thoſe of Delphos uſed B inſtead of Π, as βαθειν for παθειν, βικρον for πικρον, &c.—The Latins ſaid *ſuppono*, *oppono*, for *ſubpono*, *obpono*; and pronounced *optinuit*, though they wrote *obtinuit*, as Quintilian has obſerved.—They alſo uſed B for F or PH: thus, in an ancient inſcription mentioned by Gruter, Obrendario is uſed for Ofrendario.

As a numeral, B was uſed by the Greeks and Hebrews to denote 2; but among the Romans for 300, and with a daſh over it (thus $\bar{B}$) for 3000.

B is alſo uſed as an abbreviation. Thus B. A. ſtands for bachelor of arts; B. L. for Bachelor of laws; and B. D. for bachelor of divinity. B. F. in the preface to the decrees or ſenatus-conſulta of the old Romans ſignified *bonum factum*. In muſic, B ſtands for the tone above A; as B♭, or ♭B, does for B flat, or the ſemitone major above A. B alſo ſtands for baſs; and B. C. for *baſſo continuo*, or thorough baſs.

BAAL, the ſame as Bel, or Belus; an idol of the Chaldeans and Phœnicians, or Canaanites. The former worſhipped Mars under this name, according to Joſephus*; who, ſpeaking of Thurus the ſucceſſor of Ninus ſays, "To this Mars the Aſſyrian erected the firſt ſtatue, and worſhipped him as a god, calling him *Baal*." It is probable the Phœnicians worſhipped the ſun under the name of Baal; for Joſiah, willing to make ſome amends for the wickedneſs of Manaſſeh, in worſhipping Baal and all the hoſt of heaven, *put to death the idolatrous prieſts that burnt incenſe unto Baal, to the ſun, and to the moon, and to the planets, and to all the hoſt of heaven. He likewiſe took away the horſes that the kings of Judah had given to the ſun, and burnt the chariots of the ſun with fire* †.

The temples conſecrated to this god, are called in the Scripture *Chamanim*, which ſignifies *places incloſed with walls*, in which was kept a perpetual fire. Maundrell, in his journey from Aleppo to Jeruſalem, obſerved ſome traces of theſe incloſures in Syria. In moſt of them were no ſtatues; in a few there were ſome, but of no uniform figure.

The word *baal* (in the Punic language), ſignifies *lord* or *maſter*; and doubtleſs meant the ſupreme Deity, the Lord and Maſter of the univerſe. It is often joined with the name of ſome falſe god, as *Baal-berith, Baal-peor, Baal-zephon*, and the like. This deity paſſed from the Phœnicians to the Carthaginians, who were a colony of the Phœnicians; as appears from the Carthaginian names, Hannibal, Aſdrubal, &c. according to the cuſtom of the eaſt, where kings and great men added to their own names thoſe of their gods.

This falſe deity is frequently mentioned in Scripture in the plural number (*Baalim*): which may ſignify, either that the name *Baal* was given to ſeveral different gods; or that there were many ſtatues, bearing different appellations, conſecrated to this idol. Arnobius tells us, that Baal was of an uncertain ſex; and that his votaries, when they called upon him, invoked him thus: *Hear us, whether thou art a god or a goddeſs.*

Some learned men think, that the Baal of the Phœnicians is the Saturn of the Greeks; which is probable enough from the conformity there is between the human ſacrifices offered to Saturn and thoſe which the Scripture tells us were offered to Baal. Others are of opinion, that Baal was the Phœnician or Tyrian Hercules, a god of great antiquity in Phœnicia.

Baal-berith, the god of the Shechemites. Bochart conjectures, that Berith is the ſame as *Beroe*, the daughter of Venus and Adonis, who was given in marriage to Bacchus; and that ſhe gave her name to the city of Berith in Phœnicia, and became afterwards the goddeſs of it. Baal-berith ſignifies *Lord of the Covenant*, and may be taken for the god that preſides over alliances and oaths, in like manner as the Greeks had their Ζευς ορκιος, and the Romans their *Deus Fidius*, or *Jupiter Piſtius*. The idolatrous Iſraelites, we are told, *made Baal-berith their god*, Judg. viii. 33.

Baal-peor, *Baal-phegor*, or *Beel-phegor*, an idol of the Moabites and Midianites. We are told, that *Iſrael joined himſelf to Baal-peor*; and that Solomon erected an altar to this idol upon the mount of Olives. Baal-peor has been ſuppoſed to be no other than a Priapus, and that the worſhip of him conſiſted in the moſt obſcene practices. Others have thought, that, as Baal is a general name ſignifying *Lord*, Peor may be the name of ſome great prince deified after his death. Mede imagines, that, *Peor* being the name of a mountain in the country of Moab, on which the temple of Baal was built, Baal-peor may be only another name of that deity, taken from the ſituation of his temple; in like manner as Jupiter is ſtyled *Olympius*, becauſe he was worſhipped in a temple built on mount Olympus. Selden, who is of this latter opinion, conjectures likewiſe, that Baal-peor is the ſame with Pluto; which he grounds upon theſe words of the Pſalmiſt*, *They joined themſelves unto Baal-peor, and eat the offerings of the dead*; though by the *ſacrifices* or *offerings of the dead*, in this paſſage, may be meant no more than ſacrifices or offerings made to idols, or falſe gods, who are very properly called *the dead*, in contradiſtinction to the true God, who is ſtyled in Scripture the *living God*.

Baal-zebub, *Beel-zebub*, or *Belzebub*; the idol, or god, of the Ekronites. In Scripture he is called the *Prince of Devils*. His name is rendered the *Lord of Flies*, or the *God-fly*; which ſome think was a mock appellation beſtowed on him by the Jews. He had a famous temple and oracle at Ekron. Ahaziah king of Iſrael, having fallen from the terraſs of his houſe into a lower room, and being dangerouſly hurt, ſent to conſult this deity, to know if he ſhould be cured of his wounds. The worſhip of this falſe god muſt have prevailed in our Saviour's time, ſince the Jews accuſed him of driving out devils in the name of *Belzebub* their prince. Scaliger derives the name of this deity from *Baalim-zebahim*, which ſignifies the *Lord of ſacrifices*.

BABBLING, among hunters, is when the hounds are too buſy after they had found a good ſcent.

BABEL, a city and tower undertaken to be built by the whole human race ſoon after the flood, and remarkable for the miraculous fruſtration of the attempt by the confuſion of languages. As to the ſituation of ancient Babel, moſt authors are of opinion that it was, exactly in the place where the celebrated city of Babylon afterwards ſtood. That it was in the ſame country, appears indiſputably from Scripture; but that it was exactly in the ſame place is what cannot be proved, nor is it a matter of any conſequence.

Authors have been much divided about the motive by which the whole race of mankind were induced to join as one man in ſuch an undertaking. Some have imagined that it was out of fear of a ſecond deluge; others, that they knew beforehand that they were to be diſperſed through all the different countries of the world, and built this tower in order to defeat the deſign of the Deity, becauſe having a tower of ſuch vaſt height as they propoſed, thoſe who were at a diſtance could eaſily find their way back again. Had either of theſe been their deſign, however, it is probable they would have choſen an eminence rather than a plain for

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* Antiquit. lib. viii. cap. 7.

† 2 Kings xxiii. 5. 11.

* Pſalm cvi.

the ſituation of their tower, or indeed that they would have choſen ſome high mountain ſuch as Ararat for their mark, rather than any tower at all: for though it is ſaid that they deſigned the top of their tower to reach to heaven, we can ſcarce ſuppoſe them to have been ſo abſurd, as to imagine this poſſible in the ſenſe we underſtand it; and muſt therefore rather take it in the limited ſenſe in which it is often uſed by Moſes and his countrymen, where they ſpeak of cities walled up to heaven. Others there are who imagine that the top of this tower was not to reach up to heaven, but to be conſecrated to the heavens, *i. e.* to the worſhip of the ſun, moon, and ſtars; of the fire, air, &c. and other natural powers as deities; and therefore that the true Deity interpoſed in order to prevent a total and irrecoverable defection. Certain it is, that the ſpecies of idolatry which takes for the objects of its worſhip thoſe natural agents, as it is the moſt ancient, ſo it is by far the moſt rational, and the moſt difficult to be diſproved. It is much more difficult, for inſtance, to prove that the ſun, which by his enlivening beams gives vigour to the whole creation, is not a deity, than that a log of wood is not one; and hence, if ſuch a ſyſtem of religion became univerſally eſtabliſhed among mankind, it would be impoſſible ever afterwards to eradicate it. Indeed that the ſcheme of Babel, whatever it was, could have been put in execution by man, ſeems evident from the interpoſition of the Deity on the occaſion; for we cannot ſuppoſe that he would have worked a miracle on purpoſe to defeat that which would have defeated itſelf if he had let it alone: and he expreſsly ſays, That now nothing could be reſtrained from them; which intimates very plainly, that, had this ſcheme gone on, the plan which God had laid for the government of the world would have been totally fruſtrated: and agreeable to this hypotheſis Dr Tenniſon ſuppoſes that the tower was of a pyramidal form, in imitation of the ſpires of flame; and that it was erected in honour of the ſun, as being the moſt probable cauſe of drying up the flood.

As to the materials made uſe of in the building of this tower, the Scripture informs us that they were bricks and ſlime or bitumen. According to an eaſtern tradition, three years were taken up in making the bricks, each of which was 13 cubits long, 10 broad, and five thick. Oriental writers ſay, that the city was 313 furlongs in length, and 151 in breadth; that the walls were 5533 fathoms high, and 33 in breadth; and that the tower itſelf was no leſs than 10,000 fathom, or 12 miles high. Even St Jerome affirms from the teſtimony of eye-witneſſes, who as he ſays had examined the remains of the tower, that it was four miles high; but Ado makes the height to have been no leſs than 5000 miles. The only account of its dimenſions which can be at all depended upon (ſuppoſing it to have been the ſame which afterwards ſtood in the midſt of the city of Babylon, and round which Nebuchadnezzar built the temple of Belus), is that given under the article BABYLON.

BABEL-MANDEL, the GATE OF MOURNING; a famous ſtrait in the Indian ocean, between the coaſt of Arabia Felix in Aſia, and that of Adel and Zeila in Africa, at the entrance into the Red Sea. By ſome it is alſo called the *Straits of Moka.* It is narrow, and difficult to ſail through, on account of the ſand-banks. At the mouth of the ſtrait is a ſmall iſland called alſo *Babel-Mandel,* which is little elſe than a barren rock. E. Long. 44. 30. N. Lat. 12. 40.

BABENHAUSEN, a town of Germany in Suabia. E. Long. 9. 16. N. Lat. 48. 39.

BABINA (*Commonwealth* of), a ſociety ludicrouſly ſo called, which was founded in Poland in the reign of Sigiſmund-Auguſtus, in the 16th century. It took its riſe from a ſet of gentlemen, inhabitants of Lublin, who had agreed to meet at a place called *Babina,* merely for the purpoſes of mirth and jollity. In time their number increaſed, and they formed themſelves into a regular government, under the preſidency of a king, ſenate, and chief magiſtrates. The magiſtrates were elected from ſomething which appeared ridiculous in the character or conduct of any of the members. For inſtance, if any perſon was meddling or officious, he was immediately created an archbiſhop; a blundering or diſputatious member was promoted to the ſpeaker's chair; a boaſter of his own courage, and vainglorious *Thraſo,* was honoured with the commiſſion of generaliſſimo, which was preſented him with great ceremony by the ſubordinate heroes. Thoſe who declined the office for which they were declared qualified, were perſecuted with hiſſings, and abandoned by the ſociety. Thus every vice and every foible was attacked with ridicule; and Babina became in a ſhort time the terror, the admiration, and the reformer, of the Poliſh nation: genius flouriſhed, wit was cultivated, and the abuſes which had crept into government and ſociety were corrected by the judicious application of good-humoured ſatire. Never did any inſtitution of this nature become ſo general or ſo uſeful; but at length it degenerated into a ſeat of buffoons, and banterers of every thing ſacred or profane. For ſeveral years it was patroniſed by the kings of Poland, and Sigiſmund himſelf became a member; the ſtaroſta of Babina telling him jocularly, That "His majeſty had certain qualities which intitled him to the firſt dignity in the commonwealth." Not the leaſt remnant of this ſociety now remains, though it was honoured with extraordinary privileges by kings and emperors.

BABINGTON (Gervaſe), biſhop of Worceſter, was born, according to Fuller, in Nottinghamſhire; but in what year is uncertain. He was ſent to Trinity College, Cambridge, of which he was made fellow; and, in 1578, was incorporated maſter of arts at Oxford. He appears, however, to have made Cambridge the place of his reſidence, where he became an eminent preacher; and, being now doctor of divinity, was made domeſtic chaplain to Henry Earl of Pembroke. In this ſtation he is ſuppoſed to have aſſiſted the counteſs in her tranſlation of the Pſalms. In 1588 he was inſtalled prebend of Hereford, and in 1591 conſecrated biſhop of Landaff. In 1594 he was tranſlated to the ſee of Exeter, and thence to Worceſter in 1597. About this time, or ſoon after, he was made queen's counſel for the marſhes of Wales. He was a conſiderable benefactor to the library belonging to the cathedral of Worceſter, where he was buried in May 1610 without a monument. The ſeveral hiſtorians who have mentioned this prelate agree in giving him the character of a learned and pious man. His writings, like thoſe of moſt of his cotemporaries, abound with puns and quaint expreſſions. His works were printed both in folio and quarto in 1615, and again in folio in 1637, under this title; *The works of the right reverend father in God Gervaſe Babington, late biſhop of Worceſter, containing comfortable notes upon the five books of Moſes,* viz. *Geneſis, &c. As alſo an expoſition upon the Creed, the Ten Commandments, the Lord's Prayer; with a conference betwixt man's frailtie and faith, and three ſermons, &c.*

BABOON, in zoology. See SIMIA.

BABYLON, the capital of the ancient kingdom of Babylonia or Chaldæa, and ſuppoſed to have ſtood in E. Long. 44. 0. N. Lat. 32. 0. Semiramus is ſaid by ſome, and Belus by others, to have founded this city. But, by whomſoever it was founded, Nebuchadnezzar was the perſon who put the laſt hand to it, and made it one of the wonders of the world. The moſt famous works in and about it were the walls of the city, the temple of Belus, Nebuchadnezzar's palace, the hanging-gardens, the banks of the river, the artificial lake, and canals.

1 City deſcribed.

The city was ſurrounded with walls, in thickneſs 87 feet, in height 350 feet, and in compaſs 480 furlongs or 60 of our miles. Thus Herodotus, who was himſelf at Babylon; and though ſome diſagree with him in theſe dimenſions, yet moſt writers give us the ſame, or near the ſame, as he does. Diodorus Siculus diminiſhes the circumference of theſe walls very conſiderably, and takes ſomewhat from the height of them, as in Herodotus; tho' he ſeems to add to their breadth, by ſaying, that ſix chariots might drive abreaſt thereon; while the former writes, that one chariot only might turn upon them; but then he places buildings on each ſide of the top of theſe walls, which, according to him, were but one ſtory high; which may pretty well reconcile them together in this reſpect. It is obſerved, that thoſe who give the height of theſe walls but at 50 cubits, ſpeak of them only as they were after the time of Darius Hyſtaſpis, who had cauſed them to be beaten down to that level. Theſe walls formed an exact ſquare, each ſide of which was 120 furlongs, or 15 miles, in length; and were all built of large bricks cemented together with bitumen, which in a ſhort time grows harder than the very brick and ſtone which it cements. The city was encompaſſed, without the walls, with a vaſt ditch filled with water, and lined with bricks on both ſides; and, as the earth that was dug out of it ſerved to make the bricks, we may judge of the depth and largeneſs of the ditch from the height and thickneſs of the walls. In the whole compaſs of the wall there were 100 gates, that is, 25 on each of the four ſides, all made of ſolid braſs. Between every two of theſe gates, at proper diſtances, were three towers, and four more at the four corners of this great ſquare, and three between each of theſe corners and the next gate on either ſide, and each of theſe towers was ten feet higher than the walls. But this is to be underſtood only of thoſe parts of the walls where towers were needful for defence. For ſome parts of them being upon a moraſs, and inacceſſible by an enemy, there the labour and coſt was ſpared, which tho' it muſt have ſpoiled the ſymmetry of the whole, muſt be allowed to have favoured of good œconomy; though that is what one would not have expected from a prince who had been ſo determined, as Nebuchadnezzar muſt have been, to make the city complete both for ſtrength and beauty. The whole number, then, of theſe towers amounted to no more than 250; whereas a much greater number would have been neceſſary to have made the uniformity complete all round. From the 25 gates on each ſide of this ſquare, there was a ſtraight ſtreet, extending to the correſponding gate in the oppoſite wall; whence the whole number of the ſtreets muſt have been but 50; but then they were each about 15 miles long, 25 of them croſſing the other 25 exactly at right angles. Beſides theſe whole ſtreets, we muſt reckon four half-ſtreets, which were but rows of houſes facing the four inner ſides of the walls. Theſe four half-ſtreets were properly the four ſides of the city within the walls, and were each of them 200 feet broad, the whole ſtreets being about 150 of the ſame. By this interſection of the 50 ſtreets, the city was divided into 676 ſquares, each of four furlongs and a half on each ſide, or two miles and a quarter in compaſs. Round theſe ſquares on every ſide towards the ſtreets ſtood the houſes, all of three or four ſtories in height, and beautified with all manner of ornaments; and the ſpace within each of theſe ſquares was all void, and taken up by yards, or gardens, and the like, either for pleaſure or convenience.

A branch of the Euphrates divided the city into two, running through the midſt of it, from north to ſouth; over which, in the very middle of the city, was a bridge, a furlong in length, or rather more, and indeed much more, if we hearken to others, who ſay it was no leſs than five ſtades or furlongs in length, tho' but 30 feet broad, a difference we ſhall never be able to decide. This bridge, however, is ſaid to have been built with wonderful art, to ſupply a defect in the bottom of the river, which was all ſandy. At each end of this bridge were two palaces; the old palace on the eaſt ſide, the new one on the weſt ſide of the river; the former of which took up four of the ſquares above-mentioned, and the latter nine. The temple of Belus, which ſtood next to the old palace, took up another of the ſame ſquares.

The whole city ſtood in a large flat or plain, in a very fat and deep ſoil: that part or half of it on the eaſt ſide of the river was the old city, and, the other on the weſt was added by Nebuchadnezzar, both being included within the vaſt ſquare bounded by the walls aforeſaid. The form of the whole was ſeemingly borrowed from Nineveh, which was alſo 480 furlongs; but though it was equal in dimenſions to this city, it was leſs with reſpect to its form, which was a parallelogram, whereas that of Babylon was an exact ſquare. It is ſuppoſed, that Nebuchadnezzar, who had deſtroyed that old ſeat of the Aſſyrian empire, propoſed that this new one ſhould rather exceed it; and that it was in order to fill it with inhabitants, that he tranſported ſuch numbers of the captives from other countries hither; though that is what may be diſputed, ſeeing he therein only followed the conſtant practice of the kings of Aſſyria, who thought this the moſt certain means of aſſuring their conqueſts either to themſelves or their poſterity.

2 Was never fully peopled.

But it plainly appears, that it was never wholly inhabited; ſo that, even in the meridian of its glory, it may be compared with the flower of the field, which flouriſhes to-day, and to-morrow is no more. It never had time to grow up to what Nebuchadnezzar viſibly intended to have made it; for, Cyrus removing the ſeat of the empire ſoon after to Shuſhan, Babylon fell by degrees to utter decay; yet it muſt be owned, that no country was better able to ſupport ſo vaſt and populous a city, had it been completed up to its firſt deſign. But ſo far was it from being finiſhed according to its original deſign, that, when Alexander came to Babylon, Q. Curtius tells us, “No “more than 90 furlongs of it were then built:” which can be no otherwiſe underſtood, than of ſo much in length; and, if we allow the breadth to be as much as the length (which is the utmoſt that can be allowed), it will follow, that no more than 8100 ſquare furlongs were then built upon: but the whole ſpace within the walls contained 14,400 ſquare furlongs; and therefore there muſt have been 6300 ſquare furlongs remaining unbuilt, which, Curtius tells us, were plowed and ſown. And, beſides this, the houſes were not contiguous, but all built with a void ſpace on each ſide, between houſe and houſe.

3
Temple of Belus.

The next great work of Nebuchadnezzar was the temple of Belus. The wonderful tower, however, that ſtood in the middle of it, was not his work, but was built many ages before; that, and the famous tower of Babel, being as is commonly ſuppoſed, one and the ſame ſtructure. This tower is ſaid to have been compoſed of eight pyramidal ones raiſed above one another, and by Herodotus ſaid to have been a furlong in height, but as there is an ambiguity in his expreſſion, it has been diſputed whether each of the towers was a furlong in height, or the whole of them taken together. On the latter ſuppoſition, which is the moſt probable, this tower muſt have exceeded the higheſt of the Egyptian pyramids by 179 feet, though it fell ſhort of its breadth at the baſis by 33. The way to go up was by ſtairs on the outſide round it; whence it ſeems moſt likely, that the whole aſcent was, by the benching in, drawn in a ſloping line from the bottom to the top eight times round it; and that this made the appearance of eight towers, one above the other. Till the times of Nebuchadnezzar, it is thought that this tower was all the temple of Belus; but as he did by the other ancient buildings of the city, ſo he did by this, making great additions thereto, by vaſt edifices erected round it, in a ſquare of two furlongs on every ſide, and juſt a mile in circumference, which exceeded the ſquare at the temple of Jeruſalem by 1800 feet. On the outſide of theſe buildings was a wall, which incloſed the whole; and, in conſideration of the regularity wherewith this city was to all appearance marked out, it is ſuppoſed that this wall was equal to the ſquare of the city wherein it ſtood, and ſo is concluded to have been two miles and an half in circumference. In this wall were ſeveral gates leading into the temple, and all of ſolid braſs; which it is thought may have been made out of the braſen ſea, and braſen pillars, and other veſſels and ornaments of the kind, which Nebuchadnezzar had tranſported from Jeruſalem; for in this temple he is ſaid to have dedicated his ſpoils from that of Jeruſalem.

4
Idols of gold, &c.

In this temple were ſeveral images or idols of maſſy gold, and one of them, as we have ſeen 40 feet in height; the ſame, as ſuppoſed, with that which Nebuchadnezzar conſecrated in the plains of Dura. For though this laſt is ſaid to have been 60 cubits, or 90 feet high, theſe dimenſions appear ſo incredible, that it has been attempted to reconcile them into one, by ſuppoſing that in the 90 feet the height of the pedeſtal is included, and that the 40 feet are for the height of the ſtatue without the pedeſtal; and, being ſaid to have weighed 1000 talents of Babylon, it is thence computed, that it was worth three millions and an half of our money. In a word, the whole weight of the ſtatues and decorations, in Diodorus Siculus, amounting to 5000 and odd talents in gold, the whole is eſtimated at above one and twenty millions of our money; and a ſum about equal to the ſame, in treaſure, utenſils, and ornaments, not mentioned is allowed, for.

Next to this temple, on the eaſt ſide of the river, ſtood the old palace of the kings of Babylon, being four miles in circumference. Exactly oppoſite to it, on the other ſide of the river, was the new palace built by Nebuchadnezzar, eight miles in cirumference, and conſequently four times as big as the old one.

5
Hanging gardens.

But nothing was more wonderful at Babylon than the hanging gardens, which Nebuchadnezzar made in complaiſance to his wife Amyte; who, being a Mede, and retaining a ſtrong inclination for the mountains and foreſts of her own country, was deſirous of having ſomething like them at Babylon. They are ſaid to have contained a ſquare of four plethra, or 400 feet, on each ſide; and to have conſiſted of terraces one above another, carried up to the height of the wall of the city, the aſcent from terrace to terrace being by ſteps ten feet wide. The whole pile conſiſted of ſubſtantial arches upon arches, and was ſtrengthened by a wall ſurrounding it on every ſide, 22 feet thick; and the floors on each of them were laid in this order: firſt, on the tops of the arches was laid a bed or pavement of ſtones 16 feet long, and four feet broad; over this was a layer of reed mixed with a great quantity of bitumen; and over this two courſes of brick, cloſely cemented together with plaſter; and over all theſe were thick ſheets of lead, and on theſe the earth or mould of the garden. This floorage was deſigned to retain the moiſture of the mould; which was ſo deep, as to give root to the greateſt trees which were planted upon every terrace, together with great variety of other vegetables pleaſing to the eye. Upon the uppermoſt of theſe terraces was a reſervoir, ſupplied by a certain engine with water from the river, from whence the gardens on the other terraces were ſupplied.

6
Banks of the river, canals, &c.

The other works attributed to Nebuchadnezzar by Beroſus and Abydenus, were the banks of the river, the artificial canals, and the great artificial lake ſaid to have been ſunk by Semiramis. The canals were cut out on the eaſt ſide of the Euphrates, to convey the waters of that river, when it overflowed its banks, into the Tigris, before they reached Babylon. The lake was on the weſt ſide of Babylon; and, according to the loweſt computation, 40 miles ſquare, 160 in compaſs, and in depth 35 feet, as we read in Herodotus, or 75, as Megaſthenes will have it; the former, perhaps, meaſured from the ſurface of the ſides, and the latter from the tops of the banks that were caſt up upon them. This lake was dug to receive the waters of the river, while the banks were building on each ſide of it. But both the lake, and the canal which led to it, were preſerved after that work was completed, being found of great uſe, not only to prevent all overflowings, but to keep water all the year, as in a common reſervoir, to be let out on proper occaſions, by ſluices, for the improvement of the land.

The banks were built of brick and bitumen, on both ſides of the river, to keep it within its channel; and extended on each ſide throughout the whole length of the city, and even farther, according to ſome, who reckon they extended 160 furlongs, or twenty miles; whence it is concluded they muſt have begun two miles and an half above the city, and have been continued an equal diſtance below it, the length of the city being no more than 15 miles. Within the city they were built from the bottom of the river, and of the ſame thickneſs with the walls of the city itſelf. Oppoſite to each ſtreet, on either ſide of the river, was a brazen gate in the ſaid wall, with ſtairs leading down from it to the river: theſe gates were open by day, and ſhut by night.

Beroſus, Megaſthenes, and Abydenus, attribute all theſe works to Nebuchadnezzar; but Herodotus tells us, the bridge, the banks, and the lake, were the work of a queen after him, called *Nitocris*, who may have finiſhed what Nebuchadnezzar left imperfect, and thence have had the honour this hiſtorian gives her of the whole.

The tower or temple ſtood till the time of Xerxes. But that prince on his return from the Grecian expedition, having firſt plundered it of its immenſe wealth, demoliſhed the whole, and laid it in ruins. Alexander, on his return to Babylon from his Indian expedition, propoſed to rebuild it, and accordingly ſet 10,000 men on work to clear away the rubbiſh. But his death happening ſoon after, a ſtop was put to all further proceedings in that deſign. After the death of that conqueror, the city of Babylon began to decline apace; which was chiefly owing to the neighbourhood of Seleucia, built by Seleucus Nicator, as is ſaid, out of ſpite to the Babylonians, and peopled with 500,000 perſons drawn from Babylon, which by that means continued declining till the very people of the country were at a loſs to tell where it had ſtood.

Such is the deſcription we have by ancient hiſtorians of the grandeur of this city; which, if theſe accounts are not exaggerated, muſt have exceeded every piece of human grandeur that hath yet appeared. Many of the moderns, however, are of opinion that theſe magnificent deſcriptions are very far from being true; although it is certain that few other arguments can be brought againſt the reality of them, than that we do not ſee things of a ſimilar kind executed in our own days. The following are the arguments uſed on this ſubject by the preſident Goguet.

7
Goguet's arguments againſt the truth of the foregoing relation.

“ Authors have greatly extolled the public works and edifices which once rendered Babylon one of the wonders of the world. We may reduce all theſe objects to five principal heads; 1. The height of its walls; 2. the temple of Belus; 3. the hanging gardens; 4. the bridge built over the river Euphrates, and the quays which lined that river; 5. the lake and canals dug by the hands of man to diſtribute the waters of the Euphrates.

“ All theſe works ſo marvellous in the judgment of antiquity, appear to me to have been extremely exaggerated by the authors who have ſpoken of them. How can we conceive, in effect, that the walls of Babylon could have been 318 feet high, and 81 in thickneſs, in a compaſs of near ten leagues?

“ I ſhall ſay the ſame of that ſquare building, known under the name of *the temple of Belus*. It was compoſed of eight towers placed one above another, diminiſhing always as they went up. Herodotus does not tell us what was the height of this monument. Diodorus ſays, that it ſurpaſſed all belief. Strabo fixes it at one ſtadium, a meaſure which anſwers nearly to 600 of our feet. For in the time of this geographer the ſtadia were much more conſiderable than in the firſt ages. The entire maſs of this building ought to have been anſwerable its exceſſive height; and this is alſo the idea that the ancients deſigned to give us of it. We may judge by the following fact. Xerxes had entirely demoliſhed this temple. Alexander undertook to rebuild it. He deſigned to begin by clearing the place and removing the ruins. Ten thouſand workmen who were employed two months in this work, were not, ſay they, able to finiſh it.

“ The riches incloſed in the temple of Belus were proportioned to its immenſity. Without ſpeaking of the tables and cenſers, the cups, and other ſacred vaſes, of maſſy gold, there was a ſtatue 40 feet high, which alone weighed 1000 Babyloniſh talents. In ſhort, according to the inventory that the ancients have given us of the riches contained in this temple, the total ſum would amount to two hundred and twenty millions and a half of French livres. Exaggerations like theſe deſtroy themſelves.

“ As to the hanging gardens, according to all appearance they never exiſted. The ſilence of Herodotus on a work ſo ſingular and ſo remarkable, determines me to place in the rank of fables all that the other writers have delivered upon this pretended wonder. Herodotus had carefully viſited Babylon. He enters into ſuch details as prove that he has omitted none of the rarities of that city. Can we preſume that he would have paſſed over in ſilence ſuch a work as the hanging gardens? All the authors who have ſpoken of it are of much later date than this great hiſtorian. None of them except Beroſus ſpeaks on his own teſtimony. It is always on the report of others. Diodorus had extracted from Cteſias what he ſays of theſe famous gardens. There is alſo great appearance that Strabo had drawn from the ſame ſource. In a word, the manner in which Quintus Curtius expreſſes himſelf, ſufficiently ſhows how much the exiſtence of theſe gardens appeared to him ſuſpicious. He judged they owed the greateſt part of it to the imagination of the Greeks.

“ Let us now ſpeak of the bridge of Babylon, which the ancients have placed in the number of the moſt marvellous works of the eaſt. It was near 100 fathoms in length, and almoſt four in breadth. We cannot deny but that a great deal of art and labour was neceſſary to lay the foundations, which it could not be eaſy to ſettle in the bed of an extremely deep and rapid river, which alſo rolls along a prodigious quantity of mud, and whoſe bottom is entirely ſandy. They had therefore taken many precautions to ſecure the piers of the bridge of Babylon. They were built of ſtones joined and faſtened together with cramps of iron, and their joints filled with melted lead. The front of the piers, turned towards the current of the Euphrates, was defended by buttreſſes extremely advanced, which diminiſhed the weight and force of the water, by cutting it at a great diſtance. Such was the bridge of Babylon.

"While we do juſtice to the ſkill of the Babylonians in conducting theſe works, we cannot help remarking the bad taſte which at all times reigned in the works of the eaſtern nations. The bridge of Babylon furniſhes a ſtriking inſtance of it. This edifice was abſolutely without grace, or any air of majeſty. The breadth of it was in no ſort of proportion to its length. The diſtance between the piers was alſo very ill contrived. They were diſtant from each other only 11 feet and a half. Finally, this bridge was not arched. We may judge of its effect on the view.

"The Babylonians, however, were not the only people who were ignorant of the art of turning an arch. This ſecret, as far as I can find, was unknown to all the people of remote antiquity, who, generally ſpeaking, do not appear to have been very ſkilful in ſtone-cutting.

"As for the quays which lined the Euphrates, we may believe that they were grand and magnificent: but I ſhall not eaſily believe that they ſurpaſſed thoſe which we have daily under our eyes. In this reſpect, I believe Paris may diſpute it for magnificence, and for the extent of the work, with all the cities of the univerſe."

Babylon, a town of Egypt near the eaſtmoſt branch of the river Nile, now ſuppoſed to be *Grand Cairo*, or this city to ſtand near its ruins. E. Long. 31. 12. N. Lat. 30. 5.

BABYLONIA, or **Chaldæa**, a kingdom of Aſia and the moſt ancient in the world, being founded by Nimrod the grandſon of Ham, who alſo, according to the margin of our Bibles, founded Nineveh the capital of the kingdom of Aſſyria. Indeed, theſe two kingdoms ſeem to have always continued in ſuch a ſtate of friendſhip, that we can ſcarce help thinking they muſt have been the ſame, or perhaps Babylonia was for ſome time a province of Aſſyria. Nothing certain is known concerning either of them, except what may be gathered from Scripture. From thence we learn, that in the days Abraham there was a king of *Shinar*, called *Amraphel*, who, under the king of Elam or Perſia made war upon the Canaanites. From this time we have nothing that can be depended upon till the days of Nabonaſſar, the firſt king of Babylon mentioned in Ptolemy's canon. It is plain indeed, both from Scripture and profane hiſtory, that Babylonia ſubſiſted as a diſtinct kingdom from Aſſyria even when the latter was in all its glory. The moſt probable account of the matter is this: The empire of Aſſyria was founded by Pul, on the ruins of that of Damaſcus or Syria, in the days of Menahem king of Judah. This king left two ſons, Tiglath-Pileſer, and Nabonaſſer. To the former he bequeathed the empire of Aſſyria, and to the latter that of Babylon. Tiglath-Pileſer reſided at Nineveh, the original ſeat of the Aſſyrian empire; while Nabonaſſer, who was the younger brother, held his reſidence at Babylon. As the two kingdoms were governed by princes of the ſame family, we may well ſuppoſe a perfect harmony to have reigned between them, the younger branch at Babylon acknowledging a kind of ſubjection to the elder at Nineveh. That the Babylonian empire was of Aſſyrian origin, we are aſſured by the prophet Iſaiah, in the following words: "Behold the land of the Chaldeans: this people was not till the Aſſyrian founded it for them that dwelt in the wilderneſs; they ſet up the towers thereof: they built the palace thereof." As to the kingdom of Aſſyria, the Scripture mentions only five kings, *viz.* Pul, Tiglath-Pileſer, Shalmanaſer, Sennacharib, and Eſarhaddon; whoſe hiſtory, as related by the ſacred writers, it is needleſs to mention particularly here. From the days of Nabonaſſer, to Nabopolaſſer, that is, from the year before Chriſt 747 to 626, the kings of Babylon made no figure, and were therefore probably in a ſtate of dependence on the kings of Aſſyria; but at that time, in the reign of *Chyniladan*, the Sardanapalus of the Greeks, Nineveh was taken and deſtroyed by the Medes and Babylonians, and the ſeat of the empire transferred to Babylon. This Nabopolaſſer was the father of the famous Nebuchadnezzar, for whoſe hiſtory we muſt refer to the ſacred writers: and from his time to that of the *Belſhazzar* of Daniel, and *Nabonadius* of other authors, the hiſtory of Babylon is little better than a mere blank. Of the reduction of Babylon by Cyrus, which happened at this time, we have the following account.

War had been begun betwixt the Medes, Perſians, and Babylonians, in the reign of Nerigliſſar the father of Nabonadius, which had been carried on with very bad ſucceſs on the ſide of the Babylonians. Cyrus, who commanded the Median and Perſian army, having ſubdued the ſeveral nations inhabiting the great continent from the Ægean ſea to the Euphrates, bent his march towards Babylon. Nabonadius, hearing of his march, immediately advanced againſt him with an army. In the engagement which enſued, the Babylonians were defeated; and the king, retreating to his metropolis, was blocked up and cloſely beſieged by Cyrus. The reduction of this city was no eaſy enterpriſe. The walls were of a prodigious height, the number of men to defend them very great, and the place ſtored with all ſorts of proviſions for 20 years. Cyrus, deſpairing of being able to take ſuch a city by ſtorm, cauſed a line of circumvallation to be drawn quite round it, with a large and deep ditch; reckoning, that if all communication with the country were cut off, the beſieged would be obliged to ſurrender through famine. That his troops might not be too much fatigued, he divided his army into twelve bodies, appointing each body its month to guard the trenches; but the beſieged, looking upon themſelves to be out of all danger by reaſon of their high walls and magazines, inſulted him from the ramparts, and looked upon all the trouble he gave himſelf as ſo much unprofitable labour.

After Cyrus had ſpent two whole years before Babylon, without making any progreſs in the ſiege, he at laſt thought of the following ſtratagem, which put him in poſſeſſion of it. He was informed, that a great annual ſolemnity was to be held at Babylon; and that the inhabitants on that occaſion were accuſtomed to ſpend the whole night in drinking and debauchery. This he therefore thought a proper time for ſurpriſing them; and accordingly ſent a ſtrong detachment to the head of the canal leading to the great lake, with orders, at a certain time, to break down the great bank which was between the lake and the canal, and to turn the whole current into the lake. At the ſame time he appointed one body of troops at the place where the river entered the city, and another where it came out; ordering them to march in by the bed of the river as ſoon as they ſhould find it fordable. Towards the evening he opened the head of the trenches on both ſides the river above the city, that the water might diſcharge itſelf into them; by which means, and the breaking down of the great dam, the river was ſoon drained. Then the two abovementioned bodies of troops, according to their orders, entered the channel; the one commanded by Gobryas and the other by Gadates: and finding the gates all left open by reaſon of the diſorders of that riotous night, they penetrated into the very heart of the city without oppoſition; and meeting, according to agreement, at the palace, they ſurpriſed the guards, and cut them in pieces. Thoſe who were in the palace opening the gates to know the cauſe of this confuſion, the Perſians ruſhed in, took the palace, and killed the king, who came out to meet them ſword in hand. Thus an end was put to the Babylonian empire; and Cyrus took poſſeſſion of Babylon for one called in Scripture *Darius the Mede*, moſt probably *Cyaxares* II. uncle to Cyrus. From this time Babylonia never was erected into a diſtinct kingdom, but hath always followed the fortune of thoſe great conquerors who at different times have appeared in Aſia. It is now frequently the object of contention between the Turks and Perſians. See ASSYRIA.

Concerning the nature of the country, manners, cuſtoms, &c. of the ancient Babylonians, the following account is collected by M. Sabbathier.

"As all the nations under the dominion of Cyrus, beſide the ordinary tributes, were obliged to maintain him and his army, the monarch and his troops were ſupported by all Aſia. The country of Babylon alone was obliged to maintain him four months of the year; its fertility, therefore, yielded a third of the produce of Aſia. The government of this country, which the Perſians termed *ſatrapy*, was richer, and more extenſive, than any of the reſt. It maintained for the king, beſides the war-horſes, a ſtud of 800 ſtallions, and 16,000 mares. So great a number of Indian dogs were likewiſe bred in this province for the king, that four of its cities kept thoſe animals; and in return, they were exempted from all taxes and tributes.

"It rained very ſeldom in this country, according to Herodotus. The earth was watered by the river, which was here diffuſed by human induſtry, as the Nile is over Egypt by nature: for all the country of Babylon was divided by canals, the greateſt of which was navigable, and flowed from ſouth to north, from the Euphrates to the Tigris. In ſhort, it was one of the fineſt countries for corn in the world; but for producing trees, the fig-tree, the vine and the olive, it was not famous. It was ſo luxuriant in grain, that it commonly yielded a hundred times more than what was ſown; and in its good years it yielded three hundred times more than it received. The leaves of its wheat and barley were four inches broad. 'Though I know,' ſays Herodotus, 'that the millet and the ſeſame of that country grow to the ſize of trees, I will not deſcribe them particularly; leſt thoſe who have not been in Babylonia ſhould think my account fabulous.'

"They had no oil but what they made from Indian corn. The country abounded with palm-trees, which grew ſpontaneouſly; and moſt of them bore fruit, of which the inhabitants made bread, wine, and honey. They cultivated theſe trees and their fig-trees in the ſame manner. Some of them, as of other trees, the Greeks called *male ones*. They tied the fruit of the male to the trees which bore dates; that the moſquito, leaving the male, might cauſe the date to ripen, by penetrating it; for without that aſſiſtance it came not to maturity. Moſquitos bred in the male palms as in the wild fig-trees.

"But we muſt not here omit to give an account of the peculiar and ſurpriſing conſtruction of their boats of ſkins, in which they ſailed along the river to Babylon. Theſe boats were invented by the Armenians, whoſe country lay north from Babylonia. They made them with poles of willow, which they bent, and covered with ſkins: the bare ſide of the ſkins they put outwards; and they made them ſo tight, that they reſembled boards. The boats had neither prow nor ſtern, but were of a round form like a buckler. They put ſtraw on the bottom. Two men, each with an oar, rowed them down the river, laden with different wares, but chiefly with palm-wine. Of theſe boats ſome were very large, and ſome very ſmall. The largeſt carried the weight of 500 talents. There was room for an aſs in one of their ſmall boats; they put many into a large one. When they had unloaded, after their arrival at Babylon, they ſold the poles of their boats and the ſtraw; and loading their aſſes with the ſkins, returned to Armenia: for they could not ſail up the river, its current was ſo rapid. For this reaſon they made their boats of ſkins, inſtead of wood; and on their return to Armenia with their aſſes, they applied the ſkins to their former uſe.

"As to their dreſs, they wore a linen ſhirt, which came down to their feet. Over it they wore a woollen robe; their outer garment was a white veſt. Their ſhoes reſembled thoſe of the Thebans. They let their hair grow. On their heads they wore a turban. They rubbed their bodies all over with fragrant liquors. Each man had a ring on his finger, and an elegant cane in his hand, with an apple at the top, or a roſe, a lily, or an eagle, or ſome other figure; for they were not ſuffered to uſe canes without devices.

"With regard to their policy, Herodotus thinks that their beſt law was one which the Heneti, an Illyrian people, likewiſe obſerved in every town and village. When the girls were marriageable, they were ordered to meet in a certain place, where the young men likewiſe aſſembled. They were then ſold by the public crier; but he firſt ſold the moſt beautiful one. When he had ſold her at an immenſe price, he put up others to ſale, according to their degrees of beauty. The rich Babylonians were emulous to carry off the fineſt women, who were ſold to the higheſt bidders. But as the young men who were poor could not aſpire to have fine women, they were content to take the ugliest with the money which was given them: for when the crier had ſold the handſomeſt, he ordered the ugliest of all the women to be brought; and aſked, if any one was willing to take her with a ſmall ſum of money. Thus ſhe became the wife of him who was moſt eaſily ſatisfied; and thus the fineſt women were ſold; and from the money which they brought, ſmall fortunes were given to the uglieſt, and to thoſe who had any bodily infirmity. A father could not marry his daughter as he pleaſed; nor was he who bought her allowed to take her home, without giving ſecurity that he would marry her. But, after the ſale, if the parties were not agreeable to each other, the law enjoined that the purchaſe-money ſhould be reſtored. The inhabitants of any of their towns were permitted to marry wives at theſe auctions. Such were the early cuſtoms of the Babylonians.

“ But they afterwards made a law, which prohibited the inhabitants of different towns to intermarry, and by which huſbands were puniſhed for treating their wives ill. When they had become poor by the ruin of their metropolis, fathers uſed to proſtitute their daughters for gain. There was a ſenſible cuſtom among the Babylonians, worthy to be related. They brought their ſick into the forum, to conſult thoſe who paſſed on their diſeaſes; for they had no phyſicians. They aſked thoſe who approached the ſick, if they ever had the ſame diſtemper? if they knew any one who had it? and how he was cured? Hence, in this country, every one who ſaw a ſick perſon was obliged to go to him, and inquire into his diſtemper.

“ They embalmed their dead with honey; and their mourning was like that of the Egyptians

“ There were three Babylonian tribes, who lived only upon fiſh, and who prepared them in the following manner: they dried them in the ſun, and then beat them in a mortar to a kind of flour, which after they had ſifted through linen, they baked it in rolls.

“ The Babylonians at firſt worſhipped only the ſun, and the moon; but they ſoon multiplied their divinities. They deified Baal, Bel, or Belus, one of their kings, and Merodach-Baladan. They alſo worſhipped Venus, under the name of *Mylitta*. She and Belus were the principal deities of the Babylonians. They counted their day from ſun-riſe to ſun-riſe. They ſolemnized five days of the year with great magnificence, and almoſt the ſame ceremonies with which the Romans celebrated their Saturnalia.

“ The Babylonians were very much addicted to judicial aſtrology. Their prieſts, who openly profeſſed that art, were obliged to commit to writing all the events of the lives of their illuſtrious men; and on a fancied connection between thoſe events and the motions of the heavenly bodies, the principles of their art were founded. They pretended that ſome of their books, in which their hiſtorical tranſactions and revolutions were accurately compared with the courſes of the ſtars, were thouſands of years old. This aſſertion of their judicial aſtrologers we may reaſonably diſpute; but that their aſtronomers had made a long ſeries of obſervations, is inconteſtably true. It is certain that ſome of thoſe obſervations were extant in the days of Ariſtotle, and that they were older than the empire of the Babylonians. See *Hiſtory of* ASTRONOMY. ”

BABYLONIAN, BABYLONIUS, is uſed in ſome ancient writers, for an aſtrologer, or any thing related to aſtrology. Hence *Babylonia cura*, the art of caſting nativities; and *numeri Babylonii*, the computation of aſtrologers.

BABYLONICA TEXTA, a rich ſort of weavings, or hangings, denominated from the city of Babylon, where the practice of interweaving divers colours in their hangings firſt obtained. Hence alſo Babylonic garments, Babylonic ſkins, Babylonic carpets, houſings, &c. *Babylonica ſolana*, coverings laid over couches, &c. painted with gold, purple, and other colours.

BABYLONICS, BABYLONICA, in ancient hiſtory, a fragment of the hiſtory of the world, ending at 267 years before Chriſt; and compoſed by Beroſus, or Beroſſus, a prieſt of Babylon, about the time of Alexander. Babylonics are ſometimes alſo cited in ancient writers by the title of *Chaldaics*. The Babylonics were very conſonant with ſcripture, as Joſephus and the ancient Chriſtian chronologers aſſure; whence the author is uſually ſuppoſed to have conſulted the Jewiſh writers. Beroſus ſpeaks of an univerſal deluge, an ark, &c. He reckons ten generations beween the firſt man and the deluge; and marks the duration of the ſeveral generations by *ſaroi*, or periods of 223 lunar months; which, reduced to years, differ not much from the chronology of Moſes.—The babylonics conſiſted of three books, including the hiſtory of the ancient Babylonians, Medes, &c. But only a few imperfect extracts are now remaining of the work; preſerved chiefly by Joſephus and Syncellus, where all the paſſages of citations of ancient authors out of Beroſus are collected with great exactneſs, Annius of Viterbo, to ſupply the loſs, forged a complete Beroſus out of his own head. The world has not thanked him for the impoſture.

BABYROUSSA, in zoology, a ſynomine of a ſpecies of ſus. See SUS.

BAC, in navigation, is uſed for a praam, or ferryboat.

BAC, in brewing, a large flat kind of tub, or veſſel, wherein the wort is put to ſtand and cool before boiling. The ingredients of beer paſs through three kinds of veſſels. They are maſked in one, worked in another, and cooled in a third, called *bacs* or *coolers*.

BAC, in diſtillery, veſſels into which the liquor to be fermented is pumped from the cooler, in order to be worked with the yeſt.

Bac-Maker, is one who makes liquor-bacs, underbacs, coolers, maſh-tons, working-tons, &c. for the brewers. The workmanſhip is partly carpentry, in a particular manner, for it muſt be tight enough to hold liquor; and partly cooperage, *viz.* the maſh-tun, or vat, which is hooped. There are not many of this trade; and it requires chiefly ſtrength, with a little art. A ſmall ſtock of ſtuff, beſides tools, will ſet a man up tolerably well; but, with 200l. or 300l. he will make a good figure in buſineſs.

BACA, or BAZA, a town of Spain, in the kingdom of Granada. W. Long. 3. 6. N. Lat. 37. 18. It is ſituated in a valley called *Hoya de Baza*. It is encompaſſed with old walls, and has a caſtle half ruined. It contains about 4000 houſes, but has nothing remarkable except the church dedicated to the Virgin Mary. The land about it is well cultivated for half a league round, and is fertile in wheat, wine, honey, hemp, and flax, being watered by the little river Guadalantin.

BACACUM, a town of the Nervii in Gallia Belgica; now *Bavay*, in Hainault. E. Long. 3. 30. N. Lat. 50. 25.

BACAIM, a handſome ſea-port town of the kingdom of Viſapour on the Malabar coaſt in Aſia. It is ſubject to the Portugueſe; and ſtands in E. Long. 73. 10. N. Lat. 19. 0.

BACASERAY, a town in the peninſula of Crim Tartary, and, as the khan uſually takes up his reſidence there, it may be conſidered as the capital of the country. E. Long. 35. 10. N. Lat. 45. 30.

BACCA, BERRY, in botany, is uſed to ſignify ſuch fruits as conſiſt of a pericarpium full of juice and ſeeds, without any valves.

BACANTIBI, in eccleſiaſtical antiquity, wandering clerks, who ſtrolled from church to church.—— The word ſeems formed by corruption from *vacantivi.*

BACCALARIA, in middle age writers, denotes a kind of country-farms, conſiſting of ſeveral manſes.

Bacalaria dominicaria, or *indominicata*, was more particularly uſed for a farm belonging to the lord, and kept in his own hands.

BACCARACH, a town of Germany in the lower Palatinate; formerly imperial and free, but now ſubject to the elector Palatine. It is famous for excellent wine; and is ſituated on the Rhine, in E. Long. 7. 5. N. Lat. 49. 57.

BACCHÆ, in antiquity, the prieſteſſes of Bacchus, who celebrated the *orgia*, or myſteries of that god.— The word was alſo uſed for the ivy crowns or garlands worn by the prieſts of Bacchus, in offering ſacrifices to him.

BACCHANALIA, feaſts celebrated in honour of Bacchus by the ancients. The two moſt remarkable were called the *greater* and *leſſer*. The latter, called *lenæa*, from a word ſignifying a *wine-preſs*, were held in the open fields about autumn; the greater, called *Dionyſia*, from one of the names of Bacchus, were celebrated in the city, about the ſpring-time. Both theſe feaſts were accompanied with games, ſpectacles, and theatrical repreſentations, and it was at this time the poets contended for the prize of poetry. Thoſe who were initiated into the celebration of theſe feaſts, repreſented ſome Silenius; others, Pan; others, Satyrs; and in this manner appeared in public, night and day, counterfeiting drunkenneſs, dancing obſcenely, and committing all kinds of licentiouſneſs and debauchery. See the article BACCHUS.

BACCHARIS, PLOUGHMAN'S SPIKENARD: A genus of the polygamia ſuperflua order, belonging to the ſyngeneſia claſs of plants; and in the natural method ranking under the 49th order, *Compoſitæ diſcoides.* The characters are: It has a naked receptacle, and hairy papus; with a cylindrical imbricated calyx, and feminine florets mixed with the hermaphrodite ones. There are ſeven ſpecies, all natives of warm climates; but none of them merit notice except the two following. 1. The ivæfolia, or African tree-groundſel, is a native of the Cape of Good Hope, as alſo of Peru and other warm parts of America. It grows to the height of five or ſix feet; and though there is little beauty in the flower, has been long admitted into the gardens of the curious. It is pretty hardy, and will live abroad in moderate winters in England, but is uſually kept in green-houſes and placed abroad only in ſummer. It may be propagated either by cuttings or ſeeds, which ripen well in this country. 2. The Halimifolia, or Virginia groundſel-tree, is a native of Virginia and other parts of North-America. It grows about ſeven or eight feet high, with a crooked ſhrubby ſtem; and flowers in October: the flowers are white, and not very beautiful; but the leaves continuing green, has occaſioned this ſhrub to be admitted into many curious gardens. It may be propagated by cuttings; and will live very well in the open air, though ſevere froſts will ſometimes deſtroy it.

BACCHI, in mechanics, a kind of ancient machines, in form of goats, uſed by Jupiter, in his wars againſt the giants. Rudbeck deſcribes two kinds of bacchi, one made like the battering-ram, wherewith Jupiter demoliſhed the enemy's fortifications; the other contrived to caſt fire out of, from whence the Greeks are conjectured to have framed their idea of chimera.

BACCHIC, ſomething relating to the ceremonies of Bacchus. The celebrated *intaglio*, called Michael Angelo's ring, is a repreſentation of a bacchic feaſt.

Bacchic ſong, is ſometimes uſed for a *chanſon à boire*, or compoſition to inſpire jollity. But in a more proper ſenſe, it is reſtrained to a dithyrambic ode or hymn.

BACCHINI (Benedict), a Benedictine monk, and one of the moſt learned men in his time, was born at Borgo San Domino in 1651; and wrote a great number of books in Latin and Italian, the moſt conſiderable of which is a Literary Journal. He died at Bologna in 1721, aged 70.

BACCHIUS, a follower of Ariſtoxenus, ſuppoſed by Fabricius to have been tutor to the emperor Marcus Antoninus, and conſequently to have lived about A. C. 140. He wrote in Greek a very ſhort introduction to muſic in dialogue, which, with a Latin tranſlation thereof, Meibomius has publiſhed. It ſeems it was firſt publiſhed in the original by Merſennus, in his Commentary on the firſt ſix chapters of Geneſis; and that afterwards he publiſhed a tranſlation of it in French, which Meibomius, in the preface to his edition of the ancient muſical authors, cenſures as being groſsly erroneous.

BACCHIUS, in ancient poetry, a kind of foot compoſed of a ſhort ſyllable, and two long ones; as the word [ăvārī]. It takes its name from the god Bacchus, becauſe it frequently entered into the hymns compoſed in his honour. The Romans called it likewiſe *ænotrius*, *tripodius*, *ſaltans.*

BACCHUS, in Heathen mythology, the god of wine, with whoſe fabulous adventures every ſchool-boy is acquainted. This perſonage is ſeldom named in modern times, but as a ſenſual encourager of feaſt and jollity; but he was regarded in a more reſpectable light by the ancients, who worſhipped him in different countries under the following appellations: In Egypt, he was called *Oſiris*; in Myſia, *Fanaces*; in India, *Dionyſius*; *Liber*, throughout the Roman dominions; *Adoneus*, in Arabia; and *Pentheus*, by the Lucanians. Mythologiſts furniſh reaſons for all theſe different names given to the ſame god, which may be ſeen in the ſecond volume of Banier's Mythology.

It is natural to ſuppoſe that the Greeks and Romans, as uſual, beſtowed upon the one Bacchus which they worſhipped, the ſeveral actions and attributes of the many divinities known by that name, and by other equivalent denominations in different countries. However, antiquity chiefly diſtinguiſhed two gods under the title of *Bacchus:* that of Egypt, the ſon of Ammon, and the ſame as Oſiris; and that of Thebes in Bœotia, the ſon of Jupiter and Semele.

The Egyptian Bacchus was brought up at Nyſa, a city of Arabia Felix, whence he acquired the name of *Dionyſius*, or the God of Nyſa; and this was the conqueror of India. Though this Bacchus of the Egyptians was one of the elder gods of Egypt, yet the ſon of Semele was the youngeſt of the Grecian deities. Diodorus Siculus tells us, that Orpheus firſt deified the ſon of Semele by the name of Bacchus, and appointed his ceremonies in Greece, in order to render the family of Cadmus, the grandfather of the Grecian Bacchus, illuſtrious.

The great Bacchus, according to Sir Iſaac Newton, flouriſhed but one generation before the Argonautic expedition. This Bacchus, ſays Hermippus, was potent at ſea, conquered eaſtward as far as India, returned in triumph, brought his army over the Helleſpont, conquered Thrace, and left muſic, dancing, and poetry there. And, according to Diodorus Siculus, it was the ſon of Semele who invented farces and theatres, and who firſt eſtabliſhed a muſic-ſchool, exempting from all military functions ſuch muſicians as diſcovered great abilities in their art; on which account, ſays the ſame author, muſicians formed into companies have ſince frequently enjoyed great privileges.

Dr Burney * obſerves, that the dithyrambics which gave birth to dramatic repreſentations, are as ancient as the worſhip of Bacchus in Greece; and there is little doubt but that the ceremonies of his myſteries gave riſe to the pomp and illuſions of the theatre. Many of the moſt ſplendid exhibitions upon the ſtage for the entertainment of the people of Athens and Rome, being performed upon the feſtivals of Bacchus, gave occaſion to the calling all thoſe that were employed in them, whether for ſinging, dancing, or reciting, *ſervants of Bacchus.*

Pauſanias, in his Attics, ſpeaks of a place at Athens conſecrated to *Bacchus the ſinger;* thus named, he ſays, for the ſame reaſon as Apollo is called the *chief* and *conductor* of the muſes. Whence it ſhould ſeem that Bacchus was regarded by the Athenians not only as the god of wine, but of ſong; and it muſt be owned, that his followers, in their cups, have been much inclined to ſinging ever ſince. Indeed we are certain, that in none of the orgies, proceſſions, triumphs, and feſtivals, inſtituted by the ancients to the honour and memory of this prince of *bons vivans*, muſic was forgotten, as may be ſtill gathered from ancient ſculpture, where we find not only that muſicians, male and female, regaled him with the lyre, the flute, and with ſong; but that he was accompanied by fawns and ſatyrs playing upon timbrels, cymbals, bagpipes, and horns: theſe Suidas calls his minſtrels; and Strabo gives them the appellations of *Bacchi, Sileni, Satyri, Bacchæ, Lenæ, Thyæ, Mamillones, Naiades, Nymphæ*, and *Tityri.* Theſe repreſentations have furniſhed ſubjects for the fineſt remains of ancient ſculpture; and the moſt voluptuous paſſages of ancient poetry are deſcriptions of the orgies and feſtivals of Bacchus. See ORGIA.

BACCHYLIDES, a famous Greek poet, was the nephew of Simonides, and the cotemporary and rival of Pindar. Both ſung the victories of Hiero at the public games. Beſides odes to athletic victors, he was author of Love Verſes; Proſodies; Dithyrambics; Hymns; Pæans; Hyporchemes; Parthenia, or ſongs to be ſung by a chorus of virgins at feſtivals. The chronology of Euſebius places the birth of Bacchylides in the 82d Olympiad, about 450 B. C.

BACCIO, or BACCIUS, (Andrew), a celebrated phyſician of the 16th century, born at St Elpideo. He practiſed phyſic at Rome with great reputation, and was firſt phyſician to pope Sixtus V. The moſt ſcarce and valuable of his works are, 1. *De thermis.* 2. *De naturali vinorum hiſtoria.* 3. *De venenis et antidotis.* 4. *De gemmis ac lapidibus pretioſis.*

BACCIO (Fra. Bartolomeo), called *Bartolemi di S. Marco*, a celebrated painter of hiſtory and portrait, was born at Savignano near Florence in 1469, and was a diſciple of Coſumo Roſelli; but his principal knowledge in the art of painting was derived from Leonardo da Vinci. He underſtood the true principles of deſign better than moſt maſters of his time, and was alſo a conſiderable painter in perſpective; which induced Raphael to have recourſe to him after he had quitted the ſchool of Perugino; and under his direction likewiſe Raphael ſtudied the art of managing and uniting colours, as well as the rules of perſpective. Some years after the departure of Raphael from Florence, Baccio viſited Rome; and by the obſervations he made on the antiques, and the works of Raphael which were then the admiration of the whole world, he was extremely improved, and manifeſted his acquired abilities by a picture of S. Sebaſtian, which he finiſhed at his return to Florence. It was ſo well deſigned, ſo naturally and beautifully coloured, and had ſo ſtrong an expeſſion of pain and agony, that it was removed from the place where it was publicly ſeen (in the chapel of a convent), as it had been obſerved to have made too ſtrong an impreſſion on the imaginations of many women who beheld it. He was very laborious, and made nature his perpetual ſtudy; he deſigned the naked correctly; his figures had a great deal of grace, and his colouring was admirable. He is accounted to have been the firſt inventor of that machine called a *layman* by the artiſts, and which to this day is in general uſe. Upon that he placed his draperies, to obſerve with greater exactneſs their natural and their more elegant folds. A capital picture of the aſcenſion by Baccio, is in the Florentine collection. He died in 1517.

BACHELOR, or BATCHELOR, a common term for a man not married, or who is yet in a ſtate of celibacy.—The Roman cenſors frequently impoſed fines on old bachelors. Dion Halicarnaſſeus mentions an old conſtitution, by which all perſons of full age were obliged to marry. But the moſt celebrated law of this kind was that made under Auguſtus, called the *lex Julia de maritandis ordinibus*; by which bachelors were made incapable of legacies or inheritances by will, unleſs from their near relations. This brought many to marry, according to Plutarch's obſervation, not ſo

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* *Hiſtory of Muſic.* p. 298. *et ſeq.*

much for the ſake of raiſing heirs to their own eſtates, as to make themſelves capable of inheriting thoſe of other men.—The rabbins maintain, that, by the laws of Moſes, every body, except ſome few particulars, is obliged in conſcience to marry at 20 years of age: this makes one of their 613 precepts. Hence thoſe maxims ſo frequent among their caſuiſts, that he who does not take the neceſſary meaſures to leave heirs behind him, is not a man, but ought to be reputed a homicide.—Lycurgus was not more favourable: by his laws, bachelors are branded with infamy, excluded from all offices civil and military, and even from the ſhows and public ſports. At certain feaſts they were forced to appear, to be expoſed to the public deriſion, and led round the market-place. At one of their feaſts, the women led them in this condition to the altars, where they obliged them to make *amende honourable* to nature, accompanied with a number of blows and laſhes with a rod at diſcretion. To complete the affront, they forced them to ſing certain ſongs compoſed in their own deriſion.—The Chriſtian religion is more indulgent to the bachelor ſtate: the ancient church recommended it as in ſome circumſtances preferable to, and more perfect than, the matrimonial. In the canon law, we find injunctions on bachelors, when arrived at puberty, either to marry or to turn monks and profeſs chaſtity in earneſt.—In England, there was a tax on bachelors, after 25 years of age, 12 l. 10s. for a duke, a common perſon 1 s. by 7 Wil. III. 1695. In Britain, at preſent, they are taxed by an extra-duty on their ſervants. Every man of the age of 21 years and upwards, never having been married, who ſhall keep one male ſervant or more, ſhall pay 1 l. 5 s. for each above or in addition to the ordinary duties leviable for SERVANTS. Every man of the age of 21 years and upwards, never having been married, keeping one female ſervant, ſhall pay 2 s. 6 d. in addition to the former 2 s. 6 d.; 5 s. in addition for each, if he has two female ſervants; and 10s. in addition for each for three or more female ſervants.

BACHELOR, was anciently a denomination given to thoſe who had attained to knighthood, but had not a number of vaſſals ſufficient to have their banner carried before them in the field of battle; or if they were not of the order of Bannerets, were not of age to diſplay their own banner, but obliged to march to battle under another's banner. It was alſo a title given to young cavaliers, who, having made their firſt campaign, received the military girdle accordingly. And it ſerved to denominate him who had overcome another in a tournament, the firſt time he ever engaged.—The word *bachelor*, in a military ſenſe, is derived by Cujas from *buccellarius*, a kind of cavalry, anciently in great eſteem. Du Cange deduces it from *baccalaria*, a kind of fees or farms, conſiſting of ſeveral pieces of ground, each whereof contained 12 acres or as much as two oxen would plough; the poſſeſſors of which baccalaria were called *bachelors*. Caſeneuve and Altaſerra derive bachelor from *baculus* or *bacillus*, "a ſtaff," becauſe the young cavaliers exerciſed themſelves in fighting with ſtaves. Martinius derives it from *baccalaureus*, i. e. *bacca laurea donatus*, in alluſion to the ancient cuſtom of crowning poets with laurel, *baccis lauri*, as was the caſe with Petrarch at Rome in 1341. Alciat and Vives are of the ſame opinion: nor is this etymology improbable.

Knights-BACHELORS, the moſt ancient, but the loweſt order of knights in England; known by the name of *knights* only. They are ſtyled *knights bachelors*, either (according to ſome) as denoting their degree, *quaſi bas chevaliers*; or, according to others, becauſe this title does not deſcend to their poſterity.

The cuſtom of the ancient Germans was to give their young men a ſhield and a lance in the great council: this was equivalent to the *toga virilis* of the Romans. Before this, they were not permitted to bear arms, but were accounted as part of the father's houſehold; after it, as part of the public. Hence ſome derive the uſage of knighting, which has prevailed all over the weſtern world, ſince its reduction by colonies, from thoſe northern heroes. Knights are called in Latin *equites aurati*: *aurati*, from the gilt ſpurs they wore; and *equites*, becauſe they always ſerved on horſeback: for it is obſervable, that almoſt all nations call their knights by ſome appellation derived from an horſe. They are alſo called in our law *milites*, becauſe they formed a part, or indeed the whole, of the royal army, in virtue of their feodal tenures; one condition of which was, that every one who held a knight's fee (which in Henry II.'s time amounted to 20 l. *per annum*) was obliged to be knighted, and attend the king in his wars, or pay a fine for his non-compliance. The exertion of this prerogative, as an expedient to raiſe money in the reign of Charles I. gave great offence, though warranted by law and the recent example of Queen Elizabeth. At the Reſtoration, it was, together with all other military branches of the feodal law, aboliſhed: and it now only exiſts as an honorary title; though, on account of its indiſcriminate attainment, not very generally regarded. It is conferred indiſcriminately upon gownſmen, burghers, and phyſicians, by the king's lightly touching the perſon, who is then kneeling, on the right ſhoulder with a drawn ſword, and ſaying, *Riſe, Sir*. See the articles KNIGHT and NOBILITY.

BACHELORS, in an univerſity ſenſe, are perſons that have attained to the baccalaureate, or who have taken the firſt degree in the liberal arts and ſciences.

The degree of bachelor was firſt introduced in the 13th century by Pope Gregory IX. but it remains ſtill unknown in Italy. At Oxford, before a perſon is intitled to the degree of *bachelor of arts*, he muſt have ſtudied there four years; three years more to become maſter of arts; and ſeven more to commence bachelor of divinity.—At Cambridge, to commence bachelor of arts, he muſt have been admitted near four years; and above three years more before he commences maſter; and ſeven more ſtill to become bachelor of divinity. He may commence bachelor of law after having ſtudied it ſix years.—At Paris, to paſs bachelor in theology, a perſon muſt have ſtudied two years in philoſophy and three years in theology, and held two acts of examination in the Sorbonne.—Bachelors in the canon law are admitted after two years ſtudy in the ſame, and ſuſtaining an act according to the forms. A bachelor of phyſic muſt have ſtudied two years in medicine after having been four years maſter of arts in the univerſity, and have ſtood an examination; after which he is inveſted with the fur, in order to be licenſed.—In the univerſity of Paris, before the foundation of divinity-profeſſorſhips, thoſe who had ſtudied divinity ſix years were admitted to go through their courſe, whence they were called *baccalarii curſores;* and as there were two courſes, the firſt employed in explaining the Bible during three ſucceſſive years, the ſecond for explaining the maſter of the ſentences for one year, thoſe who were in the Bible-courſe were called *baccalarii Biblici,* and thoſe arrived at the ſentences *baccalarii ſententiarii.* And, laſtly, thoſe who had gone through both were denominated *baccalarii formati,* or *formed bachelors.*

At preſent, *formed bachelor* denotes a perſon who has taken the degree regularly after the due courſe of ſtudy and exerciſes required by the ſtatutes; by way of oppoſition to a *current bachelor,* who is admitted in the way of grace, or by diploma.

We alſo find mention of bachelors of the church, *baccalarii eccleſiæ.* The biſhop with his canons and *baccalarii, cum conſilio et conſenſu omnium canonicorum ſuorum et baccalariorum.*

BACHELORS, in the Livery companies of London, are thoſe not yet admitted to the livery. Theſe companies generally conſiſt of a maſter, two wardens, the livery, and the bachelors, who are yet but in expectation of dignity in the company, and have their function only in attendance on the maſter and wardens. They are alſo called *yeomen.*

BACHELOR is alſo a name given in the ſix companies of merchants at Paris to the elders, and ſuch as having ſerved the offices, have a right to be called by the maſters and wardens to be preſent with them, and aſſiſt them in ſome of the functions, particularly in what relates to the *chef-d'oeuvres* or maſter-pieces, of ſuch as are candidates for being admitted maſters.

BACHERAC, a town of the Palatine of the Rhine, ſituated on the weſtern ſhore of that river, in E. Long. 7°. and N. Lat. 58°. It is remarkable for excellent wine, from thence called *Bacherac.*

BACHIAN, one of the Molucca iſlands, belonging to the Dutch; ſituated under the Equator, in E. Long. 125°.

BACHU, a city of Shirvan in Perſia, and the beſt haven in the Caſpian ſea. It is defended by a double wall, as alſo by a ditch and redoubts, made by the Ruſſians when they were maſters of the place. It had a ſumptuous caſtle, but it is reduced to a ruinous ſtate by the Ruſſians. Formerly many merchants reſided here, and carried on a conſiderable traffic in raw ſilk; but that commerce is now given up. All the country round is much impregnated with ſulphur, which renders the water very unpleaſant. The neighbourhood of this city ſupplies the countries adjacent with naphtha, brimſtone, and rock-ſalt; and is the only place thereabouts which produces ſaffron. Round Bachu are ſeveral very ſteep craggy mountains, on which are ſtrong watch towers. E. Long. 49. 5. N. Lat. 40. 0

BACK, *Back-Bone,* or SPINE. See Anatomy, n° 30.

BACK, in the menage, and among farriers. A horſe's back ſhould be ſtraight, not hollow, which is called *ſaddle-backed:* horſes of this kind are generally light, and carry their heads high, but want in ſtrength and ſervice. A horſe with a weak back is apt to ſtumble. In the French riding-ſchools, to mount a horſe *a dos,* is to mount him bare-backed, without a ſaddle.

BACK-Gammon, an ingenious game played with dice, upon a table, by two perſons.

Manner of playing the game. The table is divided into two parts, upon which there are 24 black and white ſpaces, called points. Each adverſary has 15 men, black and white, to diſtinguiſh them; and they are diſpoſed of in the following manner: Suppoſing the game to be played into the right-hand table, two are placed upon the ace point in the adverſary's table, five upon the ſix point in the oppoſite table, three upon the cinque point in the hithermoſt table, and five on the ſix point in the right-hand table. The grand object in this game is for each player to bring the men round into his right-hand table, by throwing with a pair of dice thoſe throws that contribute towards it, and at the ſame time prevent the adverſary doing the like. The firſt beſt throw upon the dice is eſteemed aces, becauſe it ſtops the ſix point in the outer table, and ſecures the cinque in the thrower's table; whereby the adverſary's two men upon the thrower's ace point cannot get out with either quatre, cinque, or ſix. This throw is an advantage often given to the antagoniſt by the ſuperior player.

When he carries his men home in order to loſe no point, he is to carry the moſt diſtant man to his adverſary's bar point, that being the firſt ſtage he is to place it on; the next ſtage is ſix points farther, viz. in the place where the adverſary's five men are firſt placed out of his tables. He muſt go on in this method till all his men are brought home, except two, when by loſing a point, he may often ſave the gammon, by throwing two fours or two fives.

When a hit is only played for, he ſhould endeavour to gain either his own or adverſary's cinque point; and if that fails by his being hit by the adverſary, and he finds him forwarder than himſelf, in that caſe he muſt throw more men into the adverſary's tables; which is done in this manner: He muſt put a man upon his cinque or bar point; and if the adverſary neglects to hit it, he may then gain a forward game inſtead of a back game: but if the adverſary hits him, he ſhould play for a back game; and then the greater number of men which are taken up makes his game the better, becauſe by theſe means he will preſerve his game at home: and then he ſhould endeavour to gain both his adverſary's ace and the trois points, or his ace and deuce points, and take care to keep three men upon the adverſary's ace point, that in caſe he hits him from thence, that point may remain ſtill ſecure to himſelf.

A back game ſhould not be played for at the beginning of a ſet, becauſe it would be a great diſadvantage, the player running the riſk of a gammon to win a ſingle hit.

Rules for playing at ſetting out all the throws on the dice, when the player is to play for a gammon or for a ſingle hit (A). 1. Two aces are to be played on the cinque point and bar point, for a gammon or for a hit. 2. Two ſixes, to be played on the adverſary's bar

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(A) The rules marked thus are for a gammon only; thoſe marked thus * are for a hit only.

bar point and on the thrower's bar point, for a gammon or for a bit. 3. † Two trois, to be played on the cinque point, and the other two on the trois point in his own tables, for a gammon only. 4. † Two deuces, to be played on the quatre point in his own tables, and two to be brought over from the five men placed in the adverſary's tables for a gammon only. 5. † Two fours, to be brought over from the five men place in the adverſary's tables, and to be put upon the cinque point in his own tables for a gammon only. 6. Two fives, to be brought over from the five men placed in the adverſary's tables, and to be put on the trois point in his own tables, for a gammon or for a hit. 7. Size ace, he muſt take his bar point for a gammon or for a hit. 8. Size deuce, a man to be brought from the five men placed in the adverſary's tables, and to be placed in the cinque point in his own tables, for a gammon or for a hit. 9. Six and three, a man to be brought from the adverſary's ace point, as far as he will go, for a gammon or for a hit. 10. Six and four, a man to be brought from the adverſary's ace point, as far as he will go, for a gammon or for a hit. 11. Six and five, a man to be carried from the adverſary's ace point, as far as he can go, for a gammon or for a hit. 12. Cinque and quatre, a man to be carried from the adverſary's ace point, as far as he can go, for a gammon or for a hit. 13. Cinque trois to make the trois point in his table, for a gammon or for a hit. 14. Cinque deuce, to play two men from the five placed in the adverſary's tables, for a gammon or for a hit. 15. † Cinque ace, to bring one man from the five placed in the adverſary's tables for the cinque, and to play one man down on the cinque point in his own tables for the ace, for a gammon only. 16. Quatre trois, two men to be brought from the five place in the adverſary's tables, for a gammon or for a hit. 17. Quatre deuce, to make the quatre point in his own tables, for a gammon or for a hit. 18. † Quatre ace, to play a man from the five placed in the adverſary's tables for the quatre; and for the ace, to play a man down upon the cinque point in his own tables, for a gammon only. 19. † Trois deuce, two men to be brought from the five placed in the adverſary's tables, for a gammon only. 20. Trois ace, to make the cinque point in his own tables, for a gammon or for a hit. 21. † Deuce ace, to play one man from the five men placed in the adverſary's table for the deuce; and for the ace to play a man down upon the cinque point in his own tables, for a gammon only. 22. * Two trois, two of them to be played on the cinque point in his own tables, and with the other two he is to take the quatre point in the adverſary's tables. 23. * Two deuces, two of them are to be played on the quatre point in his own tables, and with the other two he is to take the trois point in the adverſary's tables. By playing theſe two caſes in this manner, the player avoids being ſhut up in the adverſary's tables, and has the chance of throwing out the tables to win the hit.

24. * Two fours, two of them are to take the adverſary's cinque point in the adverſary's tables, and for the other two, two men are to be brought from the five placed in the adverſary's tables. 25. * Cinque ace, the cinque ſhould be played from the five men placed in the adverſary's tables, and the ace from the adverſary's ace point. 26. * Quatre ace, the quatre to be played from the five men placed in the adverſary's ace point. 27. * Deuce ace, the deuce to be played from the five men placed in the adverſary's tables, and the ace from the adverſary's ace point.

The three laſt chances are played in this manner; becauſe an ace laid down in the adverſary's tables, there is a probability of throwing deuce ace, trois deuce, quatre trois, or ſize cinque, in two or three throws; either of which throws ſecures a point, and gives the player the beſt of the hit.

Cautions, &c. The player muſt underſtand by the directions given to play for a gammon, that he is to make ſome blots on purpoſe, the odds being in his favour that they are not hit; but if it ſhould happen that any blot is hit, as in this caſe there will be three men in the adverſary's tables, he muſt then endeavour to ſecure the adverſary's cinque, quatre, or trois point, to prevent a gammon, and muſt be very cautious of his fourth man's not being taken up.

He muſt not crowd his game at any time if he can help it; that is to ſay, he ſhould not put many men either upon the trois or deuce points in his own tables, being the ſame as loſing thoſe men not having them in play. Beſides, by crowding the game, and attempting to ſave a gammon, the player is often gammoned. His game being crowded in his own tables, the adverſary has room to play as he thinks proper.

The following calculations will ſhow the odds of entering a ſingle man upon any certain number of points; and accordingly the game ſhould be played.

It is neceſſary to know that there are thirty-ſix chances upon two dice, and the points that are upon theſe thirty-ſix chances are as follow.

Viz.	Points.
2 Aces - -	4
2 Deuces - -	8
2 Trois - -	12
2 Fours - -	16
2 Fives - -	20
2 Sixes - -	24
6 And 5 twice -	22
6 And 4 twice -	20
6 And 3 twice -	18
6 And 2 twice -	16
6 And 1 twice -	14
5 And 4 twice -	18
5 And 3 twice -	16
5 And 2 twice -	14
5 And 1 twice -	12
4 And 3 twice -	14
4 And 2 twice -	12
4 And 1 twice -	10
3 And 2 twice -	10
3 And 1 twice -	8
2 And 1 twice -	6

Divide by 36)294(8
288
———
6

and it proves, that upon an average the player has a right to 8 points each throw.

The

Back-gammon.

The chances upon two dice calculated for back-gammon are as follow.

	2 Sixes	1
	2 Fives	1
	2 Fours	1
	2 Trois	1
	2 Deuces	1
†	2 Aces	1
	6 And 5 twice	2
	6 And 4 twice	2
	6 And 3 twice	2
	6 And 2 twice	2
†	6 And 1 twice	2
	5 And 4 twice	2
	5 And 3 twice	2
	5 And 2 twice	2
†	5 And 1 twice	2
	4 And 3 twice	2
	4 And 2 twice	2
†	4 And 1 twice	2
	3 And 2 twice	2
†	3 And 1 twice	2
†	2 And 1 twice	2
		36

As it may ſeem difficult to find out by this table of thirty-ſix chances what are the odds of being hit upon a certain or flat die, let the following method be purſued.

The player may obſerve in the table that what are thus † marked are,

† 2 Aces	1
† 6 And 1 twice	2
† 5 And 1 twice	2
† 4 And 1 twice	2
† 3 And 1 twice	2
† 2 And 1 twice	2
Total	11
Which deducted from	36
There remain	25

So that it appears it is twenty-five to eleven againſt hitting an ace upon a certain or flat die.

The above method holds good with reſpect to any other flat die. For example, what are the odds of entering a man upon 1, 2, 3, 4, or 5 points?

Anſwer.

To enter it upon	for	againſt		for	ag.
1 point is	11	to 25	Or about	4	to 9
2 points	20	16		5	4
3	27	9		3	1
4	32	4		8	1
5	35	1		35	1

The following table ſhows the odds of hitting with any chance, in the reach of a ſingle die.

To hit upon	for	againſt		for	ag.
1 is	11	to 25	Or about	4	to 9
2	12	24		1	2
3	14	22		2	3
4	15	21		5	7
5	15	21		5	7
6	17	19		$8\frac{1}{2}$	$9\frac{1}{2}$

The odds of hitting with double dice are as follow.

Back-gammon.

To hit upon	for	againſt		for	ag.
7 is	6	to 30	Or about	1	to 5
8	6	30		1	5
9	5	31		1	6
10	3	33		1	11
11	2	34		1	17
12	1	36		1	35

How to find out the odds of being hit upon a ſix, by the tables of thirty-ſix chances.

2 Sixes	1
2 Trois	1
2 Deuces	1
6 And 5 twice	2
6 And 4 twice	2
6 And 3 twice	2
6 And 2 twice	2
6 And 1 twice	2
5 And 1 twice	2
4 And 2 twice	2
	17
Which deducted from	36
There remains	19

By which it appears to be 19 to 17 againſt being hit upon a ſix.

The odds on the hits.

2 Love is about	5	to 2
2 to 1 is	2	1
1 Love is	3	2

Directions for the player to bear his men. If a player has taken up two of the adverſary's men, and happens to have two, three, or more points made in his own tables, he ſhould ſpread his men, that he either may take a new point in his tables, or be ready to hit the man which the adverſary may happen to enter. If he finds upon the adverſary's entering, that the game is upon a par, or that the advantage is on his own ſide, he ſhould take the adverſary's man up whenever he can, it being 25 to 11 that he is not hit: except when he is playing for a ſingle hit only; then, if playing the throw otherwiſe gives him a better chance for it, he ought to do it.

It being five to one againſt his being hit with double dice, he ſhould never be deterred from taking up any one man of the adverſary's.

If he has taken up one of the adverſary's men, and ſhould happen to have five points in his own tables, and forced to leave a blot out of his tables, he ſhould endeavour to leave it upon doublets preferable to any other chance, becauſe in that caſe the odds are 35 to one that he is not hit; whereas it is only 17 to one but he is hit upon any other chance.

When the adverſary is very forward, a player ſhould never move a man from his own quatre, trois, or deuce points, thinking to bear that man from the point where he put it, as nothing but high doublets can give him any chance for the hit. Inſtead of playing an ace or a deuce from any of thoſe points, he ſhould play them from his own ſize or higheſt points, ſo that throwing two fives, or two fours, his ſize and cinque points being eaſed, would be a conſiderable advantage to him; whereas

Back-gammon.

whereas had they been loaded, he muſt have been obliged to play otherwiſe.

It is the intereſt of the adverſary to take up the player as ſoon as he enters. The blot ſhould be left upon the adverſary's loweſt point; that is to ſay, upon his deuce point, rather than upon his trois point; or upon his trois point rather than his quatre point; or upon his quatre point preferable to his cinque point, for a reaſon before mentioned; all the men the adverſary plays upon his trois, or his deuce points, are deemed loſt, being greatly out of play; ſo that thoſe men not having it in their power to make his cinque point, and his game being crowded in one place and open in another, the adverſary muſt be greatly annoyed by the player.

If the player has two of the adverſary's men in his tables, he has a better chance for a hit than if he had more, provided his game is forwarder than that of his antagoniſt's; for if he had three or more of the adverſary's men in his tables, he would ſtand a worſe chance to be hit.

When a player is running to ſave the gammon, if he ſhould have two men upon his ace point, and ſeveral men abroad, although he ſhould loſe one point or two in putting his men into his tables, it is his intereſt to leave a man upon the adverſary's ace point, becauſe it will prevent his adverſary from bearing his men to the greateſt advantage, and at the ſame time the player will have a chance of his adverſary's making a blot, which he may chance to hit. However, if a player finds upon a throw, that he has a probability of ſaving his gammon, he ſhould never wait for a blot, as the odds are greatly againſt his hitting it, but ſhould embrace that opportunity.

How to calculate the odds of ſaving or winning the gammon. Suppoſe the adverſary has ſo many men abroad as require three throws to put them into his tables, and at the ſame time that the player's tables are made up, and that he has taken up one of the adverſary's men; in this caſe, it is about an equal wager that the adverſary is gammoned. For in all probability the player has bore two men before he opens his tables, and when he bears the third man, he will be obliged to open his ſize or cinque point. It is then probable, that the adverſary is obliged to throw twice before he enters his men in the player's tables, twice more before he puts that man into his own tables, and three throws more to put the men which are abroad into his own tables, in all ſeven throws. Now the player having 12 men to bear, he may be forced to make an ace or a deuce twice before he can bear all his men, and conſequently will require ſeven throws in bearing them; ſo that, upon the whole, it is about equal whether the adverſary is gammoned or not.

Suppoſe a player has three men upon his adverſary's ace point and five points in his own tables, and that the adverſary has all his men in his tables, three upon each of his five higheſt points, Has the player a probability of gammoning his adverſary or not?

	Points.
For bearing three men from his 6th point is	18
From his 5th point	15
	33
Carried forward	33
From his 4th point	12
From his 3d point	9
From his 2d point	6
In all	60
Bringing his three men from the adverſary's ace point to his ſize point in his own tables, being 18 points each, and making together.	54
There muſt remain	6

It is plain from this calculation, that the player has much the beſt of the probability of the gammon, excluſive of one or more blots which the adverſary is liable to make in bearing his men, ſuppoſing at the ſame time the throws to be upon an equality.

Suppoſe two blots are left, either of which cannot be hit but by double dice; one muſt be hit by throwing eight and the other by throwing nine; ſo that the adverſary has only one die to hit either of them. What are the odds of hitting either of them? The chances of two dice being in all 36

The chances to hit 8 are 6 and 2 twice	2
5 and 3 twice	2
2 Deuces	1
2 Fours	1
The chances to hit 9 are 6 and 3 twice	2
5 And 4 twice	2
2 Trois	1
For hitting, in all	11
Chances for not hitting, remain	25

So that the odds are 25 to 11 againſt hitting either of theſe blots.

This method may be taken to find out the odds of hitting three, four, or five blots upon double dice; or blots made upon double and ſingle dice at the ſame time. After knowing how many chances there are to hit any of thoſe blots, they muſt be added all together, and then ſubtract from the number 36, which are the chances of the two dice, and the queſtion is ſolved.

A critical caſe for a Back-game. Suppoſe the fore-game to be played by A, and that all his men are placed as uſual; B has fourteen of his men placed upon his adverſary's ace point, and one upon his adverſary's deuce point, and B is to throw. Who has the beſt of the hit?—*Anſwer:* A has the beſt of it, gold to ſilver: becauſe, if B does not throw an ace to take his adverſary's deuce point, which is 25 to 11 againſt him, A will take up B's men in his tables, either ſingly or to make points; and then if B ſecures either A's deuce or trois point, A will put as many men down as poſſible, in order to hit, and thereby get a back-game. It is evident that the back-game is very powerful; conſequently, whoever practiſes it muſt become a greater proficient at the game than he could by any other means.

Another critical caſe. Suppoſe A to have five men placed upon his ſize point, as many upon his quatre point, and the ſame number upon his deuce point, all in his own tables. At the ſame time, let us ſuppoſe B to have three men placed upon A's ace point, as many upon A's trois point, and the ſame number

upon

Back-gammon.

upon A's cinque point, in his own tables, and three men placed as uſual out of his tables. Who has the beſt of the hit?—*Anſwer:* The game is equal, till B has gained his cinque and quatre points in his own tables; which if he can effect, and by playing two men from A's cinque point, in order to force his adverſary to blot by throwing an ace, which ſhould B hit, he will have the beſt of the hit.

A caſe of curioſity and inſtruction; in which is ſhewn the probability of making the hit laſt by one of the players for many hours, although they ſhould both play as faſt as uſual.—Suppoſe B to have bore 13 men, and that A has his fifteen men in B's tables, *viz.* three men upon his ſize point, as many upon his cinque point, three upon his quatre point, the ſame number upon his trois point, two upon his deuce point, and one upon his ace point. A in this ſituation can prolong it, as aforeſaid, by bringing his 15 men home, always ſecuring ſix cloſe points till B has entered his two men, and brought them upon any certain point; as ſoon as B has gained that point, A will open an ace, deuce, or trois point, or all of them; which done B hits one of them, and A taking care to have two or three men in B's tables, is ready to hit that man; and alſo he being certain of taking up the other man, has it in his power to prolong the hit almoſt to any length, provided he takes care not to open ſuch points as two fours, two fives, or two ſixes, but always to open the ace, deuce, or trois points, for B to hit him.

A critical game to play. Suppoſe A and B place their men for a hit in the following manner: A to have three men upon the ſize point in his own tables, three men out of his tables upon the uſual point, and nine men upon his adverſary's ace, deuce, and trois points; that is, three upon each; and ſuppoſe B's men to be placed in his own and his adverſary's tables in the ſame order. So ſituated, the beſt player ſhould win the hit. The game being ſo equal, that in this caſe the dice ſhould be thrown for. Now if A throws firſt, he ſhould endeavour to gain his adverſary's cinque point: this being done, he ſhould lay as many blots as poſſible, to tempt B to hit him, as it puts him backward, and A thereby gains an advantage. A ſhould always endeavour to have three men upon each of his adverſary's ace and deuce points; becauſe when B makes a blot, theſe points will remain ſecure, and when A has bore five, ſix, or more men, A yet may ſecure ſix cloſe points out of his tables, in order to prevent B from getting his man home, at which time he ſhould calculate who has the beſt of the hit. If he finds that B is foremoſt, he ſhould then try to lay ſuch blots as may be taken up by his adverſary, that he may have a chance of taking up another man, in caſe B ſhould happen to have a blot at home.

Laws of Backgammon. 1. If a man is taken from any point, it muſt be played; if two men are taken from it, they alſo muſt be played. 2. A man is not ſuppoſed to be played till it is placed upon a point and quitted. 3. If a player has only fourteen men in play, there is no penalty inflicted, becauſe by his playing with a leſſer number than he is intitled to, he plays to a diſadvantage for want of the deficient man to make up his tables. 4. If he bears any number of men before he has entered a man taken up, and which of courſe he was obliged to enter, ſuch men ſo borne muſt be entered again in the adverſary's tables as well as the man taken up. 5. If he has miſtaken his throw and played it, and his adverſary has thrown, it is not in the choice of either of the players to alter it, unleſs they both agree ſo to do.

Back-Painting, Back-Staff.

Back-Painting, the method of painting mezzotinto prints, paſted on glaſs, with oil-colours. See Mezzotinto.

The art conſiſts chiefly in laying the print upon a piece of crown-glaſs, of ſuch a ſize as fits the print.

In order to do this, take your print, and lay it in clean water for two days and two nights, if the print be on very ſtrong, cloſe, and hard gummed paper; but if upon an open, ſoft, ſpungy paper, two hours will ſometimes ſuffice, or more, according as the paper is.

The paper or picture having been ſufficiently ſoaked, take it out and lay it upon two ſheets of paper, and cover it with two more; and let it lie there a little to ſuck out the moiſture.

In the mean time, take the glaſs the picture is to be put upon, and ſet it near the fire to warm; take Straſburg turpentine, warm it over the fire till it is grown fluid, then with a hog's-hair bruſh ſpread the turpentine very ſmoothly and evenly on the glaſs.

When this has been done, take the mezzotinto print from between the papers, and lay it upon the glaſs; beginning firſt at one end, rubbing it down gently as you go on, till it lie cloſe, and there be no wind bladders between.

Then, with your fingers, rub or roll off the paper from the back ſide of the print, till it looks black, *i. e.* till you can ſee nothing but the print, like a thin film, left upon the glaſs, and ſet it by to dry.

When it is dry, varniſh it over with ſome white tranſparent varniſh, that the print may be ſeen through it; and then it is fit for painting.

The utmoſt care will be neceſſary in rubbing or rolling the paper of the print, ſo as not to tear it, eſpecially in the light parts.

You may, inſtead of ſoaking your prints two days and two nights, roll them up and boil them for about two hours, more or leſs, according to the quality of the paper, in water; and that will render it as fit for rubbing, rolling, or peeling, as the other way.

This being done, and your oil-colours prepared, ground very fine, and tempered very ſtiff, lay on the back-ſide of the tranſparent prints ſuch colours as each particular part requires; letting the maſter-lines of the print ſtill guide your pencil, and ſo each particular colour will lie fair to the eye on the other ſide of the glaſs, and look almoſt as well as a painted piece, if it be done neatly.

The ſhadows of the print are generally ſufficient for the ſhadow of every colour; but if you have a mind to give a ſhadow by your pencil, then let the ſhadows be laid on firſt, and the other colours afterward.

In laying on colours in this kind of back-painting, you need not be curious as to the laying them on ſmooth. This is not at all requiſite here, where the chief aim is only to have the colours appear well on the fore ſide of the print; and therefore the only care to be uſed in this work, is to lay the colours on thick enough, that its body may ſtrike the colour of it plainly through the glaſs.

Back-Staff, a name formerly given to a ſea-qua-

Back-Stays. ‖ Backereel.

Backhuyſen.

drant invented by Captain Davis: becauſe the back of the artiſt is turned towards the ſun at the time of obſervation. See Quadrant.

Back-Stays, of a ſhip, are ropes belonging to the main-maſt and fore-maſt, and the maſts belonging to them; ſerving to keep them from pitching forwards or overboard.

Back-Tack, in Scots law: When a wadſetter, inſtead of poſſeſſing the wadſet-lands, grants a tack thereof to the reverſer for payment of a certain ſum in name of tack-duty, that tack is called a *back-tack*.

Back-Worm. See Filanders.

BACKER, or Bakker, (Jaques), a painter of hiſtory, was born at Antwerp in 1530; and learned the principles of painting from his father, who was an artiſt very knowing in his profeſſion, though his works were in no great eſtimation. After the death of his father, he lived in the houſe of Jacopo Palermo, a dealer in pictures, who avariciouſly took care to keep him inceſſantly employed, and ſent his paintings to Paris to be diſpoſed of, where they happened to be exceedingly admired. The judicious were very eager to purchaſe them; and though the tranſactor ſold them at a great price, yet the poor artiſt was not proportionably rewarded, but continued in the ſame obſcure and depreſſed condition. His merit, indeed, was univerſally allowed, but his name, and the narrowneſs of his circumſtances, were as univerſally unknown. He had a clean light manner of pencilling, and a tint of colour that was extremely agreeable.—He died in 1560.

BACKER, or Bakker, (Jacob), painter of portrait and hiſtory, was born at Harlingen in 1609, but ſpent the greateſt part of his life at Amſterdam; and by all the writers on this ſubject, he is mentioned as an extraordinary painter, particularly of portraits, which he executed with ſtrength, ſpirit, and a graceful reſemblance. He was remarkable for an uncommon readineſs of hand and freedom of pencil; and his incredible expedition in his manner of painting, appeared even in one portrait of a lady from Haerlem, that he painted at half length, which was begun and finiſhed in one day, though he adorned the figure with rich drapery and ſeveral ornamental jewels. He alſo painted hiſtorical ſubjects with good ſucceſs; and in that ſtyle there is a fine picture of Cimon and Iphigenia, which is accounted by the connoiſſeurs an excellent performance. In deſigning academy figures his expreſſion was ſo juſt, and his outline ſo correct, that he obtained the prize from all his competitors; and his works are ſtill bought up at very high prices in the Low Countries. In the collection of the Elector Palatine there is an excellent head of Brouwer, painted by this maſter; and in the Carmelites church at Antwerp is preſerved a capital picture of the Laſt Judgment, which is well deſigned and well coloured. He died in 1651.

BACKEREEL, called Bacquerelli, (William) a painter of hiſtory, was born at Antwerp, and was a diſciple of Rubens, at the ſame time that Vandyck was educated in that ſchool. When each of them quitted that maſter and commenced painters, Backereel was very little inferior to Vandyck, if not nearly his equal. And this may be manifeſtly ſeen in the works of the former, which are in the church of the Auguſtin Monks at Antwerp; where thoſe two great artiſts painted in competition, and both were praiſed for their merit in their different ways; but the ſuperiority was never determined in favour either of the one or the other. He had likewiſe a good taſte for poetry; but, by exerciſing that talent too freely, in writing ſatires againſt the Jeſuits, theſe eccleſiaſtics purſued him with unremitted revenge, till they compelled him to fly from Antwerp; and by that means deprived his own country of ſuch paintings as would have contributed to its perpetual honour.—Sandrart took notice, that in his time there were ſeven or eight painters, who were very eminent, of the name of Backereel, in Italy and the Low Countries.

BACKHUYSEN (Ludolph), an eminent painter, was born at Embden in 1631, and received his earlieſt inſtruction from Albert Van Everdingen; but acquired his principal knowledge by frequenting the painting rooms of different great maſters, and obſerving their various methods of touching and colouring. One of thoſe maſters was Henry Dubbels, whoſe underſtanding in his art was very extenſive; and he was as remarkably communicative of his knowledge to others. From him Backhuyſen obtained more real benefit than from all the painters of his time, either by ſtudying their works, or perſonally converſing with them. His ſubjects were ſea-pieces, ſhips, and ſea-ports. He had not practiſed very long when he became the object of general admiration; ſo that even his drawings were ſought after, and ſeveral of them were bought up at 100 florins a-piece. It was obſerved of him, that while he was painting, he would not ſuffer even his moſt intimate friends to have acceſs to him, leſt his fancy might be diſturbed, and the ideas he had formed in his mind be interrupted. He ſtudied nature attentively in all her forms; in gales, calms, ſtorms, clouds, rocks, ſkies, lights, and ſhadows; and he expreſſed every ſubject with ſo ſweet a pencil, and ſuch tranſparence and luſtre, as placed him above all the artiſts of his time in that ſtyle, except the younger Vandervelde, who is deſervedly eſteemed the firſt in that manner of painting. It was a frequent cuſtom with Backhuyſen, whenever he could procure reſolute mariners, to go to ſea in a ſtorm, in order to ſtore his mind with grand images, directly copied from nature, of ſuch ſcenes as would have filled any other head and heart with terror and diſmay; and the moment he landed, he always impatiently ran to his palette to ſecure theſe incidents, of which the traces might by delay be obliterated.—He perfectly underſtood the management of the Chiaro-Scuro, and by his ſkill in that part of his art, he gave uncommon force and beauty to his objects. He obſerved ſtrictly the truth of perſpective, in the diſtances of his veſſels, the receding of the grounds on the ſhores, and the different buildings which he deſcribed in the ſea-ports; whether they were the reſult of his own imagination, or ſketched, as he uſually did, after nature. His works may eaſily be diſtinguiſhed by an obſervant eye, from the freedom and neatneſs of his touch; from the clearneſs, and natural agitation or quieſcence of the water; from a peculiar tint in his clouds and ſkies; and alſo from the exact proportions of his ſhips, and the gracefulneſs of their poſition. For the Burgomaſters of Amſterdam he painted a large picture, with a multitude of veſſels, and a view of the city at a diſtance, for which they gave him thirteen hundred guilders, and a conſiderable preſent; which picture they afterwards preſented to the king of France, who placed it in the Louvre. No painter was ever more honoured by the viſits of the kings and princes than Backhuyſen; the king of Pruſſia was one of the number; and the Czar Peter the Great took delight to ſee him paint, and often endeavoured to draw after veſſels which he had deſigned. He was remarkably aſſiduous, and yet it ſeems aſtoniſhing to conſider the number of pictures which he finiſhed, and the exquiſite manner in which they are painted. He died in 1709.

BACKING, in horſemanſhip. See HORSEMANSHIP.

BACKING *the Sails*, in navigation; to arrange them in a ſituation that will force the ſhip to retreat, or move backwards. This is, however, only done in narrow channels, when a ſhip is carried along ſidewiſe by the tide or current, and wants to avoid any thing that may interrupt her progreſs, as ſhoals, veſſels at anchor, &c. or in the line of battle, when a ſhip wants to be immediately oppoſite to another with which ſhe is engaged.

BACKS, among dealers in leather, denote the thickeſt and beſt tanned hides, uſed chiefly for ſoles of ſhoes.

BACKS, in brewing and diſtilling. See BAC.

BACULARIUS, in writers of the middle age, an eccleſiaſtical apparitor, or verger; who carries a ſtaff, *baculus*, in his hand, as an enſign of his office.

BACON, ſwines fleſh ſalted, and dried in the chimney.—Old hiſtorians and law-writers ſpeak of the *ſervice of the bacon*, a cuſtom in the manor of Whichenacre in Staffordſhire, and priory of Dunmore in Eſſex; in the former of which places, by an ancient grant of the lord, a flitch of bacon, with half a quarter of wheat, was to be given to every married couple who could ſwear, that, having been married a year and a day, they would never within that time have once exchanged their mate for any other perſon on earth, however richer, fairer, or the like. But they were to bring two of their neighbours to ſwear with them that they believed they ſwore the truth. On this the lord of another neighbouring manor, of Rudlow, was to find a horſe ſaddled, and a ſack to carry the bounty in, with drums and trumpets, as far as a day's journey out of the manor: all the tenants of the manor being ſummoned to attend, and pay ſervice to the bacon. The bacon of Dunmore, firſt erected under Henry III. was on much the ſame footing; only the tenor of the oath was, that the parties had never once repented, or wiſhed themſelves unmarried again.

BACON (Roger), a Franciſcan friar of amazing genius and learning, was born near Ilcheſter in Somerſetſhire, in the year 1214. He began his ſtudies at Oxford; but in what ſchool, or college is uncertain. Thence he removed to the univerſity of Paris, which, in thoſe times, was eſteemed the centre of literature. Here, we are told, he made ſo rapid a progreſs in the ſciences, that he was eſteemed the glory of that univerſity, and was much careſſed by ſeveral of his countrymen, particularly by Robert Grouthead, afterwards biſhop of Lincoln, his ſingular friend and patron. About the year 1240, he returned to Oxford; and aſſuming the Franciſcan habit, proſecuted his favourite ſtudy of experimental philoſophy, with unremitting ardor and aſſiduity. In this purſuit, in experiments, inſtruments, and in ſcarce books, he tells us, he ſpent, in the ſpace of 20 years, no leſs than L. 2000; which it ſeems, was given him by ſome of the heads of the univerſity, to enable him to proſecute his noble inquiries. By ſuch extraordinary talents, and aſtoniſhing progreſs in ſciences, which, in that ignorant age, were totally unknown to the reſt of mankind, whilſt they raiſed the admiration of the more intelligent few, could not fail to excite the envy and malice of his illiterate fraternity; who found no difficulty of poſſeſſing the vulgar with the notion of Bacon's dealing with the devil. Under this pretence, he was reſtrained from reading lectures; his writings were confined to his convent; and finally, in 1278, he himſelf was impriſoned in his cell. At this time he was 64 years of age. Nevertheleſs, being permitted the uſe of his books, he went on in the rational purſuit of knowledge, corrected his former labours, and wrote ſeveral curious pieces. When he had been 10 years in confinement, Jerom de Aſcoli being elected pope, Bacon ſolicited his holineſs to be releaſed; in which, it ſeems, he did not immediately ſucceed. However, towards the latter end of that pope's reign, he obtained his liberty, and ſpent the remainder of his life in the college of his order, where he died in the year 1294, in the 80th year of his age, and was buried in the Franciſcan church. Such are the few particulars which the moſt diligent reſearches have been able to diſcover concerning this very great man; who, like a ſingle bright ſtar in a dark hemiſphere, ſhone forth the glory of his country, and the pride of human nature. His works are, 1. *Epiſtola fratris Rogeri Baconis de ſecretis operibus artis et naturæ, et de nullitate magiæ*. Paris, 1542, 4to. Baſil, 1593, 8vo. 2. *Opus majus*. Lond. 1733, fol. publiſhed by Dr Jebb. 3. *Theſaurus chemicus*. Francf. 1603, 1620. This was probably the editor's title; but it contains ſeveral of our author's treatiſes on this ſubject. Theſe printed works of Bacon contain a conſiderable number of eſſays, which, in the catalogue of his writings by Bale, Pits, &c. have been conſidered as diſtinct books; but there remain in different libraries ſeveral manuſcripts not yet publiſhed. By an attentive peruſal of his works, the reader will be aſtoniſhed to find, that this great luminary of the 13th century was a great linguiſt and a ſkilful grammarian; that he was well verſed in the theory and practice of perſpective; that he underſtood the uſe of convex and concave glaſſes, and the art of making them; that the *camera obſcura*, burning-glaſſes, and the power of the teleſcope, were known to him; that he was well verſed in geography and aſtronomy; that he knew the great error in the kalendar, aſſigned the cauſe, and propoſed the remedy; that he underſtood chronology well; that he was an adept in chemiſtry, and was really the inventor of gun-powder; that he poſſeſſed great knowledge in the medical art; that he was an able mathematician, logician, metaphyſician, and theologiſt.

BACON (Sir Nicholas), lord keeper of the great ſeal in the reign of Queen Elizabeth, was born at Chiſlehurſt, in Kent, in 1510, and educated at the univerſity of Cambridge; after which he travelled into France, and made ſome ſtay at Paris. On his return, he ſettled in Gray's-inn, and applied himſelf with ſuch aſſiduity to the ſtudy of the law, that he quickly diſtinguiſhed himſelf ſo, that on the diſſolution of the monaſtery of St Edmund's Bury, in Suffolk, he had a grant from King Henry VIII. in the 36th year of his reign, of ſeveral manors. In the 38th of the ſame king, he was promoted to the office of attorney in the court of Wards, which was a place both of honour and profit. In this office he was continued by King Edward VI.; and in 1552 he was elected treaſurer of Gray's-inn. His great moderation and conſummate prudence preſerved him through the dangerous reign of Queen Mary. In the very dawn of that of Elizabeth he was knighted; and on the 22d of December 1558, the great ſeal of England, being taken from Nicholas Heath archbiſhop of York, was delivered to him with the title of *lord keeper*, and he was alſo made one of the Queen's privy council. He had a conſiderable ſhare in the ſettling of religion: as a ſtateſman, he was remarkable for a clear head and deep counſels: but his great parts and high preferment were far from raiſing him in his own opinion, as appears from the modeſt anſwer he gave Queen Elizabeth, when ſhe told him his houſe at Redgrave was too little for him: "Not ſo, madam, (returned he); but your majeſty has made me too great for my houſe." After having had the great ſeal more than 20 years, this able ſtateſman and faithful counſellor was ſuddenly removed from this life, as Mr Mallet informs us, by the following accident: he was under the hands of the barber, and thinking the weather warm, had ordered a window before him to be thrown open, but fell aſleep as the current of freſh air was blowing in upon him, and awakened ſome time after diſtempered all over. He was immediately removed into his bed-chamber, where he died a few days after, on the 26th of February 1578-9, equally lamented by the Queen and her ſubjects. He was buried in St Paul's, where a monument was erected to him, which was deſtroyed by the fire in London in 1666. Mr Granger obſerves, that he was the firſt lord keeper that ranked as lord chancellor; and that he had much of that penetrating genius, ſolidity, and judgment, perſuaſive eloquence, and comprehenſive knowledge of law and equity, which afterwards ſhone forth with ſo great a luſtre in his ſon, who was as much inferior to his father in point of prudence and integrity as his father was to him in literary accompliſhments.

Bacon (Francis), lord high chancellor of England under king James I. was ſon of Sir Nicholas Bacon lord keeper of the great ſeal in the reign of Queen Elizabeth, by Anne daughter of Sir Anthony Cook, eminent for her ſkill in the Latin and Greek tongues. He was born in 1560; and ſhowed ſuch marks of genius, that he was particularly taken notice of by Queen Elizabeth when very young. He was educated at Trinity-college, Cambridge; and made ſuch incredible progreſs in his ſtudies, that, before he was 16, he had not only run through the whole circle of the liberal arts as they were then taught, but began to perceive thoſe imperfections in the reigning philoſophy, which he afterwards ſo effectually expoſed, and thereby not only overturned that tyranny which prevented the progreſs of true knowledge, but laid the foundation of that free and uſeful philoſophy which has ſince opened a way to ſo many glorious diſcoveries. On his leaving the univerſity, his father ſent him to France; where, before he was 19 years of age, he wrote a general view of the ſtate of Europe; but Sir Nicholas dying, he was obliged ſuddenly to return to England; when he applied himſelf to the ſtudy of the common law, at Gray's-inn. At this period the famous Earl of Eſſex, who could diſtinguiſh merit, and who paſſionately loved it, entered into an intimate friendſhip with him; zealouſly attempted, though without ſucceſs, to procure him the office of queen's ſolicitor; and, in order to comfort his friend under the diſappointment, conferred on him a preſent of land to the value of 1800l. Bacon, notwithſtanding the friendſhip of ſo great a perſon; notwithſtanding the number and power of his own relations; and, above all, notwithſtanding the early prepoſſeſſion of her majeſty in his favour; met with many obſtacles to his preferment during her reign. In particular, his enemies repreſented him as a ſpeculative man, whoſe head was filled with philoſophical notions, and therefore more likely to perplex than forward public buſineſs. It was not without great difficulty that lord treaſurer Burleigh obtained for him the reverſion of regiſter to the ſtar-chamber, worth about 1600 l. a-year, which place fell to him about 20 years after. Neither did he obtain any other preferment all this reign; though if obedience to a ſovereign in what muſt be the moſt diſagreeable of all offices, viz. the caſting reflections on a deceaſed friend, intitled him, he might have claimed it. The people were ſo clamorous even againſt the Queen herſelf on the death of Eſſex, that it was thought neceſſary to vindicate the conduct of the adminiſtration. This was aſſigned to Bacon, which brought on him univerſal cenſure, nay his very life was threatened. Upon the acceſſion of King James, he was ſoon raiſed to conſiderable honours; and wrote in favour of the union of the two kingdoms of Scotland and England, which the King ſo paſſionately deſired. In 1616, he was ſworn of the privy-council. He then applied himſelf to the reducing and recompoſing the laws of England. He diſtinguiſhed himſelf, when attorney-general, by his endeavours to reſtrain the cuſtom of duels, then very frequent. In 1617, he was appointed lord keeper of the great ſeal. In 1618, he was made lord chancellor of England, and created Lord Verulam. In the midſt of theſe honours and applauſes, and multiplicity of buſineſs, he forgot not his philoſophy, but in 1620 publiſhed his great work intitled *Novum Organum*. We find by ſeveral letters of his, that he thought convening of parliaments was the beſt expedient for the king and people. In 1621, he was advanced to the dignity of Viſcount St Albans, and appeared with the greateſt ſplendour at the opening of the ſeſſion of parliament. But he was ſoon after ſurpriſed with a melancholy reverſe of fortune. For, about the 12th of March, a committee of the houſe of commons was appointed to inſpect the abuſes of the courts of juſtice. The firſt thing they fell upon was bribery and corruption, of which the lord chancellor was accuſed. For that very year complaints being made to the houſe of commons of his lordſhip's having received bribes, thoſe complaints were ſent up to the houſe of lords; and new ones being daily made of a like nature, things ſoon grew too high to be got over. The King found it was impoſſible to ſave both his chancellor, who was openly accuſed of corruption, and Buckingham his favourite, who was ſecretly and therefore more dangerouſly attacked as the encourager of whatever was deemed moſt illegal and oppreſſive: he therefore forced the former to abandon his defence, giving him poſitive advice to ſubmit himſelf to his peers, and promiſing upon his princely word to ſcreen him in the laſt determination, or, if that could not be, to reward him afterwards with ample retribution of favour. The chancellor, though he foreſaw his approaching ruin if he did not plead for himſelf, reſolved to obey; and the houſe of peers, on the 3d of May 1621, gave judgment againſt him, "That he ſhould be fined 40,000l. and remain priſoner in the tower during the king's pleaſure; that he ſhould for ever be incapable of any office, place, or employment, in the ſtate or commonwealth; and that he ſhould never ſit in parliament, or come within the verge of the court." The fault which, next to his ingratitude to Eſſex, thus tarniſhed the glory of this illuſtrious man, is ſaid to have principally proceeded from his indulgence to his ſervants, who made a corrupt uſe of it. One day, during his trial, paſſing through a room where ſeveral of his domeſtics were ſitting, upon their riſing up to ſalute him, he ſaid, "Sit down, my maſters; your riſe hath been my fall." *Stephens*, p. 54. And we are told by Ruſhworth in his hiſtorical collections, "That he treaſured up nothing for himſelf or family, but was over-indulgent to his ſervants, and connived at their takings, and their ways betrayed him to that error; they were profuſe and expenſive, and had at their command whatever he was maſter of. The gifts taken were for the moſt part for interlocutory orders; his decrees were generally made with ſo much equity, that though gifts rendered him ſuſpected for injuſtice, yet never any decree made by him was reverſed as unjuſt." It was peculiar to this great man (ſay the authors of the Biogr. Brit.) to have nothing narrow and ſelfiſh in his compoſition: he gave away without concern whatever he poſſeſſed; and believing other men of the ſame mould, he received with as little conſideration. He retired, after a ſhort impriſonment, from the engagements of an active life, to which he had been called much againſt his genius, to the ſhade of a contemplative one, which he had always loved. The King remitted his fine, and he was ſummoned to parliament in the firſt year of King Charles I. It appears from the works compoſed during his retirement, that his thoughts were ſtill free, vigorous, and noble. The laſt five years of his life he devoted wholly to his ſtudies. In his receſs he compoſed the greateſt part of his Engliſh and Latin works. He expired on the 9th of April, 1626; and was buried in St Michael's church at St Albans, according to the direction of his laſt will, where a monument of white marble was erected to him by Sir Thomas Meautys formerly his ſecretary, and afterward clerk of the privy council under two kings. A complete edition of this great man's works was publiſhed at London in the year 1740.—Addiſon has ſaid of him, That he had the ſound, diſtinct, comprehenſive knowledge of Ariſtotle, with all the beautiful light graces and embelliſhments of Cicero. The honourable Mr Walpole calls him the *Prophet of Arts* which Newton was afterwards to reveal; and adds, that his genius and his works will be univerſally admired as long as ſcience exiſts. "As long as ingratitude and adulation are deſpicable, ſo long ſhall we lament the depravity of this great man's heart. Alas! that he who could command immortal fame, ſhould have ſtooped to the little ambition of power."

Bacon (Sir Nathaniel), knight of the bath, and an excellent painter, was a younger ſon of the lord keeper, and half brother to the great Sir Francis. He travelled into Italy, and ſtudied painting there; but his manner and colouring approaches nearer to the ſtyle of the Flemiſh ſchool. Mr Walpole obſerves, that at Culford, where he lived, are preſerved ſome of his works; and at Gorhambury, his father's ſeat, is a large picture by him in oil, of a cook-maid, with a dead fowl, admirably painted, with great nature, neatneſs, and luſtre of colouring. In the ſame houſe is a whole length of him, by himſelf, drawing on a paper, his ſword and pallet hung up, and a half length of his mother by him.

BACONTHORP (John), called the *reſolute doctor*, a learned monk, was born towards the end of the 13th century, at Baconthorp a village in Norfolk. He ſpent the early part of his life in the convent of Blackney, near Walſingham in the ſame county; whence he removed to Oxford, and from thence to Paris; where being diſtinguiſhed for his learning, he obtained degrees in divinity and laws, and was eſteemed the principal of Averroiſts*. In 1329 he returned to England, and was immediately choſen twelfth provincial of the Engliſh Carmelites. In 1333 he was ſent for to Rome; where, we are told, he firſt maintained the pope's ſovereign authority in caſes of divorce, but that he afterwards retracted his opinion. He died in London in the year 1346. Leland, Bale, and Pits, unanimouſly give him the character of a monk of genius and learning. He wrote, 1. *Commentaria ſeu quæſtiones ſuper quatuor libros ſententiarum*; and, 2. *Compendium legis Chriſti, et quodlibeta*: both which underwent ſeveral editions at Paris, Milan, and Cremona. Leland, Bale, and Pits, mention a number of his works never publiſhed.

BACTRIA, or **Bactriana**, now *Choraſſan* or *Khoraſan*, an ancient kingdom of Aſia, bounded on the weſt by Margiana, on the north by the river Oxus, on the ſouth by mount Paropiſmus, and on the eaſt by the Aſiatic Scythia and the country of the Maſſagetæ. It was a large, fruitful, and well-peopled country, containing according to Ammianus Marcellinus 1000 cities, though of theſe only a few are particularly mentioned by hiſtorians, of which that formerly called *Maracanda*, now *Samarcand*, is the moſt conſiderable.

Of the hiſtory of this country we know but little. Authors agree that it was ſubdued firſt by the Aſſyrians, afterwards by Cyrus, and then by Alexander the Great. Afterwards it remained ſubject to Seleucus Nicator and his ſucceſſors till the time of Antiochus Theos; when Theodotus, from governor of that province, became king, and ſtrengthened himſelf ſo effectually in his kingdom, while Antiochus was engaged in a war with Ptolemy Philadelphus king of Egypt, that he could never afterwards diſpoſſeſs him of his acquiſitions. His poſterity continued to enjoy the kingdom for ſome time, till they were driven out by the Scythians, who reigned in Bactria at the time of Adrian, Antoninus Pius, &c. The Scythians were in their turn driven out by the Huns or Turks, and theſe often conquered by the Saracens and Tartars; nevertheleſs they continued in poſſeſſion of this country in the time of Ladiſlaus IV. king of Hungary.

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* See *Averroes*.

In early times the Bactrians differed little in their manners from the Nomades; and being near neighbours of the Scythians, who were a very warlike people, the Bactrian ſoldiers were reckoned the beſt in the world. Their appearance was very ſavage; being of an enormous ſtature, having a terrible aſpect, rough beards, and long hair hanging down their ſhoulders. Some authors aſſert that they kept dogs on purpoſe to devour ſuch as arrived at extreme old age, or who were exhauſted by long ſickneſs. They add, that for all their fierceneſs, the Bactrian huſbands were ſuch dupes to their wives, that they durſt not complain of them even for conjugal infidelity, to which it ſeems the latter were very much addicted.

BACTROPERATA, an ancient appellation given to philoſophers by way of contempt, denoting a man with a ſtaff and a budget.

We ſuppoſe it is of the ſame people that Pauchaſias Radbertus ſpeaks under the corrupt name of *Baccoperitæ*, or *Bacchionitæ*, whom he deſcribes as philoſophers who had ſo great a contempt for all earthly things, that they kept nothing but a diſh to drink out of; and that one of this order ſeeing a peaſant ſcooping up the water in his hand, threw away the cup as a ſuperfluity: which is nothing but the old ſtory of Diogenes the cynic.

BACULE, in fortification, a kind of portcullis, or gate, made like a pit-fall with a counterpoiſe, and ſupported by two great ſtakes. It is uſually made before the corpade-guard, not far from the gate of a place.

BACULOMETRY, the art of meaſuring acceſſible or inacceſſible heights, by the help of one or more baculi, ſtaves, or rods. See GEOMETRY.

BACURIUS, or BATURIUS, king of the Iberians, a people on the ſide of the Caſpian ſea. One day being a hunting, he loſt ſight of his company, through a great ſtorm and ſudden darkneſs; upon which he vowed to the God of his Chriſtian ſlave, that if he were delivered he would worſhip him alone: the day breaking up immediately, he made good his promiſe, and became the apoſtle of his country.

BADAGSHAN, a very ancient city of Great Bukharia, in the province of Balkh, ſituated at the foot of thoſe high mountains which ſeparate Indoſtan from Great Tartary. The city is exceedingly ſtrong by its ſituation; and belongs to the khan of proper Bukharia, who uſes it as a kind of ſtate-priſon to ſecure thoſe he is jealous of. The town is not very big, but well built, and very populous. It ſtands on the north ſide of the river Amu, about 100 miles from its ſource, and is a great thoroughfare for the caravans deſigned for little Bukharia. The inhabitants are enriched by mines of gold, ſilver, and rubies, which are in the neighbourhood; and thoſe who live at the foot of the mountains gather a great quantity of gold and ſilver duſt brought down in the ſpring by torrents occaſioned by the melting of the ſnow on the top.

BADAJOZ, a large and ſtrong town, capital of Eſtremadura in Spain. It is ſeated on the river Guadiana, over which there is a fine bridge built by the Romans. On this bridge the Portugueſe were defeated in 1661, by Don John of Auſtria. W. Long. 7. 3. N. Lat. 38. 35.

BADELONA, a town of Catalonia in Spain, ſeated on the Mediterranean. Lord Peterborough landed here in 1704, when, with Charles then king of Spain, he laid ſiege to Barcelona, from which it is ten miles diſtant. E. Long. 2. 20. N. Lat. 41. 12.

BADEN (the diſtrict of), in Swiſſerland, has three cities, Baden, Keiſers-Stoul, and Klingnaw, beſides a town that paſſes for a city, namely, *Zurzach.* It is one of the fineſt countries in Swiſſerland; and is watered with three navigable rivers, the Limmet, Ruſs, and Are. The land is fertile in corn and fruit, and there are places on the ſides of the Limmet which produces wine. It maintains a communication between the cantons of Zurich and Bern, being ſeated between their north extremities. It extends on one ſide to the Are, as far as the place where it falls into the Rhine, and on the other ſide beyond the Rhine, where there are ſome villages which depend thereon. Moſt of the inhabitants are Papiſts. By the treaty of peace at the concluſion of the war which broke out in 1712 between the Proteſtant and Popiſh cantons, this country was yielded to the Proteſtant cantons of Zurich and Bern. Before, it was the property of the eight old cantons; however, as the canton of Glaris had taken no part in this war, by the conſent of both parties its right was ſtill continued.

BADEN, the capital of the above diſtrict, is an agreeable city, moderately large, ſeated on the ſide of the Limmet, in a plain flanked by two high hills, between which the river runs. This city owes its riſe to its baths, which were famous before the Chriſtian æra. Several monuments of antiquity have been found here from time to time, particularly in 1420. When they were opening the large ſpring of the baths, they found ſtatues of ſeveral heathen gods, made of alabaſter; Roman coins, made of bronze, of Auguſtus, Veſpaſian, Decius, &c.; and ſeveral medals of the Roman emperors, of gold, ſilver, copper, and bronze. There are two churchs in Baden; one of which is collegiate, and makes a good appearance; the other is a monaſtery of the Capuchins, near the town-houſe. This laſt building ſerves not only for the aſſemblies of their own council, but alſo for thoſe of the cantons. The diet aſſembles there in a handſome room made for that purpoſe; the deputies of Zurich ſit at the bottom behind a table, as the moſt honourable place; the ambaſſadors of foreign powers are ſeated on one ſide to the right, and the deputies of the other cantons are ranged on each ſide the room. The bailiff of Baden reſides in a caſtle at the end of a handſome wooden bridge, which is covered in. Before this caſtle there is a ſtone pillar, erected in honour of the emperor Trajan, who paved a road in this country 85 Italian miles in length. The inhabitants are rigid Roman catholics, and formerly behaved in a moſt inſolent manner to the Proteſtants, but they are now obliged by their maſters to be more ſubmiſſive. The baths which are on each ſide the river are a quarter of a league from the city. Joining to the ſmall baths there is a village, and to the large a town which may paſs for a ſecond Baden. It is ſeated on a hill, of which the aſcent is ſteep. There the baths are brought into inns and private houſes, by means of pipes, which are about 60 in all. There are alſo public baths in the middle of the town, from a ſpring which riſes in the ſtreet, where the poor bathe *gratis*, but they are expoſed quite naked to all that paſs by. All the baths are hot, and one to ſo great a degree as to ſcald the hand; and they are impregnated with a great deal of ſulphur, with ſome alum and nitre. They are uſeful for drinking as well as bathing; and are ſaid to cure all diſeaſes from a cold cauſe, head-achs, vertigos, &c. They ſtrengthen the ſenſes, cure diſeaſes of the breaſt and bowels, aſthmas, and obſtructions. They are peculiarly excellent for women's diſeaſes. E. Long. 8. 25. N. Lat. 47. 27.

Baden (the Margravate of), in the circle of Swabia, in Germany, is bounded by the Palatinate of the Rhine, on the north; by the Black Foreſt, on the eaſt; by Swiſſerland, on the ſouth; and by the Rhine, which divides it from Alſace, on the eaſt: and is about 90 miles in length, from north to ſouth; but not above 20 in breadth, where it is wideſt. It is a very populous and fruitful country, abounding in corn and wine. Veniſon and wild fowl are ſo plentiful, that they are the common diet of the peaſants. The rivers that water this territory, are the Rhine, Ens, Wirmbs, and Phints, which yield plenty of fiſh. They feed their hogs with cheſnuts, which make the bacon excellent. They have free-ſtone for building, and marble of all colours. They have ſome agate, and great quantities of hemp and flax for exportation. The chief towns are Baden, Durlach, Stolhafen, Raſtadt, Gerſbach, Pforſheim, and Horchberg.

Baden, the chief city of the above margravate, has a caſtle that ſtands on the top of a hill, which is the reſidence of a prince. The town is ſeated among hills, on rocky and uneven ground, which renders the ſtreets inconvenient and crooked. It is famous for its baths, the ſprings of which are ſaid to be above 300. Some of them are hot, and accounted to be very good in nervous caſes. They partake of ſalt, alum, and ſulphur. E. Long. 9. 24. N. Lat. 48. 50.

Baden, a town of Germany, in the arch-duchy of Auſtria, ſeated on the Little Suechat, is a neat little walled town, ſtanding in a plain not far from a ridge of hills which run out from the mountain Cetius. It is much frequented by the people of Vienna, and the neighbouring parts, on account of its baths. The ſprings ſupply two convenient baths within the town, five without the walls, and one beyond the river. They are good for diſtempers of the head, the gout, dropſy, and moſt chronic diſeaſes. E. Long. 17. 10. N. Lat. 48. 0.

BADENOCH, the moſt eaſterly part of Inverneſs-ſhire, in Scotland, extending about 33 miles in length from eaſt to weſt, and 27 from north-eaſt to ſouth-weſt where broadeſt. It has no conſiderable town, and is very barren and hilly, but abounds with deer, and other kinds of game.

BADEN-WEILLER, a town of Germany, belonging to the lower Margravate of Baden. E. Long. 7. 50. N. Lat. 47. 55.

BADENS (Francis), hiſtorical and portrait painter, was born at Antwerp in 1571, and the firſt rudiments of the art were communicated to him by his father, who was but an ordinary artiſt. However, he viſited Rome, and ſeveral parts of Italy, and there formed a good taſte of deſign, and a manner exceedingly pleaſing. When he returned to his own country his merit procured for him great employment, and ſtill greater reputation, and he was uſually diſtinguiſhed by the name of the Italian painter. His touch was light and ſpirited, and his colouring warm; and he had the honour of being the firſt who introduced a good taſte of colouring among his countrymen. While his acknowledged merit was rewarded with every public teſtimony of eſteem and applauſe, unhappily he received an account of the death of his brother, who had been aſſaſſinated on a journey; and the intelligence affected him ſo violently, that it occaſioned his own death, to the inexpreſſible regret of every lover of the art, in 1603.

BADGE, in naval architecture, ſignifies a ſort of ornament placed on the outſide of a ſmall ſhips, very near the ſtern, containing either a window for the convenience of the cabin, or a repreſentation of it. It is commonly decorated with marine figures, martial inſtruments, or ſuch like emblems.

BADGER, in zoology, the Engliſh name for a ſpecies of urſus. See Ursus.

Badger, in old law-books, one that was licenſed to buy corn in one place and carry it to another to ſell, without incurring the puniſhment of an engroſſer.

BADIA, an ancient town of Bætica on the Anas; now ſuppoſed to be Badajoz on the Guadiana.

BADIAGA, in the materia medica, the name of a ſort of ſpongy plant, common in the ſhops in Moſcow, and ſome other northern kingdoms. The uſe of it is the taking away the livid marks from blows and bruiſes, which the powder of this plant is ſaid to do in a night's time.

BADIANE, or Bandian, the ſeed of a tree which grows in China, and ſmells like aniſe-ſeed. The Chineſe, and the Dutch in imitation of them, ſometimes uſe the badiane to give their tea an aromatic taſte.

BADIGEON, a mixture of plaſter and free-ſtone, well ground together, and ſifted; uſed by ſtatuaries to fill up the little holes, and repair the defects in ſtones, whereof they make their ſtatues and other work.

The ſame term is alſo uſed by joiners, for ſaw-duſt mixed with ſtrong glue, wherewith they fill up the chaps and other defects in wood, after it is wrought.

BADILE (Antonio), hiſtory and portrait painter, was born at Verona in 1480, and by great ſtudy and application acquired a more extenſive knowledge of the true principles of painting than any of his predeceſſors. He was confeſſedly a moſt eminent artiſt; but he derived greater honour from having two ſuch diſciples as Paolo Veroneſe and Baptiſta Zelotti, than he did even from the excellence of his own compoſitions. He died in 1560. His colouring was admirably good; his carnations beautiful; and his portraits preſerved the perfect reſemblance of fleſh and real life; nor had he any cauſe to envy the acknowledged merit of Titian, Giorgione, or the beſt of his cotemporaries.

BADIS, a fortreſs of Livonia, ſubject to Ruſſia. E. Long. 23. 10. N. Lat. 59. 15.

BADIUS (Conrad), and (Stephen Robert), his brother; French refugees; celebrated as printers at Geneva, and Conrad as an author. The latter died in 1566.

BÆCKEA, in botany: A genus of the octandria order, belonging to the monogynia claſs of plants. The calyx is a permanent perianthium, conſiſting of a ſingle funnel-ſhaped leaf, cut in five ſegments at the brim; the corolla conſiſts of five roundiſh ſpreading petals inſerted into the calyx; the pericarpium is a globoſe capſule, made up of four valves, and containing four cells, in which are a few roundiſh angular ſeeds.

BÆTERRÆ, an ancient town of the Tertoſages in Gallia Narbonenſis; now *Beſiers*, on the eaſt bank of the Obris, now *Orbis*, or *Orbe*, in Lower Languedoc.

BÆTICA, a province of ancient Spain, ſo called from the famed river Bætis, afterwards *Tarteſſus*, now *Guadalquiver*, or the great river. It was bounded on the weſt by Luſitania; on the ſouth, by the Mediterranean, and Sinus Gaditanus; on the north, by the Cantabric ſea, now the Bay of Biſcay. On the eaſt and north-eaſt, its limits cannot be ſo well aſcertained, as they are very reaſonably thought to have been in a continual ſtate of fluctuation, as each petty monarch had an opportunity of encroaching upon his neighbour. The province was divided in two by the river Bætis already mentioned. On the one ſide of which, towards the Anas, were ſituated the Turdetani, from whence the kingdom was called *Turdetania*, though more generally known by the name of *Bæturia*. On the other ſide were ſituated the Baſtuli, Baſtetani, and Conteſtani, along the Mediterranean coaſts. The Baſtuli were ſuppoſed to be of Phœnician extract, and dwelt along the coaſts of the Mediterranean, till driven from thence by the Moors, they fled into the mountainous parts of Galicia, which they then called from their own name *Baſtulia*. The Baſtetani were ſeated higher up, on the ſame coaſts. The territories of both theſe made part of what has ſince become the kingdom of *Granada*; in which there is a ridge of very high mountains called from the abovementioned people, the *Baſtetanian mountains*. Mention is alſo made of their capital *Baſtetana*; a place of ſuch ſtrength, that King Ferdinand was ſix months beſieging it before he could take it from the Moors.—The whole province of Bætica, according to the moſt probable account, contains what is now called *Andaluſia*, part of the kingdom of Grenada, and the outward boundaries of Eſtremadura.

BÆTIS. See Bætica.

BÆTULO, a town of ancient Spain, in the Terraconenſis; now *Badelona* in Catalonia.

BÆTYLIA, anointed ſtones, worſhipped by the Phœnicians, by the Greeks before the time of Cecrops, and by other babarous nations. They were commonly of a black colour, and conſecrated to ſome god, as Saturn, Jupiter, the Sun, &c.—Some are of opinion that the true original of theſe idols is to be derived from the pillar of ſtone which Jacob erected at Bethel, and which was afterwards worſhipped by the Jews.

Theſe *bætylia* were much the object of the veneration of the ancient heathens. Many of their idols were no other. In reality, no ſort of idol was more common in the eaſtern countries, than that of oblong ſtones erected, and hence termed by the Greeks, κιονες, *pillars*. In ſome parts of Egypt they were planted on both ſides of the highways. In the temple of of Heliogabulus, in Syria, there was one pretended to have fallen from heaven. There was alſo a famous black ſtone in Phrygia, ſaid to have fallen from heaven. The Romans ſent for it and the prieſts belonging to it with much ceremony, Scipio Naſika being at the head of the embaſſy.

BÆZA, a city of Andaluſia in Spain, ſeated on a high hill three miles from the Gaudalquiver; it is the ſee of a biſhop, and has a kind of univerſity founded by John d'Avila. It was taken from the Moors about the end of the 15th century. E. Long. 3. 15. N. Lat. 37. 45.

BAFFETAS, or Bastas, a cloth made of coarſe white cotton-thread, which comes from the Eaſt Indies. That of Surat is the beſt.

BAFFIN's bay, a gulph of North America, running north-eaſt from Cape Farewel in Weſt Greenland, from 60° to 80° of north latitude.

BAFFO, a conſiderable town in the iſland of Cyprus, with a fort built near ancient Paphos, of which ſome conſiderable ruins yet remain, particularly ſome broken columns, which probably belonged to the temple of Venus. E. Long. 32. 20. N. Lat. 34. 50.

BAG, in commerce, a term ſignifying a certain quantity of ſome particular commodity: a bag of almonds, for inſtance, is about 300 weight; of aniſeſeeds, from 300 to 400, &c.

Bags are uſed in moſt countries to put ſeveral ſorts of coin in, either of gold, ſilver, braſs, or copper. Bankers, and others, who deal much in current caſh, label their bags of money, by tying a ticket or note at the mouth of the bag, ſignifying the coin therein contained, the ſum total, its weight, and of whom it was received. Tare is allowed for the bag.

Bag, among farriers, is when, in order to retrieve a horſe's loſt appetite, they put in an ounce of aſa-fœtida, and as much powder of ſavin, into a bag, to be tied to the bit, keeping him bridled for two hours, ſeveral times a-day; as ſoon as the bag is taken off, he will fall to eating. The ſame bag will ſerve a long time.

BAGAMADER, or Bagamedri, a province of the kingdom of Abyſſinia in Africa. It is ſaid to receive its name from the great number of ſheep bred in it; *meder* ſignifying land or earth, and *bag* a ſheep. Its length is eſtimated about 60 leagues, and its breadth 20: but formerly it was much more extenſive; ſeveral of its provinces having been diſmembered from it, and joined to that of Tigre. A great part of it, eſpecially towards the eaſt, is inhabited by wandering Gallas and Caffres.

BAGAUDÆ, or Bacaudæ, an ancient faction of peaſants, or malecontents, who ravaged Gaul. The Gauls being oppreſſed with taxes, roſe about the year of Chriſt 290, under the command of Amand and Elian; and aſſumed the name *bagaudæ*, which, according to ſome authors, ſignified in the Gallic language *forced rebels*; according to other, *tribute*; according to others, *robers*; which laſt ſignification others allow the word had, but then it was only after the time of the *bagaudæ*, and doubtleſs took its riſe from them.

BAGDAD, a celebrated city of Aſia in Irak Arabi, ſeated on the eaſtern banks of the Tigris, in E. Long. 43. 40. N. Lat. 33. 15. By many authors this city is very improperly called *Babylon*. The latter ſtood on the Euphrates at a conſiderable diſtance.

This city, for many years the capital of the Saracen empire, was founded by the khalif Al Manſur, the ſecond of the houſe of Al Abbas, after an attempt by the Rawandians to aſſaſſinate him, as already mentioned. See Arabia, n° 184.

1 Why the city was built.

The reaſons aſſigned by the Arabian hiſtorians for buiding the city of Bagdad are, That the abovementioned attempt to aſſaſſinate the khalif had diſguſted him at his Arabian ſubjects in general, and that the ſpot where Bagdad ſtood was at a conſiderable diſtance from the city of Cufa particularly; the inhabitants of which were remarkable for their treachery and inconſtancy, Al Manſur himſelf having felt ſeveral inſtances of it. Beſides, the people of Irak, who had always continued faithful to him, repreſented, that by building his capital near the confluence of the Euphrates and Tigris, it would be in a great meaſure ſecured from the inſults and attacks of thoſe who ſhould have an inclination to diſpute the kalifat with him; and that by being ſituated as it were in the middle of the tract comprehending the diſtricts of Baſra, Cufa, Waſet, Mawſel, and Swada, at no great diſtance from thoſe cities, it would be plentifully ſupplied with proviſions by means of the aforeſaid rivers.

2 Ancient city deſcribed.

Concerning the origin of the name *Bagdad*, there are various accounts, which being equally uncertain and trifling, merit no attention. The firſt city that went by this name was ſituated on the weſtern bank of the Tigris; from whence Al Manſur diſpatched his ſon Al Mohdi with a body of Moſlem troops, to the oppoſite bank. Here the young prince took poſt, and fortified the place on which he had encamped with a wall, in order to cover his troops, as well as the workmen employed by his father on the other ſide of the river, from the incurſions of the Perſians, who ſeemed to have taken umbrage at the erection of a new metropolis ſo near the frontiers of their dominions. Hence that part of the city ſoon afterwards built on the eaſtern banks of the Tigris, received the name of the *Camp*, or *Fortreſs of Al Mohdi*. The khalif had a ſuperb and magnificent palace both in the eaſtern and weſtern part of the town. The eaſtern palace was ſurrounded on the land-ſide by a ſemicircular wall that had ſix gates; the principal of which ſeems to have been called *the gate of prefects*, whoſe entrance was generally kiſſed by the princes and ambaſſadors that came to the khalif's court. The weſtern part of the city was entirely round, with the khalif's palace in the centre, and having the great moſque annexed to it. The eaſtern part conſiſted of an interior and exterior town, each of which was ſurrounded by a wall. For ſome time the building of the city went but ſlowly on, owing to a ſcarcity of materials for building; for which reaſon the khalif was ſometimes inclined to remove the materials of Al Madayen the ancient metropolis of the Perſian empire. But, upon trial, he found the ſtones to be of ſuch an immenſe ſize, that the removal of them to Bagdad would be attended with great difficulty and expence; beſides, he conſidered that it would be a reflection upon himſelf to have it ſaid that he could not finiſh his metropolis without deſtroying ſuch a pile of building as perhaps could not be paralleled in the whole world; for which reaſons he at length gave over his deſign, and erected the city of Bagdad, moſt probably out of the ruins of the ancient cities of Seleucia and Cteſiphon, putting an end to his undertaking in the 149th year of the Hegira, or four years after the city was begun.

From the building the city of Bagdad to the death of Al Manſur, nothing very remarkable happened, excepting ſome irruptions made into the territories of the Greeks, and by the Arabs into ſome of the khalif's other territories. In the 157th year of the Hegira alſo, a grievous famine was felt in Meſopotamia, which was quickly after followed by a plague that deſtroyed great numbers. This year likewiſe, the Chriſtians, who had been all along very ſeverely dealt with by Al Manſur, were treated with the utmoſt rigour by Muſa Ebn Moſaab the khalif's governor; every one who was unable to pay the enormous tribute exacted of them being thrown into priſon without diſtinction.

3 Death of Al Manſur.

The next year being the 158th of the Hegira, the khalif ſet out from Bagdad, in order to perform the pilgrimage to Mecca: but being taken ill on the road, he expired at Bir Maimun, whence his body was carried to Mecca; where, after 100 graves had been dug, that his ſepulchre might be concealed, he was interred, having lived, according to ſome 63, according to others 68 years, and reigned 22. He is ſaid to have been extremely covetous, and to have left in his treaſury 600,000,000 dirhems, and 24,000,000 dinars. He is reported to have paid his cook by aſſigning him the heads and legs of the animals dreſſed in his kitchen, and to have obliged him to procure at his own expence all the fuel and veſſels he had occaſion for.

4 Succeeded by Al Mohdi.

When Al Manſur expired at Bir Maimun, he had only his domeſtics and Rabi his freedman with him. The latter of theſe, for ſome time, kept his death concealed, and pretended to have a conference with him; in which, as he gave out, the khalif commanded him to exact an oath of allegiance to Al Mohdi his ſon, as his immediate ſucceſſor, and to Iſa Ebn Muſa his couſin-german, as the next apparent heir to the crown. He then diſpatched a courier to Bagdad with the news of Al Manſur's death; upon which Al Mohdi was unanimouſly proclaimed khalif. Iſa Ebn Muſa, however, no ſooner heard this news, than he began to entertain thoughts of ſetting up for himſelf at Cufa, where he then reſided; and in order to facilitate the execution of his ſcheme, fortified himſelf in that city. but Al Moluda being apprized of his defection, ſent a detachment of 1000 horſe to bring him to Bagdad; which being done, Al Mohdi not only prevailed upon him to own his allegiance to him, but alſo to give up his right to the ſucceſſion for 10,000 according to ſome, or, according to others, for 10,000,000, dinars.

5 Rebellion of Al Mokanna.

From the acceſſion of Al Mohdi to the 164th year of the Hegira, the moſt remarkable event was the rebellion of Al Mokanna. This impious impoſtor, whoſe true name was *Hakem Ebn Heſham*, came originally from Khoraſan, and had been an under ſecretary to Abu Moſlem governor of that province. He afterwards turned ſoldier, and paſſed thence into Mawaralnah, where he gave himſelf out for a prophet. The name of Al Mokanna, as alſo that of Al Borkai, that is, the *veiled*, he took from his cuſtom of covering his face with a veil or girdle maſk, to conceal his deformity; he having loſt an eye in the wars, and being otherwiſe of a deſpicable appearance; though his followers pretended he did this for the ſame reaſon that

Moſes did, viz. leſt the ſplendor of his countenance ſhould dazzle the eyes of his beholders. In ſome places he made a great many proſelytes, deluding the people with a number of juggling tricks which they ſwallowed as miracles, and particularly by cauſing the appearance of a moon to riſe out of a well for many nights together; whence he was alſo called in the Perſian tongue, *Sazendeh mah*, or the *moon-maker*. This wretch, not content with being reckoned a prophet, arrogated to himſelf divine honours; pretending that the Deity reſided in his perſon, having proceeded to him from Abu Moſlem, in whom he had taken up his reſidence before. At laſt this impoſtor raiſed an open rebellion again the khalif, and made himſelf maſter of ſeveral fortified places in Khoraſan, ſo that Al Mohdi was obliged to ſend one of his generals with an army againſt him. Upon the approach of the khalif's troops, Al Mokanna retired into one of his ſtrong fortreſſes which he had well provided for a ſiege; and ſent his emiſſaries abroad to perſuade the people that he raiſed the dead to life, and foretold future events.

6 Dreadful cataſtrophe of him and his family.

But being cloſely beſieged by the khalif's forces, and ſeeing no poſſibility of eſcaping, he gave poiſon in wine to his whole family and all that were with him in the caſtle; when they were dead, he burnt their bodies, together with all their furniture, proviſions, and cattle; and laſtly, he threw himſelf into the flames, or, as others ſay, into a tub of aqua-fortis, or ſome other preparation, which conſumed every part of him except the hair. When the beſiegers therefore entered the place, they found no living creature in it, except one of Al Mokanna's concubines, who, ſuſpecting his deſign, had hid herſelf, and now diſcovered the whole matter. This terrible contrivance, however, failed not to produce the deſired effect. He had promiſed his followers, that his ſoul ſhould tranſmigrate into the form of an old man, riding on a greyiſh coloured beaſt, and that after ſo many years he would return and give them the earth for their poſſeſſion; which ridiculous expectation kept the ſect in being for ſeveral years.

7 Harun Alraſhid's ſucceſs againſt the Greeks.

All this time war had been carried on with the Greeks, but without any remarkable ſucceſs on either ſide. In the 164th year of the Hegira, however, Al Mohdi ordered his ſon Harun Al Raſhid to penetrate into the Greek territories with an army of 95,000 men. Harun, then, having entered the dominions of the empreſs Irene, defeated one of her commanders that advanced againſt him; after which he laid waſte ſeveral of the imperial provinces with fire and ſword, and even threatened the city of Conſtantinople itſelf. By this the empreſs was ſo terrified, that ſhe purchaſed a peace with the khalif by paying him an annual tribute of 70,000 pieces of gold; which, for the preſent at leaſt, delivered her from the depredations of theſe barbarians. After the ſigning of the treaty, Harun returned

8 Unaccountable darkneſs.

home laden with ſpoil and glory. This year, according to ſome of the oriental hiſtorians, the ſun, one day, a little after his riſing, totally loſt his light in a moment, without being eclipſed, when neither any fog nor any cloud of duſt appeared to obſcure him. This frightful darkneſs continued till noon, to the great aſtoniſhment of the people ſettled in the countries where it happened*.

9 Al Mohdi poiſoned.

In the 169th year of the Hegira, Al Mohdi was poiſoned, though undeſignedly, by one of his concubines named *Haſanah*. She had deſigned to deſtroy one of her rivals, whom ſhe imagined to have too great an aſcendant over the khalif, by giving her a poiſoned pear. This the latter, not ſuſpecting any thing, gave to the khalif; who had no ſooner eaten it than he felt himſelf in exquiſite torture, and ſoon after expired.

10 As likewiſe his ſucceſſor Al Hadi.

On the death of Al Mohdi, he was ſucceeded by his eldeſt ſon Al Hadi; who having formed a deſign to deprive his younger brother Harun Al Raſhid of his right of ſucceſſion, and even to aſſaſſinate him, was poiſoned by his vizier in the 170th year of the Hegira; and on his death the celebrated khalif Harun Alraſhid aſcended the throne.

11 Harun Al-Raſhid khalif.

This was one of the beſt and wiſeſt princes that ever ſat on the throne of Bagdad. He was alſo extremely fortunate in all his undertakings, tho' he did not much extend his dominions by conqueſt. In his time the Moſlem empire may be ſaid to have been in its moſt flouriſhing ſtate, though, by the independency of the Moſlems in Spain, who had formerly ſet up a khalif of the houſe of Ommiyah, his territories were not quite ſo extenſive as thoſe of ſome of his predeceſſors.

12 Extent of his empire.

He poſſeſſed the provinces of Syria, Paleſtine, Arabia, Perſia, Armenia, Natolia, Media or *Aderbijan*, Babylonia, Aſſyria, Sindia, Sijiſtan, Khoraſan, Tabreſtan, Jorjan, Zableſtan, or *Sableſtan*, Mawaralnahr, or *Great Bukharia*, Egypt, Lybia, Mauritania, &c.; ſo that his empire was by far the moſt powerful of any in the world, and extended farther than the Roman empire ever had done.

13 He finds a ring he had thrown into the Tigris.

The firſt inſtance of Harun's good fortune, and which was taken for a preſage of a proſperous and happy reign, was his finding a valuable ring which he had thrown into the Tigris to avoid being deprived of it by his brother Al Hadi. He was able to give the divers no other direction than by throwing a ſtone from the bridge of Bagdad, about the ſame place of the river in which he had thrown the ring: notwithſtanding which, they found it without any great difficulty.

14 Divides the empire among his ſons, and ſettles the ſucceſſion.

In the 186th year of the Hegira, beginning January 10th, 802, the khalif divided the government of his extenſive dominions among his three ſons in the following manner: To Al Amin the eldeſt, he aſſigned the provinces of Syria, Irak, the three Arabias, Meſopotamia, Aſſyria, Media, Paleſtine, Egypt, and all that part of Africa extending from the confines of Egypt and Ethiopia to the ſtraits of Gibraltar, with the dignity of khalif; to Al Mamun the ſecond, he aſſigned Perſia, Kerman, the Indies, Khoraſan, Tabreſtan, Cableſtan and Zableſtan, together with the vaſt province of Mawaralnahr; and to his third ſon Al Kaſem, he gave Armenia, Natolia, Jorjan, Georgia, Circaſſia, and all the Moſlem territories bordering upon the Euxine ſea. As to the order of ſucceſſion, Al Amin was to aſcend the throne immediately after his father's deceaſe; after him Al Mamun; and then Al Kaſem, whom he had ſurnamed *Al Mutaman*.

15 His ſucceſsful wars with the Greeks.

The moſt conſiderable exploits performed by this khalif were againſt the Greeks, who by their perfidy provoked him to make war upon them, and whom he always overcame. In the 187th year of the Hegira, the khalif received a letter from the Greek emperor

Neciphorus

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*See *Aſtronomy*, nº 57 and 486.

Nicephorus ſoon after he had been advanced to the imperial dignity, commanding him to return all the money he had extorted from the empreſs Irene, though that had been ſecured to him by the laſt treaty concluded with that princeſs, or expect ſoon to ſee an imperial army in the heart of his territories. This inſolent letter ſo exaſperated Harun, that he immediately aſſembled his forces and advanced to Heraclea, laying the country through which he paſſed waſte with fire and ſword. For ſome time alſo he kept that city ſtraitly beſieged; which ſo terrified the Greek emperor, that he ſubmitted to pay an annual tribute. Upon this Harun granted him a peace, and returned with his army. But a hard froſt ſoon after happening in theſe parts, Nicephorus took for granted that Al Raſhid would not pay him another viſit, and therefore broke the treaty he had concluded. Of this the khalif receiving advice, he inſtantly put himſelf in motion; and, notwithſtanding the inclemency of the weather, forced the emperor to accept of the terms propoſed. According to a Perſian hiſtorian, before the hoſtilities at this time commenced, Nicephorus made the khalif a preſent of ſeveral fine ſwords, giving him thereby plainly to underſtand that he was more inclinable to come to blows than to make peace with him. All theſe ſwords Harun cut aſunder with his famous ſword *Samſamah*, as if they had been ſo many radiſhes, after which ſevere proof there did not appear the leaſt flaw in the blade; a clear proof of the goodneſs of the ſword, as the cutting the others with it was of the ſtrength of Harun's arm. This ſword had fallen into Al Raſhid's hands among the ſpoils of Ebn Dakikan, one of the laſt Hamyaritic princes of Yaman; but is ſaid to have belonged originally to a valiant Arab named *Amru Ebn Maadi Carb*, by whoſe name it generally went among the Moſlems. This man is ſaid to have performed very extraordinary feats with his ſword, which induced a certain prince to borrow it from him; but he not being able to perform any thing remarkable with it, complained to Amru that it had not the deſired effect: upon which that brave man took the liberty to tell him, that he had not ſent his arm along with his ſword.

In the 188th year of the Hegira, war was renewed with the Greeks, and Nicephorus with a great army attacked the khalif's forces with the utmoſt fury. He was, however, defeated with the loſs of 40,000 men, and received three wounds in the action; after which the Moſlems committed terrible ravages in his territories, and returned home laden with ſpoils. The next year Harun invaded Phrygia; defeated an imperial army ſent to oppoſe him; and having ravaged the country, returned without any conſiderable loſs. In the 190th year of the Hegira, commencing November 27th, 805, the khalif marched into the Imperial territories with an army of 135,000 men, beſides a great number of volunteers and others who were not inrolled among his troops. He firſt took the city of Heraclea, from whence he is ſaid to have carried 16,000 priſoners; after which he made himſelf maſter of ſeveral other places; and, in the concluſion of the expedition, he made a deſcent on the iſland of Cyprus, which he plundered in a terrible manner. This ſucceſs ſo intimidated Nicephorus, that he immediately ſent the tribute due to Harun, the withholding of which had been the cauſe of the war; and concludes a peace upon the khalif's own terms; one of which was, that the city of Heraclea ſhould never be rebuilt. This perhaps Harun would not have ſo readily granted, had not one Raſe Ebn Al Leith revolted againſt him at Samarcand, and aſſembled a conſiderable force to ſupport him in his defection.

16
Rebellion in Khoraſan.

The next year, being the 191ſt of the Hegira, the khalif removed the governor of Khoraſan from his employment becauſe he had not been ſufficiently attentive to the motions of the rebel Raſe Ebn Al Leith. As this governor had alſo tyrannized over his ſubjects in the moſt cruel manner, his ſucceſſor no ſooner arrived than he ſent him in chains to the khalif: but notwithſtanding all Harun's care, the rebels made this year a great progreſs in the conqueſt of Khoraſan.

Next year, the khalif found it neceſſary to march in perſon againſt the rebels, who were daily becoming more formidable. The general rendezvous of his troops was in the plains of Rakka, from whence he advanced at the head of them to Bagdad. Having at that place ſupplied the troops with every thing neceſſary, he continued his march to the frontiers of Jorjan, where he was ſeized with an illneſs which grew more violent after he had entered that province. Finding himſelf therefore unable to purſue his journey, he reſigned the command of the army to his ſon Al Mamun, retiring himſelf to Tus in Khoraſan.

17
The khalif's death predicted by a dream.

We are told by Khondemir, that, before the khalif departed from Rakka, he had a dream wherein he ſaw a hand over his head full of red earth, and at the ſame time heard a perſon pronouncing theſe words, "See the earth where Harun is to be buried." Upon this he demanded where he was to be buried; and was inſtantly anſwered, "At Tus." This dream greatly diſcompoſing him, he communicated it to his chief phyſician, who endeavoured to divert him, telling the khalif that the dream had been occaſioned by the thoughts of his expedition againſt the rebels. He therefore adviſed him to purſue ſome favourite diverſion that might draw his attention another way. The khalif accordingly, by his phyſician's advice, prepared a magnificent regale for his courtiers, which laſted ſeveral days. After this, he put himſelf at the head of his forces, and advanced to the confines of Jorjan, where he was attacked by the diſtemper that proved fatal to him. As his diſorder increaſed, he found himſelf obliged to retire to Tus; where being arrived, he ſent for his phyſician, and ſaid to him, "Gabriel, do you remember my dream at Rakka? we are now arrived at Tus, the place, according to what was predicted in that dream, of my interment. Send one of my eunuchs to fetch me a handful of earth in the neighbourhood of this city." Upon this, *Maſrur*, one of his favourite eunuchs, was diſpatched to bring a little of the ſoil of the place to the khalif. He ſoon returned, and brought a handful of red earth, which he preſented to the khalif with his arm half bare. At the ſight of this, Harun inſtantly cried out, "In truth this is the earth, and this the very arm, that I ſaw in my dream."

18
He dies according to the prediction.

His ſpirits immediately failing, and his malady being greatly increaſed by the perturbation of mind enſuing upon this ſight, he died three days after, and was buried in the ſame place. According to Abul Faraj, Baſhir Ebn Al Leith the arch-rebel's brother, was brought in chains to the khalif, who was then at the point of death. At the ſight of whom Harun declared, that if he could ſpeak only two words he would ſay *kill him*; and immediately ordered him to be cut to pieces in his preſence. This being done, the khalif ſoon after expired, in the year of the Hegira 193, having reigned 23 years. The diſtemper that put an end to his days is ſaid to have been the bloody flux.

19 Succeeded by his ſon Al Amin.

Upon the arrival of a courier from Tus, with the news of Al Raſhid's death, his ſon Al Amin was immediately proclaimed khalif; and was no ſooner ſeated on the throne, than he formed a deſign of excluding his brother Al Mamun from the ſucceſſion. Accordingly he deprived him of the furniture of the imperial palace of Khoraſan; and in open violation of his father's will, who had beſtowed on Al Mamun the perpetual government of Khoraſan; and of all the troops in that province, he ordered theſe forces to march directly to Bagdad. Upon the arrival of this order, Al Mamun expoſtulated with the general Al Fadl Ebn Rabi who commanded his troops, and endeavoured to prevent his marching to Bagdad; but without effect, for he punctually obeyed the orders ſent by the khalif. Al Mamun, however, took care not to be wanting in fidelity to his brother. He obliged the people of Khoraſan to take an oath of fidelity to Al Amin, and reduced ſome who had actually excited a conſiderable body of the people to revolt, while the general Al Fadl having ingratiated himſelf with the khalif by his ready compliance with his orders, was choſen prime vizir, and governed with an abſolute ſway; Al Amin abandoning himſelf entirely to drunkenneſs.

20 Infamous behaviour of the new khalif.

Al Fadl was a very able miniſter; though fearing Al Mamun's reſentment if ever he ſhould aſcend the throne, he gave Al Amin ſuch advice as proved in the end the ruin of them both. He told him that his brother had gained the affection of the people of Khoraſan by the good order and police he had eſtabliſhed among them; that his unwearied application to the adminiſtration of juſtice had ſo attracted their eſteem, that the whole province was entirely at his devotion; that his own conduct was by no means reliſhed by his ſubjects, whoſe minds were almoſt totally alienated from him; and therefore that he had but one part to act, which was to deprive Al Mamun of the right of ſucceſſion that had been given him by his father, and transfer it to his own ſon Muſa, though then but an infant. Agreeable to this pernicious advice, the khalif ſent for his brother Al Kaſem from from Meſopotamia, and recalled Al Mamun from Khoraſan, pretending he had occaſion for him as an aſſiſtant in his councils.

21 Al Mamun takes up arms againſt his brother.

By this treatment Al Mamun was ſo much provoked, that he reſolved to come to an open rupture with his brother, in order, if poſſible, to fruſtrate his wicked deſigns. Inſtead, therefore, of going to Bagdad as he had been commanded, he cut off all communication between his own province and that capital; pretending, that as his father Harun had aſſigned him the lieutenancy of Khoraſan, he was reſponſible for all the diſorders that might happen there during his abſence. He alſo coined money, and would not ſuffer Al Amin's name to be impreſſed upon any of the dirhems or dinars ſtruck in that province. Not content with this, he prevailed upon Rafe' Ebn Al Leith, who had been for ſome time in rebellion, to join him with a body of troops; whoſe example was ſoon after followed by Harthema Ebn Aafan; which put him in poſſeſſion of all the vaſt territory of Khoraſan. Here he governed with an abſolute ſway, officiated in the moſque as *Iman*, and from the pulpit conſtantly harangued the people.

The following year, being the 195th year of the Hegira, beginning October 4th, 810, the khalif Al Amin, finding that his brother ſet him at defiance, declared war againſt him, and ſent his general Ali Ebn Iſa with an army of 60,000 men to invade Khoraſan. Al Mamun, being informed that Ali was advancing againſt him with ſuch a powerful army, put on foot all the troops he could raiſe, and gave the command to Thaher Ebn Hoſein, one of the greateſt generals of his age. Thaher being a man of undaunted reſolution, choſe only 4000 men, whom he led againſt Al Amin's army. Ali, ſeeing ſo ſmall a number of troops advancing againſt him, was tranſported with joy, and promiſed himſelf an eaſy victory. Deſpiſing his enemies, therefore, he behaved in a ſecure and careleſs manner; the conſequence of which was, that his army was entirely defeated, and himſelf killed, his head being afterwards ſent as a preſent to Al Mamun, who amply rewarded Thaher and Harthema for their ſervices.

22 Al Amin's forces defeated.

After this victory, Al Mamun aſſumed the title of *khalif*, ordered Al Amin's name to be omitted in the public prayers, and made all neceſſary preparations for carrying the war into the very heart of his brother's dominions. For this purpoſe he divided his forces into two bodies, and commanded them to march into Irak by different routes. One of them obeyed the orders of Thaher, and the other of Harthema. The firſt directed his march towards Ahwas, and the other towards Holwan, both of them propoſing to meet in the neighbourhood of Bagdad, and after their junction to beſiege that city.

23 Al Mamun's rapid conqueſts.

In the 196th year of the Hegira, Thaher Ebn Hoſein made a moſt rapid progreſs with the troops under his command. Having advanced towards Ahwas, he there defeated a body of the khalif's forces; and though the victory was by no means deciſive, it ſo intimidated the commander of Ahwas, that he thought fit to ſurrender that fortreſs to him. This opened him a way to Waſet upon the Tigris, and facilitated the conqueſt of that place. After this he marched with his army to Al Madayen; the inhabitants of which immediately opened their gates to him. The rapidity of theſe conqueſts, and the infamous conduct of Al Amin, excited the people of Egypt, Syria, Hejaz, and Yaman, unanimouſly to declare for Al Mamun; who was accordingly proclaimed khalif in all theſe provinces.

24 Siege of Bagdad.

The next year, Al Mamun's forces under Thaher and Harthema laid ſiege to Bagdad. As the khalif was ſhut up in that place, and it had a numerous garriſon, the beſieged made a vigorous defence, and deſtroyed a great number of their enemies. The beſiegers, however, inceſſantly played upon the town with their catapults and other engines, though they were in their turn not a little annoyed by the garriſon with the ſame ſort of military machines. The latter likewiſe made continual ſallies, and fought like men in deſpair, though they were always at laſt beaten back into the town with conſiderable loſs. In ſhort, the ſiege continued during the whole of this year, in which the greateſt part of the eaſtern city, called the *Camp of Al Mohdi*, was demoliſhed or reduced to aſhes. The citizens, as well as the garriſon, were reduced to the laſt extremity by the length and violence of the ſiege.

25
Al Amin murdered.

In the beginning of the 198th year of the Hegira, Al Amin finding himſelf deſerted by his troops, as well as by the principal men of Bagdad, who had kept a private correſpondence with Thaher, was obliged to retire to the old town on the weſt bank of the Tigris. He did not, however, take this ſtep, before the inhabitants of the new town had formally depoſed him, and proclaimed his brother Al Mamun khalif. Thaher, receiving advice of this, cauſed the old town to be immediately inveſted, planted his engines againſt it, and at laſt ſtarved it to a ſurrender. Al Amin being thus reduced to the neceſſity of putting himſelf into the hands of one of the generals, choſe to implore the protection of Harthema, whom he judged to be of a more humane diſpoſition than Thaher. Having obtained this, he embarked in a ſmall veſſel in order to arrive at that part of the camp where Harthema was poſted; but Thaher being informed of his deſign, which, if put in execution, he thought would eclipſe the glory he had acquired, laid an ambuſh for him, which he had not the good fortune to eſcape. Upon his arrival in the neighbourhood of Harthema's tent, Thaher's ſoldiers ruſhed upon him, drowned all his attendants, and put himſelf in priſon. Here he was ſoon after maſſacred by Thaher's ſervants, who carried his head in triumph to their maſter, by whoſe order it was afterwards expoſed to public view in the ſtreets of Bagdad. Thaher afterwards ſent it to Al Mamun in Khoraſan, together with the ring or ſeal of the khalifat, the ſceptre, and the imperial robe. At the ſight of theſe, Al Mamun fell down on his knees, and returned thanks to God for his ſucceſs; making the courier who brought them a preſent of a million of dirhems, in value about L. 100,000 Sterling.

26
Succeeded by Al Mamun.

27
Khoraſan diſmembered from the empire.

The ſame day that Al Amin was aſſaſſinated, his brother Al Mamun was proclaimed khalif at Bagdad. He had not been long ſeated on the throne when he was alarmed by rebellions breaking out in different parts of the empire. Theſe, however, were at laſt happily extinguiſhed; after which, Thaher Ebn Hoſein had the government of Khoraſan conferred upon him and his deſcendants with almoſt abſolute and unlimited power. This happened in the 205th year of the Hegira, from which time we may date the diſmemberment of that province from the empire of the khalifs.

28
Death of Al Mamun

During the reign of this khalif nothing remarkable happened; only the African Moſlems invaded the iſland of Sicily, where they made themſelves maſters of ſeveral places. He died of a ſurfeit in the 218th year of the Hegira, having reigned 20, and lived 48 or 49 years.

29
War between the new khalif Al Motaſem and Babec.

On the death of Al Mamun, his brother Al Motaſem, by ſome of the oriental hiſtorians ſurnamed *Billah*, was ſaluted khalif. He ſucceeded by virtue of Al Mamun's expreſs nomination of him to the excluſion of his own ſon Al Abbas and his other brother Al Kaſem who had been appointed by Harun Al Raſhid. In the beginning of his reign he was obliged to employ the whole forces of his empire againſt one Babec, who had been for a conſiderable time in rebellion in Perſia and Perſian Irak. This Babec firſt appeared in the year of the Hegira 201, when he began to take upon him the title of a *prophet*. What his particular doctrine was, is now unknown; but his religion is ſaid to have differed from all others then known in Aſia. He gained a great number of proſelytes in Aderbijan and the Perſian Irak, where he ſoon grew powerful enough to wage war with the khalif Al Mamun, whoſe troops he often beat, ſo that he was now become extremely formidable. The general ſent by Al Motaſem to reduce him was Haider Ebn Kaus, ſurnamed *Afſhin*, a Turk by nation, who had been brought a ſlave to the khalif's court, and having been employed in diſciplining the Turkiſh militia there, had acquired the reputation of a great captain. By him Babec was defeated with prodigious ſlaughter, no fewer than 60,000 men being killed in the firſt engagement. The next year, being the 220th of the Hegira, he received a ſtill greater overthrow, loſing 100,000 men either killed or taken priſoners. By this defeat he was obliged to retire into the Gordyæan mountains; where he fortified himſelf in ſuch a manner, that Afſhin found it impoſſible to reduce him till the year of the Hegira 222. This commander having reduced with invincible patience all Babec's caſtles one after another, the impoſtor was obliged to ſhut himſelf up in a ſtrong fortreſs called *Caſbabad*, which was now his laſt reſource. Here he defended himſelf with great bravery for ſeveral months; but at laſt finding he ſhould be obliged to ſurrender, he made his eſcape into a neighbouring wood, from whence he ſoon after came to Afſhin, upon that general's promiſſing him pardon. But Afſhin no ſooner had him in his power, than he firſt cauſed his hands and feet, and afterwards his head, to be cut off. Babec had ſupported himſelf againſt the power of the khalifs for upwards of 20 years, during which time he had cruelly maſſacred 250,000 people; it being his cuſtom to ſpare neither man, woman, nor child, of the Mahometans or their allies. Amongſt the priſoners taken at Caſbabad there was one Nud, who had been one of Babec's executioners, and who owned that in obedience to his maſter's commands he had deſtroyed 20,000 Moſlems with his own hands; to which he added, that vaſt numbers had alſo been executed by his companions, but that of theſe he could give no preciſe account.

30
Babec defeated.

31
Taken priſoner and put to death

32
He deſtroyed vaſt numbers of Moſlems.

In the 223d year of the Hegira, the Greek emperor Theophilus invaded the khalif's territories, where he behaved with the greateſt cruelty, and by deſtroying Sozopetra the place of Al Motaſem's nativity, notwithſtanding his earneſt intreaties to the contrary, occaſioned the terrible deſtruction of *Amorium* mentioned under that article. The reſt of this khalif's reign is remarkable for nothing but the execution of Afſhin, who was accuſed of holding correſpondence with the khalif's enemies. After his death a great number of idols were found in his houſe, which were immediately burned, as alſo ſeveral books ſaid to contain impious and deteſtable opinions.

33
Death of Al Motaſem.

In the 227th year of the Hegira died the khalif Al Motaſem, in the 48th or 49th year of his age. He reigned eight years eight months and eight days, was born in the eighth month of the year, fought eight battles had 8000 ſlaves, and had 8,000,000 dinars and 80,000 dirhems in his treaſury at his death, whence the oriental hiſtorians give him the name of *Al Mothamen*, or the *Octonary*. He is ſaid to have been ſo robuſt, that he once carried a burden of 1000 pounds weight ſeveral paces. As the people of Bagdad diſturbed him with frequent

Badgad.

34
He built the city of Sarra Manray.

frequent revolts and commotions, he took the reſolution to abandon that city, and build another for his own reſidence. The new city he built was firſt called *Samarra*, and afterwards *Sarra Manray*, and ſtood in the Arabian Irak. He was attached to the opinion of the Motazalites, who maintain the creation of the Koran; and both he and his predeceſſor cruelly perſecuted thoſe who believed it to be eternal.

35
His ſucceſſors Al Wathek and Al Motowakkel.

Al Motaſem was ſucceeded by Al Wathek Billah, who the following year, being the 228th of the Hegira, invaded and conquered Sicily. Nothing remarkable happened during the reſt of his reign; he died in the 232d year of the Hegira, and was ſucceeded by his brother Al Motawakkel.

56
Monſtrous cruelty of Al Motowakkel.

The new khalif began his reign with an act of the greateſt cruelty. The late khalif's vizir having treated Al Motawakkel ill in his brother's lifetime, and oppoſed his election to the khalifat, was on that account now ſent to priſon. Here the khalif ordered him to be kept awake for ſeveral days and nights together: after this, being ſuffered to fall aſleep, he ſlept a whole day and night; and after he awoke was thrown into an iron furnace lined with ſpikes or nails heated red hot, where he was miſerably burnt to death. During this reign nothing remarkable happened, except wars with the Greeks, which were carried on with various ſucceſs. In the year 859 too, being the 245th of the Hegira, violent earthquakes happened in many provinces of the Moſlem dominions; and the ſprings at Mecca failed to ſuch a degree, that the celebrated well Zemzem was almoſt dried up, and the water ſold for 100 dirhems a bottle.

37
He is aſſaſſinated.

38
Hard fate of Al Motazz a ſucceeding khalif.

In the 247th year of the Hegira, the khalif was aſſaſſinated at the inſtance of his ſon Al Montaſer; who ſucceeded him, and died in ſix months after. He was ſucceeded by Al Moſtain, who in the year of the Hegira 252 was forced to abdicate the throne by his brother Al Motazz, who afterwards cauſed him to be privately murdered. He did not long enjoy the dignity of which he had ſo iniquitouſly poſſeſſed himſelf; being depoſed by the Turkiſh militia (who now began to ſet up and depoſe khalifs as they pleaſed) in the 255th year of the Hegira. After his depoſition, he was ſent under an eſcort from Sarra Manray to Bagdad, where he died of thirſt or hunger, after a reign of four years and about ſeven months. The fate of this khalif was peculiarly hard: the Turkiſh troops had mutinied for their pay; and Al Motazz, not having money to ſatisfy their demands, applied to his mother named *Kabiha* for 50,000 dinars. This ſhe refuſed, telling him that ſhe had no money at all, although it afterwards appeared that ſhe was poſſeſſed of immenſe treaſures. After his depoſition, however, ſhe was obliged to diſcover them, and even depoſite them in the hands of the new khalif Al Mokhtadi. They conſiſted of 1,000,000 dinars, a buſhel of emeralds, and another of pearls, and three pounds and three quarters of rubies of the colour of fire.

39
Irruption of the Zenjians in the reign of Al-Mokhtadi.

Al Mokhtadi, the new khalif, was the ſon of one of Al Wathek's concubines named *Korb*, or *Karb*, who is by ſome ſuppoſed to have been a Chriſtian. The beginning of his reign is remarkable for the irruption of the Zenjians, a people of Nubia, Ethiopia, and the country of Caffres, into Arabia, where they penetrated into the neighbourhood of Baſra and Cufa. The chief of this gang of robbers, who according to ſome of the Arab hiſtorians, differed but little from wild beaſts, was Ali Ebn Mohammed Ebn Abdalrahman, who falſely gave himſelf out to be of the family of Ali Ebn Abu Taleb. This made ſuch an impreſſion upon the Shiites in thoſe parts, that they flocked to him in great numbers; which enabled him to ſeize upon the cities of Baſra and Ramla, and even to paſs the Tigris at the head of a formidable army. He then took the title of *Prince of the Zenjians*, in order to ingratiate himſelf with thoſe barbarians, of whom his army was principally compoſed.

Bagdad.

30
Al Habib's ſucceſs.

In the 256th year of the Hegira, Al Mokhtadi was barbarouſly murdered by the Turks who had raiſed him to the throne, and was ſucceeded by Al Montamed the ſon of Al Motawakkel. This year the prince of the Zenjians, Ali, or as he is alſo called, *Al Habib*, made incurſions to the very gates of Bagdad, doing prodigious miſchief wherever he paſſed. The khalif therefore ſent againſt him one Jolan with a conſiderable army; he was overthrown, however, with very great ſlaughter by the Zenjian, who made himſelf maſter of 24 of the khalif's largeſt ſhips in the bay of Baſra, put a vaſt number of the inhabitants of Obolla to the ſword, and ſeized upon the town. Not content with this, he ſet fire to it, and ſoon reduced it to aſhes, the houſes moſtly conſiſting of the wood of a certain plane-tree called by the Arabians *Saj*. From thence he marched to Abadan, which likewiſe ſurrendered to him. Here he found an immenſe treaſure, which enabled him to poſſeſs him of the whole diſtrict of Ahwaz. In ſhort, his forces being now increaſed to 80,000 ſtrong, moſt of the adjacent territories, and even the khalif's court itſelf, were ſtruck with terror.

In the 257th year of the Hegira, Al Habib continued victorious, defeated ſeveral armies ſent againſt him by the khalif, reduced the city of Baſrah, and put 20,000 of the inhabitants to the ſword. The following year, the khalif, ſupported by his brother Al Mowaffek, had formed a deſign of circumſcribing the power of the Turkiſh ſoldiery, who had for ſome time given law to the khalifs themſelves. But this year the Zenjians made ſo rapid a progreſs in Perſia, Arabia, and Irak, that he was obliged to ſuſpend the execution of his deſign, and even to employ the Turkiſh troops to aſſiſt his brother Al Mowaffek in oppoſing theſe robbers. The firſt of the khalif's generals who encountered Al Habib this year, was defeated in ſeveral engagements, and had his army at laſt entirely deſtroyed. After this Al Mowaffek and another general named *Moſleh* advanced againſt him. In the firſt engagement Moſleh being killed by an arrow, the khalif's troops retired; but Al Mowaffek put them afterwards in ſuch a poſture of defence, that the enemy durſt not renew the attack. Several other ſharp encounters happened this year, in which neither party gained great advantage; but, at laſt, ſome contagious diſtempers breaking out in Al Mowaffek's army, he was obliged to conclude a truce, and retire to Waſet to refreſh his troops.

In the 259th year of the Hegira, commencing Nov. 7th, 872, the war between the khalif and Al Habib ſtill continued. Al Mowaffek, upon his arrival at Bagdad, ſent Mahammed, ſurnamed *Al Mowalled*, with a powerful army to act againſt the Zenjians: but he could not hinder them from ravaging the province of Ahwaz, cutting off about 50,000 of the khalif's ſubjects, and diſmantling the city of Ahwas; and notwithſtanding the utmoſt efforts of all the khalif's generals, no conſiderable advantages could be gained either this or the following year.

41 Rebellion in Fars, Ahwas, and Baſra.

In the 261ſt year of the Hegira, beginning October 16th, 874, Mohammed Ebn Waſel, who had killed the khalif's governor of Fars, and afterwards made himſelf maſter of that province, had ſeveral engagements with Al Habib, but with what ſucceſs is not known. The khalif, having been apprized of the ſtate of affairs on that ſide, annexed the government of Fars, Ahwas, and Baſra, to the prefecture he had given to Muſa Ebn Boga, whom he looked upon as one of the beſt generals he had. Muſa, ſoon after his nomination to that poſt, ſent Abdalrahman Ebn Moſleh as his deputy to Ahwas, giving him as a colleague and aſſiſtant one Tiſam, a Turk. Mohammed Ebn Waſel, however, refuſing to obey the orders of Abdalrahman and Tiſam; a fierce conflict enſued, in which the latter were defeated, and Abdalrahman taken priſoner. After this victory, Mohammed advanced againſt Muſa Ebn Boga himſelf; but that general, finding he could not take poſſeſſion of his new government without a vaſt effuſion of blood, recalled the deputies from their provinces, and made the beſt of his way to Sarra Manray. After this, Yakub Ebn Al Leit, having taken Khoraſan from the deſcendants of Thaher, attacked and defeated Mohammed Ebn Waſel, ſeizing on his palace, where he found a ſum of money amounting to 40,000,000 dirhems.

42 Rebels defeated, but cannot be reduced.

The next year Yakub Ebn Al Leit being grown formidable by the acquiſition of Ahwas and a conſiderable portion of Fars, or at leaſt the Perſian Irak, declared war againſt the khalif. Againſt him Al Motamed diſpatched Al Mowaffek; who having defeated him with prodigious ſlaughter, plundered his camp, and purſued him into Khoraſan; where meeting with no oppoſition, he entered Niſabur, and releaſed Mahomet the Thaherian, whom Yakub had detained in priſon three years. As for Yakub himſelf, he made his eſcape with great difficulty, tho' he and his family continued ſeveral years in poſſeſſion of many of the conqueſts he had made. This war with Yakub proved a ſeaſonable diverſion in favour of Al Habib, who this year defeated all the forces ſent againſt him, and ravaged the diſtrict of Waſet.

43 Al Habib ſtill victorious.

The following year, being the 263d of the Hegira, beginning September 24th, 876, the khalif's forces, under the command of Ahmed Ebn Lebuna, gained two conſiderable advantages over Al Habib; but being at laſt drawn into an ambuſcade, they were almoſt totally deſtroyed, their general himſelf making his eſcape with the utmoſt difficulty; nor were the khalif's forces able, during the courſe of the next year, to make the leaſt impreſſion upon theſe rebels.

44 Rebellion in Egypt which cannot be ſuppreſſed.

In the 265th year of the Hegira, beginning September 3d, 878, Ahmed Ebn Tolun rebelled againſt the khalif, and ſet up for himſelf in Egypt. Having aſſembled a conſiderable force, he marched to Antioch, and beſieged Sima the governor of Aleppo, and all the provinces known among the Arabs, by the name of *Al Awaſem* in that city. As the beſieged found that he was reſolved to carry the place by aſſault, they thought fit, after a ſhort defence, to ſubmit, and to put Sima into his hands. Ahmed no ſooner had that officer in his power, than he cauſed him to be beheaded; after which he advanced to Aleppo, the gates of which were immediately opened unto him. Soon after, he reduced Damaſcus, Hems, Hamath, Kinniſrin, and Al Rakka, ſituated upon the eaſtern bank of the Euphrates. This rebellion ſo exaſperated Al Motamed, that he cauſed Ahmed to be publicly curſed in all the moſques belonging to Bagdad and Irak; and Ahmed on his part ordered the ſame malediction to be thundered out againſt the khalif in all the moſques within his juriſdiction. This year alſo a detachment of Al Habib's troops penetrated into Irak, and made themſelves maſters of four of the khalif's ſhips laden with corn; then they advanced to Al Nomanic, laid the greateſt part of it in aſhes, and carried off with them ſeveral of the inhabitants priſoners. After this they poſſeſſed themſelves of Jarjaraya, where they found many priſoners more, and deſtroyed all the adjacent territory with fire and ſword. This year there were four independent powers in the Moſlem dominions, beſides the houſe of Ommiyah in Spain; viz. The African Moſlems, or Aglabites, who had for a long time acted independently; Ahmed in Syria and Egypt; Al Leit in Khoraſan; and Al Habib in Arabia and Irak.

45 Four independent powers in the khalif's nominal dominions.

In the 266th year of the Hegira, beginning Auguſt 23d, 879, Al Habib reduced Ramhormoz, burnt the ſtately moſque there to the ground, put a vaſt number of the inhabitans to the ſword, and carried away great numbers, as well as a vaſt quantity of ſpoil.—This was his laſt ſucceſsful campaign; for the year following, Al Mowaffek, attended by his ſon Abul Abbas, having attacked him with a body of 10,000 horſe, and a few infantry, notwithſtanding the vaſt diſparity of numbers (Al Habib's army amounting to 100,000 men), defeated him in ſeveral battles, recovered moſt of the towns he had taken, together with an immenſe quantity of ſpoil, and releaſed 5000 women that had been thrown into priſon by theſe barbarians. After theſe victories, Al Mowaffek took poſt before the city of Al Mabiya', built by Al Habib, and the place of his reſidence, burnt all the ſhips in the harbour; thoroughly pillaged the town; and then entirely diſmantled it. After the reduction of this place, in which he found immenſe treaſures, Al Mowaffek purſued the flying Zenjians, put ſeveral of their chiefs to the ſword, and advanced to Al Mokhtara, a city built by Al Habib. As the place was ſtrongly fortified, and Al Habib was poſted in its neighbourhood, with an army, according to Abu Jaafer Al Tabari, of 300,000 men, Al Mowaffek perceived that the reduction of it would be a matter of ſome difficulty. He therefore built a fortreſs oppoſite to it, where he erected a moſque, and coined money. The new city, from its founder, was called by the Arabs *Al Mowaffekkia*, and ſoon rendered conſiderable by the ſettlement of ſeveral wealthy merchants there. The city of Al Mokhtara being reduced to great ſtraits was at laſt taken by ſtorm, and given up to be plundered by the khalif's troops; after which Al Mowaffek defeated the numerous forces of Al Habib in ſuch a manner, that they could no more be rallied during that campaign.

46 Al Habib's bad ſucceſs and death.

The following year, being the 268th of the Hegira, Al Mowaffek penetrated again into Al Mabiya', and demoliſhed the fortifications which had been raiſed ſince its former reduction, though the rebels diſputed every inch of ground. Next year he again attacked Al Habib with great bravery; and would have entirely defeated him, had he not been wounded in the breaſt with an arrow, which obliged him to ſound a retreat. However, as ſoon as he was cured of his wound, Al Mowaffek advanced a third time to Al Mabiya', made himſelf maſter of that metropolis, threw down the walls that had been raiſed, put many of the inhabitants to the ſword, and carried a vaſt number of them into captivity.

The 27th year of the Hegira, commencing July 11th, 883, proved fatal to the rebel Al Habib. Al Mowaffek made himſelf a fourth time maſter of Al Mabiya', burnt all Habib's palace, ſeized upon his family, and ſent them to Sarra Manray. As for the uſurper himſelf, he had the good fortune to eſcape at this time; but being cloſely purſued by Al Mowaffek into the province of Ahwas, where the ſhattered remains of his forces were entirely defeated, he at laſt fell into the hands of the victor, who ordered his head to be cut off, and carried through a great part of that region which he had ſo long diſturbed. By this complete victory Al Mowaffek obtained the title of *Al Naſir Lidmilbah*, that is, *the protector of Mahometaniſm*. This year alſo died Ahmed Ebn Tolun, who had ſeized upon Egypt and Syria, as we have already obſerved; and was ſucceeded by his ſon *Khamarawiyah*.

47
Succeſs of the ſultan of Egypt.

The next year, a bloody engagement happened between the khalif's forces commanded by Al Mowaffek's ſon, and thoſe of Khamarawiyah, who had made an irruption into the khalif's territories. The battle was fought between Al Ramla and Damaſcus. In the beginning, Khamarawiyah found himſelf ſo hard preſſed, that his men were obliged to give way; upon which, taking for granted that all was loſt, he fled with great precipitation, even to the borders of Egypt; but, in the mean time, his troops being ignorant of the flight of their general, returned to the charge, and gained a complete victory. After this, Khamarawiyah, by his juſt and mild adminiſtration, ſo gained the affections of his ſubjects, that the khalif found it impoſſible to gain the leaſt advantage over him. In the 276th year of the Hegira, he overthrew one of the khalif's generals named Abul Saj, at Al Bathnia near the city of Damaſcus; after which he advanced to Al Rakka on the Euphrates, and made himſelf maſter of that place. Having annexed ſeveral large provinces to his former dominions, and left ſome of his friends in whom he could confide to govern them, he then returned into Egypt, the principal part of his empire, which now extended from the Euphrates to the borders of Nubia and Ethiopia.

48
Al Mowaffek dies.

49
Origin of the Karmatians.

The following year, being the 278th of the Hegira, was remarkable for the death of Al Mowaffek. He died of the elephantiaſis or leproſy; and while in his laſt illneſs, could not help obſerving, that of 100,000 men whom he commanded, there was not one ſo miſerable as himſelf. This year is alſo remarkable for the firſt diſturbances raiſed in the Moſlem empire by the Karmatians. The origin of this ſect is not certainly known; but the moſt common opinion is, that a poor fellow, by ſome called *Karmata*, came from Khuzeſtan to the villages near Cufa, and there pretended great ſanctity and ſtrictneſs of life, and that God had enjoined him to pray 50 times a-day; pretended alſo to invite people to the obedience of a certain Imam of the family of Mahomet; and this way of life he continued till he had made a very great party, out of whom he choſe twelve as his apoſtles to govern the reſt, and to propagate his doctrines. He alſo aſſumed the title of *prince*, and obliged every one of his earlier followers to pay him a dinar a-year. But Al Haidam, the governor of that province, finding men neglected their work, and their huſbandry in particular, to ſay thoſe 50 prayers a-day, ſeized the fellow, and having put him in priſon, ſwore that he ſhould die. This being overheard by a girl belonging to the governor, ſhe, out of compaſſion, took the key of the dungeon at night from under her maſter's head, releaſed the man, and reſtored the key to its place while her maſter ſlept. The next morning the governor found his priſoner gone; and the accident being publicly known, raiſed great admiration; Karmata's adherents giving out that God had taken him into heaven. After this he appeared in another province, and declared to a great number of people he got about him, that it was not in the power of any perſon to do him hurt; notwithſtanding which, his courage failing him, he retired into Syria, and was never heard of any more. After his diſappearance, the ſect continued and increaſed; his diſciples pretending that their maſter had manifeſted himſelf to be a true prophet, and had left them a new law, wherein he had changed the ceremonies and form of prayer uſed by the Moſlems, &c. From this year, 278, theſe ſectaries gave almoſt continual diſturbance to the khalifs and their ſubjects, committing great diſorders in Chaldæa, Arabia, and Meſopotamia, and at length eſtabliſhed a conſiderable principality.

50
Sultan of Egypt's daughter married to the khalif Al Motaded.

In the 279th year of the Hegira died the khalif Al Motamed; and was ſucceeded by Al Motaded, ſon to Al Mowaffek. The firſt year of his reign, Al Motaded demanded in marriage the daughter of Khamarawiyah, ſultan, or khalif, in Egypt; which was agreed to by him with the utmoſt joy, and their nuptials were ſolemnized with great pomp in the 282d year of the Hegira. He carried on a war with the Karmatians; but very unſucceſsfully, his forces being defeated with great ſlaughter, and his general Al Abbas taken priſoner. This khalif alſo granted to Harun, ſon to Khamarawiyah, the perpetual prefecture of Awaſam and Kinniſrin, which he annexed to that of Egypt and Syria, upon condition that he paid him an annual tribute of 45,000 dinars. He died in the year of the Hegira 289, and was ſucceeded by his ſon Al Moctaſi.

51
Egypt, &c. recovered by the khalif Al Moctaſi.

This khalif proved a warlike and ſucceſsful prince. He gained ſeveral advantages over the Karmatians, but was not able to reduce them. The Turks, however, having invaded the province of Mawarnalnahr, were defeated with great ſlaughter; after which, Al Moctaſi carried on a ſucceſsful war againſt the Greeks, from whom he took Seleucia. After this he invaded Syria and Egypt, which provinces he recovered from the houſe of Ahmed Ebn Tolun.

52
Diſtreſſed ſtate of the khalifs after his death.

The reduction of Egypt happened in the 292d year of the Hegira, after which the war was renewed with ſucceſs againſt the Greeks and Karmatians. The khalif died in the 295th year of the Hegira, after a reign of about ſix years and a half. He was the laſt of the khalifs who made any figure by their warlike exploits. His ſucceſſors Al Moktader, Al Kaher, and Al Radi, were ſo diſtreſſed by the Karmatians and numberleſs uſurpers who were every day ſtarting up, that by the 325th year of the Hegira, they had nothing left but the city of Bagdad.

53 New office of Emir Al Omra inſtituted by Al Radi.

In the 324th year of the Hegira, commencing November 30th, 935, the khalif Al Radi, finding himſelf diſtreſſed on all ſides by uſurpers, and having a vizir of no capacity, inſtituted a new office ſuperior to that of vizir, which he intitled *Emir Al Omra*, or *Commandant of Commandants*. This great officer was truſted with the management of all military affairs, and had the entire management of the finances in a much more abſolute and unlimited manner than any of the khalif's vizirs ever had. Nay, he officiated for the khalif in the great moſque at Bagdad, and had his name mentioned in the public prayers throughout the kingdom. In ſhort, the khalif was ſo much under the power of this officer, that he could not apply a ſingle dinar to his own uſe without the leave of the Emir Al Omra.

54 Diviſion of the Moſlem empire in the 325th year of the Hegira.

In the year 325, the Moſlem empire, once ſo great and powerful, was ſhared among the following uſurpers:

The cities of Waſet, Baſra, and Cufa, with the reſt of the Arabian Irak, were conſidered as the property of the Emir Al Omra, though they had been in the beginning of the year ſeized upon by a rebel called *Al Baridi*, who could not be driven out of them.

The country of Fars, Farſeſtan, or *Perſia*, properly ſo called, was poſſeſſed by Amado'ddawla Ali Ebn Buiya, who reſided in the city of Shiraz.

Part of the tract denominated *Al Jebal*, together with Perſian Irak, which is the mountainous part of Perſia, and the country of the ancient Parthians obeyed Rucno'ddawla, the brother of Amado'ddawla, who reſided at Iſpahan. The other part of that country was poſſeſſed by Waſhmakin the Deylamite.

Diyar Rabia, Diyar Becr, Diyar Modar, and the city of Al Mawſel, or Moſul, acknowledged for their ſovereign a race of princes called *Hamdanites*.

Egypt and Syria no longer obeyed the khalifs, but Mahomet Ebn Taj, who had formerly been appointed governor of theſe provinces.

Africa and Spain had long been independent.

Cicily and Crete were governed by princes of their own.

The provinces of Khoraſan and Marawalnahr were under the dominion of Al Naſr Ebn Ahmed, of the dynaſty of the Sammarians.

The provinces of Tabreſtan, Jorjan or Georgiana, and Mazanderan, had kings of the firſt dynaſty of the Deylamites.

The province of Kerman was occupied by Abu Ali Mahomet Ebn Eylia Al Sammani, who had made himſelf maſter of it a ſhort time before. And,

Laſtly, the provinces of Yamama and Bahrein, including the diſtrict of Hajr, were in the poſſeſſion of Abu Thaher the Karmatian.

Thus the khalifs were deprived of all their dominions, and reduced to the rank of ſovereign pontiffs; in which light, though they continued for ſome time to be regarded by the neighbouring princes, yet their power never arrived to any height. In this low ſtate the khalifs continued till the year of the Hegira 656, commencing January 8th, 1258.

55 Bagdad taken by the Tartars.

This year was rendered remarkable by the taking of Bagdad by Hulaku the Mogul or Tartar; who likewiſe aboliſhed the khalifat, putting the reigning khalif Al Moſtaſem Billah to a moſt cruel death. Theſe diabolical conquerors, after they had taken the city, maſſacred, according to cuſtom a vaſt number of the inhabitants; and after they had plundered it, ſet it on fire. The ſpoil they took from thence was prodigiouſly great, Bagdad being then looked upon as the firſt city in the world.

56 Hiſtory of the city ſince that time.

Bagdad remained in the hands of the Tartars or Moguls to the year of the Hegira 795, of Chriſt 1392, when it was taken by Tamerlane from Sultan Ahmed Ebn Weis; who being incapable of making head againſt Tamerlane's numerous forces, found himſelf obliged to ſend all his baggage over the Tigris, and abandon his capital to the conqueror. He was, however, hotly purſued by his enemy's detachments to the plain of Karbella, where ſeveral ſkirmiſhes happened, and a conſiderable number of men were loſt on both ſides. Notwithſtanding this diſaſter, he found means to eſcape the fury of his purſuers, took refuge in the territories of the Greek emperor, and afterwards repoſſeſſed himſelf of the city of Bagdad. There he remained till the year of the Hegira 803, when the city was taken a ſecond time by Tamerlane; who nevertheleſs reſtored it to him, and he continued ſovereign of the place till driven from thence by Miram Shah. Still, however, he found means to return; but in the 815th year of the Hegira was finally expelled by Kara Yuſef the Turkman. The deſcendants of Kara Yuſef continued maſters of Bagdad till the year of the Hegira 875, of Chriſt 1470, when they were driven out by Uſun Caſſun. The family of this prince continued till the year of the Hegira 914, of our Lord 1508, when Shah Iſhmael, ſurnamed *Sufi* or *Sofi*, the firſt prince of the royal family reigning in Iran or Perſia, till the dethroning of the late Shah Hoſein, made himſelf maſter of it. From that time to this Bagdad has continued to be a bone of contention between the Turks and Perſians. It was taken by Soliman ſurnamed the *magnificent*, and retaken by Shah Abbas the great, king of Perſia: but being at laſt beſieged by Amurath or Morad IV. with a formidable army, it was finally obliged to ſurrender to him in the year 1638; ſince which time the Perſians have never been able to make themſelves maſters of it for any length of time.

57 Its preſent ſtate.

The city is large and populous; and the advantage of the Tigris is ſo conſiderable, with regard to commerce, that although the climate is exceſſive hot, and in other reſpects far from being agreeable, yet the number of its inhabitants is computed at 300,000; but before the plague broke out there, they were ſuppoſed to be four times that number. It is governed by a baſhaw, whoſe authority extends as far as Courdiſtan. The revenues would be immenſe was the government mild; but inſtead thereof, oppreſſion rules here with the moſt deſpotic ſway. The baſhaw is continually extorting money from the poor inhabitants, and none ſuffer more than the unfortunate Jews and Chriſtians, many of whom are put to the moſt cruel tortures in order to force their property from them. This ſeries of tyranny and oppreſſion has almoſt entirely drove them out of the city, in conſequence of which the trade muſt ſuffer very conſiderably, they being generally the principal merchants in the place. In the months of June, July, and Auguſt, the weather is ſo extremely hot, as to oblige the inhabitants to live for theſe months in ſubterraneous apartments, which are arched over, to admit the freer circulation of the air. The houſes are generally large, built of brick and cement, and are arched over; many of the windows are made of elegant Venetian glaſs; the ceilings are moſtly ornamented with a kind of chequered work, which has generally a noble appearance; moſt of the houſes have a court-yard before them, in the middle of which is a little plantation of orange trees, &c. that has a very pleaſing effect. The ſoil, which would produce not only every conveniency in life, but almoſt every luxury, is through the natural indolence of the Turks, and the many faults in the government of the country, in a great meaſure uncultivated and neglected. The revenues are computed at 125 lacks of piaſtres, or 1,562,500l. ſterling; but a quarter part of this is not collected, owing to the ſlothfulneſs of the Turks, who ſuffer the Arabs to plunder them of the remainder. This in ſome meaſure accounts for the cruelties and extortions that are continually practiſed here. As the baſhaw lives in all the ſplendor of a ſovereign prince, and maintains a very large army, he could not be able to defray his expences, was he not to have recourſe to oppreſſion and injuſtice; and he, by his extenſive power, acting almoſt independent of the Porte, only acknowledging it to bring in a balance from thence yearly in his favour.

The bazars or markets here are large and extenſive; being covered over with arches built of maſonry, and divided into different ſtreets, filled with ſhops of all kinds of merchandize, to the number of 12,000. Every thing a perſon can have occaſion for may be had there. The number of houſes in the city is computed at near 80,000; and each houſe and ſhop pay an annual tribute to the baſhaw, which is calculated to produce the ſum of 300,000l. ſterling. Beſides theſe immenſe revenues that are collected, the baſhaw pretends, that by repairs on the fortifications 30,000l. or 40,000l. are annually expended, when not ſo many hundreds are taken out of his coffers for that purpoſe. Likewiſe clearing the river and mending the bridge become a charge greater than their income, and probably not the value of an Engliſh ſhilling is expended. —To ſupport the expence of the ſeraglio, their clothes, capariſons of their horſes, and every outward pomp, the amount is conſiderable.

On the north ſide of the town ſtands the citadel, which commands the river; and conſiſts of curtains and baſtions, on which ſome very long cannon are mounted, with two mortars in each baſtion, placed no other beds than the ground, and in very bad condition. The carriages of the guns are likewiſe ſo unwieldy, and in ſuch a ſhattered condition, that from their appearances they would not ſupport one firing, but would be ſhaken in pieces. Their elevations were from 30 to 40 degrees, but they had no quoins to level them. There are beſides, a number of ſmall towers, and loop-holes for muſquetry, placed at certain diſtances, all well encompaſſed by a ditch of 27 feet deep, which can be filled at any time by the waters of the Tigris. The citadel is ſo cloſe to the houſes, that it might be eaſily taken if poſſeſſion was once gained of the town; but an attack made towards the land would not probably be ſucceſsful, as ſluices might with the greateſt facility be cut into the ditch, and ſo overflow the country for miles round; but it is ſaid an advantageous attack might be made from the water.

The city, which is fortified by lofty thick walls of brick covered with earth, and ſtrengthened by great towers much reſembling cavalier baſtions, the whole being ſurrounded by a deep ditch, is in the form of an irregular ſquare; but the walls in many places are broken down, occaſioned by the diſputes which happened on the death of Abdulla Baſha a few years ago, when two competitors aroſe in Bagdad for the baſhawic, who fought ſeveral times in the town and citadel, and laid great part of it in ruins. In the interim, the governor of Muſſool and Nineveh being appointed Baſhaw by the Porte, came hither with a conſiderable army, and took poſſeſſion of the ſovereignty, vanquiſhing his two opponents. Oppoſite to the city, on the other ſide of the river, are very extenſive ſuburbs, from whence ſhells might be thrown into the town, which would have a dreadful effect on a place ſo cloſely built. There is a communication beween the city and ſuburbs by a bridge of boats; the only kind of bridge which that river will admit of, as it is broad and deep, and in its ordinary courſe very rapid. At certain ſeaſons it ſwells to a prodigious height, and overflowing the country occaſions many moraſſes on that ſide oppoſite to the city. Among theſe are ſeveral towns and villages, whoſe inhabitants are ſaid to be the ancient Chaldeans: they are of a particular religion, which they pretend is that of Seth. The inhabitants of this city are compoſed chiefly of Perſians, Armenians, Turks, Arabs, and Jews, which laſt act in the capacity of ſchroffs, or bankers, to the merchants. The Jews, notwithſtanding the ſevere treatment they meet with from the government, are induced to live here from a reverence to the prophet Ezekiel, whoſe mauſoleum they pretend is a day's journey from the city. Beſides the Jews who reſide here, there are many that come every year out of devotion to viſit the prophet's tomb. There are alſo two European gentlemen, a Venetian and a Frenchman, with five Romiſh prieſts, who are Frenchmen and Italians. Two chapels are permitted for thoſe of the Romiſh and Greek perſuaſions; at the former the five prieſts officiate. In the city are ſeveral large beautiful moſques, but into which Chriſtians are never ſuffered to enter, if known to be ſuch, for fear it ſhould defile them. The Mahometan women are very richly dreſſed, wearing bracelets on their arms and jewels in their ears: the Arabian women have the partition between their noſtrils bored, wherein they wear rings.

There are alſo a number of antique buildings. At the diſtance of about ten miles ſtand the ruins of an ancient tower called the *Tower of Nimrod*. Whether this tower was at firſt of a ſquare or round form is now difficult to determine; though the former is moſt probable, becauſe all the remaining bricks are placed ſquare, and not in the leaſt circular. The bricks are all twelve inches ſquare and four and an half thick. The cement is of mud or ſlime, mixed with broken reed, as we mix hair with mortar; which ſlime might either have been had from one of the great rivers, or taken out of one of the ſwamps in the plain, with which the country hereabout very much abounds. The height of the ruin is 126 feet; the diameter of the largeſt and middle part about 100 feet. It would appear to be ſolid to the centre; yet near the top there is a regular opening of an oval form. The circumference of that part of the tower which remains, and is above the rubbiſh, is about 300 feet; but probably, could the foundation be come at, it would be found of far greater extent. The preſent Turks, Jews, and Arabians, are fond of believing this to be the identical ruin of the ancient tower of Babel, for which they aſſign a variety of reaſons; but all ſo void of the appearance of truth, that to ſet about confuting them would be loſing time in trifles. It appears to have been a beacon or watch-tower, to give notice of the approach of an enemy: or perhaps was uſed as an obſervatory to inſpect the various motions of the heavenly bodies; which ſcience was ſo much cultivated among the ancient inhabitants of this country, that even the Grecians, though deſirous of being eſteemed the inventors of all arts and ſciences, could never deny the Babylonians the honour of having laid the foundations of aſtronomy.

BAGGAGE, in military affairs, denotes the clothes, tents, utenſils of divers ſorts, proviſions, and other neceſſaries belonging to the army.

Before a march, the waggons with the baggage are marſhalled according to the rank which the ſeveral regiments bear in the army; being ſometimes ordered to follow the reſpective columns of the army, ſometimes to follow the artillery, and ſometimes to form a column by themſelves. The general's baggage marches firſt; and each waggon has a flag, ſhowing the regiment to which it belongs.

Packing up the BAGGAGE, *vaſa colligere*, was a term among the Romans, for preparing to go to war, or to be ready for an expedition.

The Romans diſtinguiſhed two ſorts of baggage; a *greater* and *leſs*. The leſſer was carried by the ſoldier on his back, and called *ſarcina*; conſiſting of the things moſt neceſſary to life, and which he could not do without. Hence *colligere ſarcinas*, packing up the baggage, is uſed for decamping, *caſtra movere*. The greater and heavier was carried on horſes and vehicles, and called *onera*. Hence *onera vehiculorum, ſarcinæ hominum*. The baggage-horſes were denominated *ſagmentarii equi*.

The Roman ſoldiers in their marches were heavy loaden; inſomuch, that they were called by way of jeſt *muli mariani*, and *ærumnæ*. They had four ſorts of luggage, which they never went without, *viz.* corn, or *buccellatum*, utenſils, valli, and arms. Cicero obſerves, that they uſed to carry with them above half a month's proviſions; and we have inſtances in Livy, where they carried proviſions for a whole month. Their utenſils comprehended thoſe proper for gathering fuel, dreſſing their meat, and even for fortification or intrenchment; and what is more, a chain for binding captives. For arms, the foot carried a ſpear, ſhield, ſaw, baſket, rutrum, hatchet, lorum, falx, &c. Alſo ſtakes or pales, *valli*, for the ſudden fortifying a camp; ſometimes ſeven or even twelve of theſe pales were carried by each man, though generally, as Polybius tells us, only three or four. On the Trajan column we ſee ſoldiers repreſented with this fardle of corn, utenſils, pales, &c. gathered into a bundle and laid on their ſhoulders. Thus inured to labour, they grew ſtrong, and able to undergo any fatigue in battle; the greateſt heat of which never tired them, or put them out of breath. In aftertimes, when diſcipline grew ſlack, this luggage was thrown on carriages and porters ſhoulders.

The Macedonians were not leſs inured to hardſhip than the Romans; when Philip firſt formed an army, he forbid all uſe of carriages; yet, with all their load, they would march, in a ſummer's day, 20 miles in military rank.

BAGLANA, or BUGLANA, a province of the kingdom of Dekkan in the Mogul's empire. It is bounded on the north and eaſt by Guzerat and Ballagat; and on the ſouth and weſt by that part of Viziapur called *Konhan*, belonging to the Marattas. It ends in a point at the ſea-coaſt between Daman and Balſora, and is the leaſt province in the kingdom. The Portugueſe territories begin in this province at the port Daman, 21 leagues ſouth of Surat; and run along the coaſt by Baſſaim, Bombay, and Chawl, to Dabul, almonſt 50 leagues to the north of Goa.

BAGLIVI (George), a moſt illuſtrious phyſician of Italy, was a native of Apulia, and born about the year 1668. He ſtudied at Padua, where he became doctor; and then went to Rome, where he was choſen profeſſor of anatomy. He was a man of moſt uncommon force of underſtanding, of which he gave ample proofs in many curious and accurate productions, philoſophical as well as medicinal. He died at Rome 1706, in the flower of his age, and when he was no more than 38. A collection of his works were printed firſt in 1710, quarto; and have ſince been reprinted, in the ſame ſize, at various places. His *Praxis Medica*, and *De Fibra Matricis*, are the principal pieces. He wrote a Diſſertation upon the Anatomy, Bite, and Effects, of the Tarantula, which is the production of his country; and gave a particular account of the earthquake at Rome and the adjacent cities in 1703. His works are all in Latin.

BAGNAGAR, a town of Aſia, in the dominions of the Great Mogul, and capital of the kingdom of Golconda in the peninſula on this ſide the Ganges. The inhabitants within the town are the better ſort; the merchants and meaner people inhabiting the ſuburbs, which is three miles long. It is chiefly remarkable for a magnificent reſervoir of water, ſurrounded with a colonnade ſupported by arches. It is ſeated on the river Newa, in E. Long. 96. 0. N. Lat. 15. 30.

BAGNARA, a ſea-port town of Italy in the kingdom of Naples, in the farther Calabria, with the title of a duchy. E. Long. 16. 8. N. Lat. 38. 15.

BAGNAREA, a town of Italy in St Peter's patrimony, and in the territory of Orvieta, with a biſhop's ſee. E. Long. 12. 10. N. Lat. 42. 36.

BAGNERES, a town of France in Gaſcony, and in the county of Bigorre, ſo called from its mineral waters. It is ſeated on the river Adour, in E. Long. 0. 12. N. Lat. 43. 3.

BAGNIALACK, a large town of Turkey in Europe, in the province of Boſnia. E. Long. 18. 10. N. Lat. 44. 0.

BAGNIO, an Italian word, ſignifying *a bath*. We uſe it for a houſe with conveniences for bathing, cupping, ſweating, and otherwiſe cleanſing the body; and ſometimes for worſe purpoſes. In Turkey it is become

come a general name for the priſons where the ſlaves are incloſed, it being uſual in theſe priſons to have baths.

BAGNOLAS, a town of Lower Languedoc in France. It has a very handſome ſquare, and two fountains which riſe in the middle of the town; the waters of which, being received in a baſon, are conveyed by a canal out of town, and from thence to the lands about it. E. Long. 4. 43. N. Lat. 44. 10.

BAGNOLIANS, or BAGNOLANSES, in church-hiſtory, a ſect of heretics, who in reality were Manichees, though they ſomewhat diſguiſed their errors. They rejected the Old Teſtament and part of the New; held the world to be eternal; and affirmed that God did not create the ſoul when he infuſed it into the body.

BAGOI, among the ancient Perſians, were the ſame with thoſe called by the Latins *ſpadones, viz.* a ſpecies of eunuchs, in whom the canal of the penis was ſo contorted by a tight vinculum, that they could not emit the ſemen.

BAG-PIPE, a muſical inſtrument, of the wind kind, chiefly uſed in Scotland and Ireland. The peculiarity of the bag-pipe, and from which it takes its name, is, that the air which blows it is collected into a leathern bag, from whence it is preſſed out by the arm into the pipes. Theſe pipes conſiſt of a baſs, and tenor or rather treble; and are different according to the ſpecies of the pipe. The baſs part is called the *drone*, and the tenor or treble part the *chanter*. In all the ſpecies, the baſs never varies from its uniform note, and therefore very deſervedly gets the name of *drone;* and the compaſs of the chanter is likewiſe very limited. There is a conſiderable difference between the Highland and Lowland bag pipe of Scotland; the former being blown with the mouth, and the latter with a ſmall bellows: though this difference is not eſſential, every ſpecies of bag-pipe being capable, by a proper conſtruction of the reeds, of producing muſic either with the mouth or bellows. The following are the ſpecies of bag-pipes moſt commonly known in Britain.

1. The *Iriſh Pipe.* This is the ſofteſt, and in ſome reſpects the moſt melodious of any, ſo that muſic-books have been publiſhed with directions how to play on it. The chanter, like that of all the reſt, has eight holes like the Engliſh flute, and is played on by opening and ſhutting the holes as occaſion requires; the baſs conſiſts of two ſhort drones, and a long one. The loweſt note of the chanter is D on the German flute, being the open note on the counter-ſtring of a violin; the ſmall drone (one of them commonly being ſtopped up) is tuned in uniſon with the note above this, and the large one to an octave below; ſo that a great length is required in order to produce ſuch a low note, on which account the drone hath ſometimes two or three turns. The inſtrument is tuned by lengthening or ſhortening the drone till it ſounds the note deſired.

2. The *Highland Bag-Pipe.* This conſiſts of a chanter and two ſhort drones, which ſound in uniſon the loweſt note of the chanter except one. This is exceedingly loud, and almoſt deafening if played in a room; and is therefore moſtly uſed in the fields, for marches, &c. It requires a prodigious blaſt to ſound it; ſo that thoſe unaccuſtomed to it cannot imagine how Highland pipers can continue to play for hours together, as they are often known to do. For the ſame reaſon, thoſe who uſe the inſtrument are obliged either to ſtand on their feet or walk when they play. This inſtrument hath but nine notes; its ſcale, however, hath not yet been reduced to a regular ſtandard by comparing it with that of other inſtruments, ſo that we can ſay nothing about its compaſs. Thoſe who are beſt acquainted with it, however, affirm that it plays only the natural notes, without being capable of variation by flats or ſharps.

3. The *Scots Lowland Pipe.* This is likewiſe a very loud inſtrument, though leſs ſo than the former. It is blown with bellows, and hath a baſs like the Iriſh pipe. This ſpecies is different from all the reſt, as it cannot play the natural notes, but hath F and C ſharp. The loweſt note of a good bag-pipe of this kind is uniſon with C ſharp on the tenor of a violin tuned concert-pitch; and as it hath but nine notes, the higheſt is D in alt. From this peculiar conſtruction, the Highland and Lowland bag-pipes play two ſpecies of muſic eſſentially different from one another, as each of them alſo is from every other ſpecies of muſic in the world. Hence theſe two ſpecies of bag-pipes deſerve notice as curioſities; for the muſic which they play is accompanied with ſuch peculiar ornaments, or what are intended as ſuch, as neither violin, nor even organ, can imitate, but in a very imperfect manner.

This kind of bag-pipe was formerly very much uſed in Scotland at weddings and other feſtivals: being indeed extremely well calculated for playing that peculiar ſpecies of Scots muſic called *reels.* It has been often a matter of ſurpriſe how this was poſſible, as the inſtrument has only a compaſs of nine or ten notes at the utmoſt, and which cannot be varied as in other inſtruments. In this reſpect, however, it has a very great compaſs, and will play an inconceivable variety of tunes. As its notes are naturally ſo high, there is ſcarce any one tune but what is naturally tranſpoſed by it, ſo that what would be a flat note on the key proper for the violin, may be a ſharp one on the bag-pipe; and though the latter cannot play any flat note, it may nevertheleſs in this manner play tunes which on other inſtruments would be flat, to as great perfection as theſe inſtruments themſelves.

4. *The Small Pipe.* This is remakable for its ſmallneſs, the chanter not exceeding eight inches in length; for which reaſon, the holes are ſo near each other, that it is with difficulty they can be cloſed. This hath only eight notes, the lower end of the chanter being commonly ſtopped. The reaſon of this is, to prevent the ſlurring of all the notes, which is unavoidable in the other ſpecies; ſo that in the hands of a bad player they become the moſt ſhocking and unintelligible inſtruments imaginable: but this, by having the lower hole cloſed, and alſo by the peculiar way in which the notes are expreſſed, plays all its tunes in the way called by the Italians *ſtaccato*, and cannot ſlur at all. It hath no ſpecies of muſic peculiar to itſelf; and can play nothing which cannot be much better done upon other inſtruments; though it is ſurpriſing what vollubility ſome performers on this inſtrument will diſplay, and how much they will overcome the natural diſadvantages of it. Some of this ſpecies, inſtead of having drones like the others, have their baſs parts conſiſting of a winding cavity in a kind

of ſhort caſe, and are tuned by opening theſe to a certain degree by means of ſliding covers; from which contrivance they are called *ſhuttle-pipes*.—Beſides theſe, there are a variety of others, called *Italian*, *German*, *Organ*, &c. bag-pipes, which have nothing different in their conſtruction from thoſe above deſcribed, nor any good quality to recommend them.

As to the origin of bag-pipe muſic, ſome are of opinion that it is to be derived from the Danes; but Mr Pennant thinks differently, and gives the following reaſons for deriving it from Italy.

Voyage to the Hebrides, p. 302.

" Neither of theſe inſtruments (the Highland and Lowland bag-pipes above deſcribed) were the invention of the Danes, or, as is commonly ſuppoſed, of any of the northern nations; for their ancient writers prove them to have been animated by the *clangor tubarum*. Notwithſtanding they have had their fœck-pipe long amongſt them, as their old ſongs prove, yet we cannot allow them the honour of inventing this melodious inſtrument; but muſt aſſert, that they borrowed it from the invaded Caledonians. We muſt ſtill go farther, and deprive even that ancient race of the credit; and derive its origin from the mild climate of Italy, perhaps from Greece.

" There is now in Rome a moſt beautiful bas relievo, a Grecian ſculpture of the higheſt antiquity, of a bag-piper playing on his inſtrument, exactly like a modern Highlander. The Greeks had their Ασκαυλης, or inſtrument, compoſed of a pipe and blown-up ſkin: the Romans in all probability borrowed it from them, and introduced it among their ſwains, who ſtill uſe it under the names of *piva* and *cornu-muſa*.

" That maſter of muſic, Nero, uſed one; and had not the empire been ſo ſuddenly deprived of that great artiſt, he would (as he graciouſly declared his intention, have treated the people with a concert, and, among other curious inſtruments, would have introduced the *utricularius* or bag-pipe. Nero periſhed; but the figure of the inſtrument is preſerved on one of his coins, but highly improved by that great maſter: it has the bag and two of the vulgar pipes; but was blown with a bellows like an organ, and had on one ſide a row of nine unequal pipes reſembling the ſyrinx of the god Pan. The bag-pipe, in the unimproved ſtate, is alſo repreſented in an ancient ſculpture; and appears to have had two long pipes or drones, and a ſingle ſhort pipe for the fingers. Tradition ſays, that the kind played on by the mouth was introduced by the Danes: as theirs was wind-muſic, we will admit that they might have made improvement; but more we cannot allow: they were ſkilled in the uſe of the trumpet; the Highlanders in the piohb, or bag-pipe,

Non tuba in uſu illis, conjecta at tibia in utrum
*Dat belli ſignum, et martem vocat horrida in arma**."

The bag-pipe appears to have been an inſtrument of great antiquity in Ireland, though it is uncertain whence they derived it. Mr Pennant, by means of an antique found at Richborough in Kent, has determined that the bag-pipe was introduced at a very early period into Britain; whence it is probable that both Iriſh and Danes might borrow the inſtrument from the Caledonians, with whom they had ſuch frequent intercourſe. Ariſtides Quintilianus informs us, that it prevailed in the Highlands in very early ages; and indeed the genius of the people ſeems to render the opinion highly probable. The attachment of that people to their muſic called pibrachs is almoſt incredible, and on ſome occaſions is ſaid to have produced effects little leſs marvellous than thoſe aſcribed to the ancient muſic. At the battle of Quebec in 1760, while the Britiſh troops were retreating in great diſorder, the general complained to a field-officer in Fraſer's regiment of the bad behaviour of his corps. " Sir (ſaid he with ſome warmth), you did very wrong in forbidding the pipers to play this morning; nothing encourages the Highlanders ſo much in the day of action. Nay, even now they would be of uſe."—" Let them blow like the devil, then (replies the general), if it will bring back the men." The pipers were then ordered to play a favourite martial air; and the Highlanders, the moment they heard the muſic, returned and formed with alacrity in the rear. In the late war in India, Sir Eyre Coote, aware of the attachment of the Highlanders to their favourite inſtrument, gave them L. 50 to buy a pair of bag-pipes after the battle of Porto Nuovo.

Formerly there was a kind of college in the iſland of Skie where the Highland bag-pipe was taught; the teachers making uſe of pins ſtuck into the ground inſtead of muſical notes. This college, however, has been for ſome time entirely diſſolved, and the uſe of the Highland pipe became much leſs general than before. At laſt a ſociety of gentlemen, thinking it perhaps impolitic to allow the ancient martial muſic of the country to decline, reſolved to revive it by giving an annual prize to the beſt peformers on the inſtrument. Theſe competitions were firſt held at Falkirk, but for a good number of years at Edinburgh; where the only ſurviving member of the ancient college of Skie is now *profeſſor* of bag-pipe muſic.

The Lowland pipe, as has been already obſerved, is an inſtrument eſſentially different from the Highland pipe; it was reformed and the muſic improved by George Mackie, who is ſaid to have attended the college of Skie ſeven years. He had before been the beſt performer on that inſtrument in that part of the country where he lived; but, while attending the college at Skie, he adapted the graces of the Highland muſic to the Lowland pipe. Upon his return, he was heard with aſtoniſhment and admiration; but unluckily, not being able to commit his improvements to writing, and indeed the nature of the inſtrument ſcarce admitting of it, the knowledge of this kind of muſic hath continued to decay ever ſince, and will probably ſoon wear out altogether. What contributes much to this is, that the bag-pipers, not content with the natural nine notes which their inſtrument can play eaſily, force it to play tunes requiring higher notes, which diſorders the whole inſtrument in ſuch a manner as to produce the moſt horrid diſcords; and this practice brings, though undeſervedly, the inſtrument itſelf into contempt.

BAGUETTE, in architecture, a ſmall round moulding, leſs than an aſtragal, and ſo called from the reſemblance it bears to a ring.

BAHAMA, or Lucaya, Islands, are the eaſtermoſt of the Antilles, lying in the Atlantic ocean. They are ſituated to the ſouth of Carolina, between 22 and 27 degrees N. Lat. and 73 and 81 degrees W. Long. They extend along the coaſt of Florida quite down to

* *Melvini* Topogr. Scotiæ.

the iſle of Cuba, and are ſaid to be 500 in number, ſome of them only mere rocks; but twelve of them are large, fertile, and in nothing different from the ſoil of Carolina: all are, however, uninhabited except Providence, which is 200 miles eaſt of the Floridas; though ſome others are larger and more fertile, on which the Engliſh have plantations. Between them and the continent of Florida is the gulf of Bahama, or Florida, through which the Spaniſh galeons ſail in their paſſage to Europe.

Theſe iſlands were the firſt fruits of Columbus's diſcoveries; but they were not known to the Engliſh till 1667, when Captain Seyle, being driven among them in his paſſage to Carolina, gave his name to one of them; and being a ſecond time driven upon it, gave it the name of *Providence*. The Engliſh, obſerving the advantageous ſituation of theſe iſlands for being a check on the French and Spaniards, attempted to ſettle them in the reign of Charles II. Some unlucky accidents prevented this ſettlement from being of any advantage; and the iſle of Providence became an harbour for the buccaneers or pirates, who for a long time infeſted the American navigation. This obliged the government in 1718 to ſend out Captain Woodes Rogers with a fleet to diſlodge the pirates, and for making a ſettlement. This the captain effected; a fort was erected, and an independent company was ſtationed in the iſland. Ever ſince this laſt ſettlement theſe iſlands have been improving, though they advance but ſlowly. In time of war, people gain conſiderably by the prizes condemned there; and at all times by the wrecks which are frequent in this labyrinth of rocks and ſhelves. The Spaniards and Americans captured theſe iſlands during the laſt war; but they were retaken by a detachment from St Auguſtine April 7, 1783.

BAHAR, or BARRE, in commerce, weights uſed in ſeveral places in the Eaſt Indies.

There are two of theſe weights; one the great bahar, with which they weigh pepper, cloves, nutmegs, ginger, &c. and contains 550 pounds of Portugal, or about 524 lb. 9 oz. averdupois weight. With the little bahar, they weigh quickſilver, vermilion, ivory, ſilk, &c. It contains about 437 lb. 9 oz. avoirdupois weight.

BAHAREN, an iſland in the Perſian gulf, ſituated in E. Long. 50. 0. N. Lat. 26. 0. This iſland is chiefly remarkable for its pearl-fiſhery, and has often changed its maſters. It fell with Ormus under the dominion of the Portugueſe, was again reſtored to Perſia by Thamas Khouli Kan; and after his death the confuſion into which his empire was thrown, gave an opportunity to an enterprizing and ambitious Arab of taking poſſeſſion of the iſland, where he ſtill maintains his authority. Baharen was famous for its pearl-fiſhery even at the time when pearls were found at Ormus, Karek, Kaſhy, and other places in the Perſian gulf; but it is now become of much greater conſequence; all the other banks having been exhauſted, while this has ſuffered no ſenſible diminution. The time of fiſhing begins in April, and ends in October. It is confined to a tract four or five leagues in breadth. The pearls taken at Baharen, though not ſo white as thoſe of Ceylon or Japan, are much larger than thoſe of the former place, and more regularly ſhaped than thoſe of the latter. They have a yellowiſh colour; but have alſo this good quality, that they preſerve their golden hue, whereas the whiter kind loſe much of their luſtre by keeping, eſpecially in hot countries. The annual revenue from the Baharen pearl-fiſhery is computed at about L.157,500. The greateſt part of the pearls that are uneven, are carried to Conſtantinople and other parts of Turkey, where the larger go to compoſe ornaments for head-dreſſes, and the ſmaller are uſed in embroideries. The perfect pearls muſt be reſerved for Surat, whence they are diſtributed through all Indoſtan.

BAHI, a province of Lucon or Manila, one of the Philippine iſlands in the Eaſt Indies, belonging to the Spaniards. It is remarkable for producing excellent betel, which the inhabitants, Spaniards as well as natives, perpetually chew from morning till night. It is alſo the place where moſt of the ſhips are built. But the natives ſuffer much from this work; ſeveral hundreds of them being conſtantly employed in it, on the mountains, or at the port of Cavite. The king allows theſe labourers a piece-of-eight per month, with a ſufficient quantity of rice. The whole province contains about 6000 tributary natives.

BAHIA, DE TODOS LOS SANCTOS, a province of Braſil in South America, belonging to the Portugueſe, and the richeſt in the whole country; but unhappily the air and climate do not correſpond with other natural advantages: yet ſo fertile is the province in ſugar and other commercial articles, that the Portugueſe flock hither not only as it is the ſeat of affluence, but alſo of pleaſure and grandeur. The capital, called *St Salvador*, or *Cividad de Bachia*, is populous, magnificent, and beyond compariſon the moſt gay and opulent city in Braſil. It ſtands on a bay in S. Lat. 12. 11. is ſtrong by nature, well fortified, and always defended by a numerous garriſon. It contains 12,000 or 14,000 Portugueſe, and about three times as many negroes, beſides people of different nations who chooſe to reſide in that city.

BAHIR, a Hebrew term ſignifying *famous or illuſtrious*; but particularly uſed for a book of the Jews, treating of the profound myſteries of the caballa, being the moſt ancient of the Rabinical works.

BAHUS, a ſtrong town of Sweden, and capital of a government of the ſame name, ſeated on a rock in a ſmall iſland, in E. Long. 11. 10. N. Lat. 57. 52.

BAJA, BAYJAH, or BEGIA, a town of the kingdom of Tunis in Africa, ſuppoſed to be the ancient *Vacca* of Salluſt, and *Oppidum Vaggenſe* of Pliny. It was formerly, and ſtill continues to be, a place of great trade, and the chief market of the kingdom for corn; of which the adjacent territories produce ſuch abundance, that they can ſupply more than the whole kingdom with it; and the Tuneſians ſay, that if there was in the kingdom ſuch another town as this for plenty of corn, it would become as cheap as ſand. Here is alſo a great annual fair, to which the moſt diſtant Arabian tribes reſort with their families and flocks. Notwithſtanding all this, however, the inhabitants are very poor, and great part of the land about the town remains uncultivated, through the cruel exactions of the government, and the frequent incurſions of the Arabs who are very powerful in theſe parts. The town ſtands on the declivity of a hill on the road to Conſtantina, about 10 leagues from the northern coaſt, and 36 ſouth-weſt from Tunis; and hath the convenience of being well watered. On the higheſt part is a citadel that commands the whole place, but is now of no great ſtrength. The walls were raiſed out of the ruins of the ancient Vacca, and have ſome ancient inſcriptions.

Baja, a populous town of Hungary, ſeated on the Danube, in E. Long. 19. 50. N. Lat. 46. 40.

BAIÆ, an ancient village of Campania in Italy, between the promontory of Miſenum and Puteoli, on the Sinus Baianus: famous for its natural hot baths, which ſerved the wealthier Romans for the purpoſes both of medicine and pleaſure.—The variety of thoſe baths, the ſoftneſs of its climate, and the beauty of its landſcape, captivated the minds of opulent nobles, whoſe paſſion for bathing knew no bounds. Abunnance of linen, and diſuſe of ointments, render the practice leſs neceſſary in modern life; but the ancients performed no exerciſe, engaged in no ſtudy, without previous ablutions, which at Rome required an enormous expence in aqueducts, ſtoves, and attendants: a place therefore, where waters naturally heated to every degree of warmth bubbled ſpontaneouſly out of the ground, in the pleaſanteſt of all ſituations, was ſuch a treaſure as could not be overlooked. Baiæ was this place in the higheſt perfection; its eaſy communication with Rome was alſo a point of great weight. Hither at firſt retired for a temporary relaxation the mighty rulers of the world, to ſtring anew their nerves and revive their ſpirits, fatigued with bloody campaigns and civil conteſts. Their habitations were ſmall and modeſt: but ſoon increaſing luxury added palace to palace with ſuch expedition and ſumptuoſity, that ground was wanting for the vaſt demand: enterpriſing architects, ſupported by infinite wealth, carried their foundations into the ſea, and drove that element back from its ancient limits: it has ſince taken ample revenge, and recovered much more than it ever loſt. From being a place of reſort for a ſeaſon, Baiæ now grew up to a permanent city: whoever found himſelf diſqualified by age, or infirmity, for ſuſtaining any longer an active part on the political theatre; whoever, from an indolent diſpoſition, ſought a place where the pleaſures of a town were combined with the ſweets of a rural life; whoever wiſhed to withdraw from the dangerous neighbourhood of a court, and the baneful eye of informers flocked hither, to enjoy life untainted with fear and trouble. Such affluence of wealthy inhabitants rendered Baiæ as much a miracle of art as it was before of nature; its ſplendor may be inferred from its innumerable ruins, heaps of marbles, moſaics, ſtucco, and other precious fragments of taſte.—It flouriſhed in full glory down to to the days of Theodoric the Goth, but the deſtruction of theſe enchanted palaces followed quickly upon the irruption of the northern conquerors, who overturned the Roman ſyſtem, ſacked and burnt all before them, and deſtroyed or diſperſed the whole race of nobility. Loſs of fortune left the Romans neither the means, nor indeed the thought, of ſupporting ſuch expenſive eſtabliſhments, which can only be enjoyed in perfection during peace and proſperity. No ſooner had opulence withdrawn her hand, than the unbridled ſea ruſhed back upon its old domain; moles and buttreſſes were torn aſunder and waſhed away; whole promontories, with the proud towers that once crowned their brows, were undermined and tumbled headlong into the deep, where, many feet below the ſurface, pavements of ſtreets, foundations of houſes, and maſſes of walls may ſtill be deſcried. Internal commotions of the earth contributed alſo largely to this general devaſtation; mephitic vapours and ſtagnated waters have converted this favourite ſeat of health into the den of peſtilence, at leaſt during the eſtival heats: yet Baiæ in its ruined ſtate, and ſtripped of all its ornaments, ſtill preſents many beautiful and ſtriking ſubjects for the pencil. E. Long. 14. 45. N. Lat. 41. 6.

Swinburn's Sicily.

BAJADOR, a cape on the weſt coaſt of Africa, ſouth of the Canary Iſlands. W. Long. 15. 20. N. Lat. 27. 0.

BAIANUS SINUS, a bay ſo called from *Baiæ*, (Suetonius); *Portus Baiarum*, (Pliny); which was enlarged by Auguſtus, by giving entrance to the ſea into the Lacus Lucrinus, and Averni, ordering it to be called *Portus Julius apud Baias*, (Suetonius). We alſo read *Baianus Lacus* in Tacitus, which ſome interpret the *Lucrinus*. The modern name is *Golfo di Pozzuolo*. From the higheſt point that forms the bay, a large caſtle commands the road, where foreign ſhips of war uſually ride at anchor, the harbour of Naples not being ſpacious enough for the reception of a fleet: here they enjoy good ſheltering, watering, and victualing; but in ſummer riſk the health of their crews, on account of the unwholeſomeneſs of the air.

BAJAZET I. ſultan of the Turks, a renowned warrior, but a tyrant, was conquered by Tamerlane, and expoſed by him in an iron cage; the fate he had deſtined (it is ſaid) for his adverſary if he had been the victor.

The iron cage, however, ſo long and ſo often repeated as a moral leſſon, has been rejected as a fable by modern writers, who ſmile at the vulgar credulity. They appeal to the Perſian hiſtory of Sherefeddin Ali, of which a French verſion has been given, and from which Mr Gibbon has collected the following more ſpecious narrative of this memorable tranſaction. "No ſooner was Timour informed that the captive Ottoman was at the door of his tent, than he graciouſly ſtepped forwards to receive him, ſeated him by his ſide, and mingled with juſt reproaches a ſoothing pity for his rank and misfortune. 'Alas!' ſaid the Emperor, 'the decree of fate is now accompliſhed by your own fault: it is the web which you have woven; the thorns of the tree which yourſelf have planted. I wiſhed to ſpare, and even to aſſiſt, the champion of the Moſlems: you braved our threats, you deſpiſed our friendſhip; you forced us to enter your kingdom with our invincible armies. Behold the event. Had you vanquiſhed, I am not ignorant of the fate which you reſerved for myſelf and my troops. But I diſdain to retaliate: your life and honour are ſecure; and I ſhall expreſs my gratitude to God by my clemency to man.' The royal captive ſhowed ſome ſigns of repentance, accepted the humiliation of a robe of honour, and embraced with tears his ſon Mouſa, who at his requeſt was ſought and found among the captives of the field. The Ottoman princes were lodged in a ſplendid pavilion; and the reſpect of the guards could be ſurpaſſed only by their vigilance. On the arrival of the haram from Bourſa, Timour reſtored the queen Deſpina and her daughter to their father and huſband; but he piouſly required, that the Servian princeſs, who had hitherto been indulged in the profeſſion of Chriſtanity, ſhould embrace without delay the religion of the prophet. In the feaſt of victory, to which Bajazet was invited, the Mogul Emperor placed a crown on his head and a ſceptre in his hand, with a ſolemn aſſurance of reſtoring him with an increaſe of glory to the throne of his anceſtors. But the effect of this promiſe was diſappointed by the ſultan's untimely death: amidſt the care of the moſt ſkilful phyſicians, he expired of an apoplexy at Akſhehr, the Antioch of Piſidia, about nine months after his defeat. The victor dropped a tear over his grave; his body, with royal pomp, was conveyed to the mauſoleum which he had erected at Bourſa; and his ſon Mouſa, after receiving a rich preſent of gold and jewels, of horſes and arms, was inveſted by a patent in red ink with the kingdom of Anatolia.

Such is the portrait of a generous conqueror, which has been extracted from his own memorials, and dedicated to his ſon and grandſon, 19 years after his deceaſe; and, at a time when the truth was remembered by thouſands, a manifeſt falſehood would have implied a ſatire on his real conduct. On the other hand, of the harſh and ignominious treatment of Bajazet there is alſo a variety of evidence. The Turkiſh annals in particular, which have been conſulted or tranſcribed by Leunclavius, Pocock, and Cantemir, unanimouſly deplore the captivity of the iron cage; and ſome credit may be allowed to national hiſtorians, who cannot ſtigmatize the Tartar without uncovering the ſhame of their king and country."—From theſe oppoſite premiſes, Mr Gibbon thinks a fair and moderate concluſion may be deduced. He is ſatisfied that Sherefeddin Ali has faithfully deſcribed the firſt oſtentatious interview, in which the conqueror, whoſe ſpirits were harmoniſed by ſucceſs, affected the character of generoſity. But his mind was inſenſibly alienated by the unſeaſonable arrogance of Bajazet; the complaints of his enemies, the Anatolian princes, were juſt and vehement; and Timour betrayed a deſign of leading his royal captive in triumph to Samarcand. An attempt to facilitate his eſcape by digging a mine under the tent, provoked the Mogul Emperor to impoſe a harſher reſtraint; and in his perpetual marches, an iron cage on a waggon might be invented, not as a wanton inſult, but as a rigorous precaution. Timour had read in ſome fabulous hiſtory a ſimilar treatment of one of his predeceſſors, a king of Perſia; and Bajazet was condemned to repreſent the perſon and expiate the guilt of the Roman Cæſar. But the ſtrength of his mind and body fainted under the trial, and his premature death might without injuſtice be aſcribed to the ſeverity of Timour. He warred not, however, with the dead; a tear and a ſepulchre were all that he could beſtow on a captive who was delivered from his power; and if Mouſa, the ſon of Bajazet, was permitted to reign over the ruins of Bourſa, the greateſt part of the province of Anatolia had been reſtored by the conqueror to their lawful ſovereigns.

BAIKAL, a great lake in Siberia, laying between 52 and 55 degrees north latitude. It is reckoned to be 500 werſts in length; but only 20 or 30 broad, and in ſome places not above 15. It is environed on all ſides by high mountains. In one part of it, which lies near the river Barguſin, it throws up an inflammable ſulphureous liquid called *Maltha*, which the people of the adjacent country burn in their lamps. There are likewiſe ſeveral ſulphureous ſprings near this lake. Its water at a diſtance appears of a ſea-green colour: it is freſh; and ſo clear, that objects may be ſeen in it ſeveral fathoms deep. It does not begin to freeze till near the latter end of December, and thaws again about the beginning of May: from which time till September, a ſhip is ſeldom known to be wrecked on it; but by the high winds which then blow, many ſhipwrecks happen. This lake is called by the neighbouring people *Swiatoie More*, or the *Holy Lake*; and they imagine, that when ſtorms happen on it, they will be preſerved from all danger by complimenting it with the title of *Sea*. When it is frozen over, people travel upon it in the road to China; but they muſt be very ſharp ſhod, otherwiſe they cannot ſtand upon the ice, which is exceedingly ſmooth. Notwithſtanding that the ice on this lake is ſometimes two ells thick, there are ſome open places in it to which tempeſtuous winds will often drive thoſe who are croſſing it, in which caſe they are irrecoverably loſt. The camels that paſs along have a particular kind of ſhoes ſharp at bottom, and the oxen have ſharp irons driven through their hoofs, without which it would be impoſſible for them to paſs. Here are plenty of large ſturgeon and pike; with many ſeals of the black, but none of the ſpotted kind. It contains ſeveral iſlands; and the borders are frequented by black ſables and civet-cats.

BAIL, BALLIUM, from the French *bailler*, which comes of the Greek *βαλλειν*, and ſignifies to deliver into hands), is uſed in our common law for the freeing or ſetting at liberty of one arreſted or impriſoned upon any action, either civil or criminal, on ſurety taken for his appearance at a day and place certain.

The reaſon why it is called *bail*, is becauſe by this means the party reſtrained is delivered into the hands of thoſe that bind themſelves for his forthcoming, in order to a ſafekeeping or protection from priſon; and the end of bail is to ſatisfy the condemnation and coſts, or render the defendant to priſon.

With reſpect to bail in civil caſes, it is to be obſerved, that there is both common and ſpecial bail. Common bail is in actions of ſmall concernment, being called *common*, becauſe any ſureties in that caſe are taken; whereas in cauſes of greater weight, as actions upon bonds, or ſpecialty, &c. where the debt amounts to 10l. *ſpecial* bail or ſurety muſt be taken, ſuch as ſubſidy men at leaſt, and they according to the value.

The commitment of a perſon being only for ſafe cuſtody, wherever bail will anſwer the ſame intention, it ought to be taken; as in moſt of the inferior crimes: but in felonies, and other offences of a capital nature, no bail can be a ſecurity equivalent to the actual cuſtody of the perſon. For what is there that a man may not be induced to forfeit, to ſave his own life? and what ſatisfaction or indemnity is it to the public, to ſeize the effects of them who have bailed a murderer, if the murderer himſelf be ſuffered to eſcape with impunity? Upon a principle ſimilar to which, the Athenian magiſtrates, when they took a ſolemn oath never to keep a citizen in bonds that could give three ſureties of the ſame quality with himſelf, did it with an exception to ſuch as had embezzled the public money, or been guilty of treaſonable practices.

Bail may be taken either in court, or, in ſome particular caſes, by the ſheriff or other magiſtrate; but moſt uſually by the juſtices of the peace. To refuſe or delay to bail any perſon bailable, is an offence againſt the liberty of the ſubject, in any magiſtrate, by the common law; as well as by the ſtatute Weſtm. 1. 3. Edw. I. c. 15. and the *habeas corpus* act, 31 Car. II. c. 2. And, leſt the intention of the law ſhould be fruſtrated by the juſtices requiring bail to a greater amount than the nature of the caſe demands, it is expreſsly declared by ſtatute 1 W. & M. ſt. 2. c. 1. that exceſſive bail ought not to be required; though what bail ſhall be called *exceſſive*, muſt be left to the courts, on conſidering the circumſtances of the caſe, to determine. And on the other hand, if the magiſtrate takes inſufficient bail he is liable to be fined, if the criminal doth not appear.

In *civil* caſes, every defendant is bailable. But it is otherwiſe in

Criminal matters. Regularly, all offences either againſt the common law or act of parliament, that are below felony, the offender ought to be admitted to bail unleſs it be prohibited by ſome ſpecial act of parliament.—By the ancient common law, before and ſince the conqueſt, all felonies were bailable, till murder was excepted by ſtatute: ſo that perſons might be admitted to bail almoſt in every caſe. But the ſtatute Weſt. 1. 3 Ed. I. c. 15. takes away the power of bailing in treaſon, and in divers inſtances of felony. The ſtatutes 23 Hen. VI. c. 9. and 1 and 2 Ph. and Mar. c. 13. gave farther regulations in this matter: and upon the whole we may collect, that no juſtices of the peace can bail, 1. Upon an accuſation of treaſon: nor, 2. Of murder: nor 3. In caſe of manſlaughter, if the priſoner be clearly the ſlayer, and not barely ſuſpected to be ſo; or if any indictment be found againſt him; nor 4. Such as, being committed for felony, have broken priſon; becauſe it not only carries a preſumption of guilt, but is alſo ſuperadding one felony to another: 5. Perſons outlawed: 6. Such as have abjured the realm: 7. Perſons taken with the mainour, or in the fact of felony: 8. Perſons charged with Arſon: 9. Excommunicated perſons, taken by writ *de excommunicato capiendo*: all which are clearly not admiſſible to bail by the juſtices. Others are of a dubious nature, as, 10. Thieves openly defamed and known: 11. Perſons charged with other felonies, or manifeſt and enormous offences, not being of good fame: and, 12. Acceſſories to felony, that labour under the ſame want of reputation. Theſe ſeem to be in the diſcretion of the juſtices, whether bailable or not. The laſt claſs are ſuch as *muſt* be bailed upon offering ſufficient ſurety; as, 13. Perſons of good fame, charged with a bare ſuſpicion of manſlaughter, or other infamous homicide; 14. Such perſons being charged with petit larceny or any felony, not before ſpecified: or, 16. With being acceſſory to any felony. Laſtly, it is agreed, that the court of king's bench (or any judge thereof in time of vacation) may bail for any crime whatſoever, be it treaſon, murder, or any other offence, according to the circumſtances of the caſe. And herein the wiſdom of the law is very manifeſt. To allow bail to be taken commonly for ſuch enormous crimes, would greatly tend to elude the public juſtice: and yet there are caſes, though they rarely happen, in which it would be hard and unjuſt to confine a man in priſon, though accuſed even of the greateſt offence. The law has therefore provided one court, and only one, which has a diſcretionary power of bailing in any caſe: except only, even to this high juriſdiction, and of courſe to all inferior ones, ſuch perſons as are committed by either houſe of parliament, ſo long as the ſeſſion laſts; or ſuch as are committed for contempts by any of the king's ſuperior courts of juſtice. See Law, Part III. N° xxxvi. 42.

Clerk of the Bails, is an officer belonging to the court of the King's Bench: he files the bail-pieces taken in that court, and attends for that purpoſe.

Bail, or Bale, in the ſea-language. The ſeamen call throwing the water by hand out of the ſhip's or boat's hold, *bailing*. They alſo call thoſe hoops that bear up the tilt of a boat, its *bails*.

BAILIE, in Scots law, a judge anciently appointed by the king over ſuch lands not erected into a regality as happened to fall to the crown by forfeiture or otherwiſe, now aboliſhed. It is alſo the name of a magiſtrate in royal boroughs, and of the judge appointed by a baron over lands erected into a barony. See Law, Part III. N° cxviii. 6, 7.

BAILIFF (*ballivus*), from the French word *bayliff*, that is, *præfectus provinciæ*: and as the names, ſo the office itſelf was anſwerable to that of France; where there are eight parliaments, which are high courts from whence there lies no appeal, and within the precincts of the ſeveral parts of that kingdom which belong to each parliament there are ſeveral provinces to which juſtice is adminiſtered by certain officers called *bailiffs*; and in England there are ſeveral counties in which juſtice hath been adminiſtered to the inhabitants by the officer who is now called *ſheriff* or *viſcount* (one of which names deſcends from the Saxons, the other from the Normans); and though the ſheriff is not called *bailiff*, yet it is probable that was one of his names alſo, becauſe the county is often called *balliva*. And in the ſtatute of Magna Charta, cap. 28. and 14 Ed. 3. c. 9. the word *bailiff* ſeems to compriſe as well ſheriffs as bailiffs of hundreds. As the realm is divided into counties, ſo every county is divided into hundreds; within which in ancient times the people had juſtice miniſtered to them by the officers of every hundred. But now the hundred courts, except certain franchiſes, are ſwallowed in the county-courts; and the bailiff's name and office is grown into contempt, they being generally officers to ſerve writs, &c. within their liberties. Though, in other reſpects, the name is ſtill in good eſteem: for the chief magiſtrates in divers town are called *bailiffs* or *bailies*; and ſometimes the perſons to whom the king's caſtles are committed are termed *bailiffs*, as the *bailiff of Dover caſtle*, &c.

Of the ordinary bailiffs there are ſeveral ſorts, *viz.* ſheriff's bailiffs, bailiffs of liberties, &c.

Sheriff's bailiffs, or ſheriff's officers, are either bailiffs of hundreds, or ſpecial bailiffs. Bailiffs of hundreds are officers appointed over thoſe reſpective diſtricts by the ſheriffs, to collect fines therein; to ſummon juries; to attend the judges and juſtices at the aſſiſes, and quarter-ſeſſions; and alſo to execute writs and proceſs in the ſeveral hundreds. But as theſe are generally plain men, and not thoroughly ſkilful in this latter part of their office, that of ſerving writs, and making arreſts and executions, it is now uſual to join ſpecial bailiffs with them; who are generally mean perſons employed by the ſheriffs on account only of their adroitneſs and dexterity in hunting and ſeizing of their prey.

Bailiffs of liberties are thoſe bailiffs who are appointed by every lord within his liberty, to execute proceſs and do ſuch offices therein as the bailiff errant doth at large in the county; but bailiffs errant or itinerant, to go up and down the county to ſerve proceſs, are out of uſe.

There are alſo bailiffs of foreſts, and bailiffs of manors, who direct huſbandry, fell trees, gather rents, pay quit-rents, &c.

Water B*AILIFF*, an officer appointed in all port-towns, for the ſearching of ſhips, gathering the toll for anchorage, &c. and arreſting perſons for debt, &c. on the water.

BAILII (David), painter of perſpective views and portraits, was the ſon of Peter Bailii, an artiſt of ſome note; and was born at Leyden in 1584. From his father he learned to draw and deſign: but he was afterwards placed under the care of Adrian Verburg, and continued with him for ſome time; and when he quitted that maſter, he ſtudied to much greater advantage with Cornelius Vandervoort, an excellent portrait painter, and with him he ſpent above ſix years. As Vandervoort poſſeſſed many capital paintings of ſome great maſters, Bailii, for his own improvement, copied them with critical care and obſervation; and particularly copied one perſpective view of the inſide of a church, originally painted by Stenwyck, which he finiſhed with ſuch accuracy, that even Stenwyck himſelf could ſcarce determine which was the original, or which the copy, when both were placed before him. He travelled through ſeveral parts of Italy, to ſee the works of the celebrated maſters of that country, and for a few years reſided at Rome; and abroad, as well as in his own country, the correctneſs of his drawing, and the delicate handling and finiſhing of his pictures, procured him employment, admirers, and friends. In the latter part of his life he diſcontinued painting, and only drew portraits on vellum with a pen, which he heightened with black lead, and gave them wonderful force and roundneſs. He died in 1638.

BAILIWICK, that liberty which is exempted from the ſheriff of the county; over which liberty the lord thereof appoints his own bailiff, with the like power within his precinct as an under ſheriff exerciſes under the ſheriff of the county: Or it ſignifies the precinct of a bailiff, or the place within which his juriſdiction is terminated.

BAILLET (Adrian), a very learned French writer and critic, born in 1649, at the village of Neuville near Beauvais in Picardy. His parents were too poor to give him a proper education, which however he obtained by the favour of the Biſhop of Beauvais, who afterwards preſented him with a ſmall vicarage. In 1680, he was appointed librarian to M. de Lamoignon, advocate general to the parliament of Paris; of whoſe library he made a copious index in 35 vols folio, all written with his own hand. He died in 1706, after writing many works, the principal of which are, *A Hiſtory of Holland from* 1609, *to the peace of Nimeguen in* 1679, 4 vols 12mo; *Lives of the Saints*, 3 vols folio, which he profeſſed to have purged from fables; *Jugemens des Sçavans*, which he extended to 9 vols 12mo; and *The Life of Des Cartes*, 2 vols 4to, which he abridged, and reduced to 1 vol. 12mo.

BAILLEUL, a town of France, in the earldom of Flanders, formerly very ſtrong, but now without any fortifications. It has been ſeveral times burnt by accident, and contains now only about 500 houſes. E. Long. 2. 55. N. Lat. 40. 35.

BAILMENT, in law, is a delivery of goods in truſt, upon a contract, expreſſed or implied, that the truſt ſhall be faithfully executed on the part of the bailee. As if cloth be delivered, or (in our legal dialect) bailed, to a taylor to make a ſuit of clothes, he has it upon an implied contract to render it again when made, and that in a workmanly manner. If money or goods be delivered to a common carrier, to convey from Oxford to London, or from Glaſgow to Edinburgh, &c. he is under a contract in law to pay, or carry them to the perſon appointed. If a horſe or other goods be delivered to an inn-keeper or his ſervants, he is bound to keep them ſafely, and reſtore them when his gueſt leaves the houſe. If a man takes in a horſe, or other cattle, to graze and depaſture in his grounds, which the law calls *agiſtment*, he takes them upon an implied contract to return them on demand to the owner. If a pawnbroker receives plate or jewels as a pledge or ſecurity for the repayment of money lent thereon at a day certain, he has them upon an expreſs contract or condition to reſtore them if the pledger performs his part by redeeming them in due time: for the due execution of which contract, many uſeful regulations are made by ſtatute 30 Geo. II. c. 24. And ſo, if a landlord diſtrains goods for rent, or a pariſh officer for taxes, theſe for a time are only a pledge in the hands of the diſtrainers, and they are bound by an implied contract in law to reſtore them on payment of the debt, duty, and expences, before the time of ſale; or when ſold, to render back the overplus. If a friend delivers any thing to his friend to keep for him, the receiver is bound to reſtore it on demand: and it was formerly held, that in the mean time he was anſwerable for any damage or loſs it might ſuſtain, whether by accident or otherwiſe; unleſs he expreſsly undertook to keep it only with the ſame care as his own goods, and then he ſhould not be anſwerable for theft or other accidents. But now the law ſeems to be ſettled on a much more rational footing; that ſuch a general bailment will not charge the bailee with any loſs, unleſs it happens by groſs neglect, which is conſtrued to be an evidence of fraud: but if the bailee undertakes ſpecially to keep the goods ſafely and ſecurely, he is bound to anſwer all perils and damages that may befal them for want of the ſame care with which a prudent man would keep his own.

BAILO; thus they ſtyle at Conſtantinople the ambaſſador of the republic of Venice, who reſides at the Porte. This miniſter, beſides his political charge, acts there the part of a conſul of Venice.

BAINBRIDGE (Dr John), an eminent phyſician and aſtronomer, born at Aſhby de la Zouche in Leiceſterſhire, in 1582. He taught a grammar ſchool for ſome years, and practiſed phyſic, employing his leiſure hours in aſtronomy, which was his favourite ſtudy: at length he removed to London, was admitted a fellow of the college of phyſicians, and raiſed his character by his deſcription of the comet in 1618. The next year Sir Henry Savile appointed him his firſt profeſſor of aſtronomy at Oxford; and the maſters and fellows of Merton-college made him firſt junior, and then ſuperior, reader of Linacre's lecture. He died in 1643, having written many works, ſome of which have never been publiſhed: but the MSS. are preſerved in the library of Trinity-college, Dublin.

BAIOCAO, a copper-coin, current at Rome, and throughout the whole ſtate of the church, ten of which make a Julio, and an hundred a Roman crown.

BAIRAM, or Beiram, a Turkiſh word which ſignifies a ſolemn feaſt. The Mahometans have two Bairams, the *Great* and the *Little*. The *Little* Bairam is properly that held at the cloſe of the faſt Ramazan, beginning with the firſt full moon in the following month Shawal. This is called in Arabic *Id al Fetz, or the Feaſt of breaking the faſt;* by European writers, *the Turkiſh Eaſter,* becauſe it ſucceeds Ramazan, which is their Lent, more uſually the *Great Bairam,* becauſe obſerved with great ceremony and rejoicing at Conſtantinople, and through Turkey, for three days, and in Perſia for five or ſix days, at leaſt by the common people, to make themſelves amends for the mortification of the preceding month.—The feaſt commencing with the new moon, the Mahometans are very ſcrupulous in obſerving the time when the new moon commences; to which purpoſe, obſervers are ſent to the tops of the higheſt mountains, who the moment they ſpy the appearance of a new moon, run to the city, and proclaim *Muzhdaluk,* "welcome news;" as it is the ſignal for beginning the feſtivity.—The *Great Bairam,* is properly that held by the pilgrims at Mecca, commencing on the tenth of Dhu Ihajia, when the victims are ſlain, and laſting three days. This is called by the Arabs, *Id al adha,* that is, *the feaſt of ſacrifice,* as being celebrated in memory of the ſacrifice of Abram, whoſe ſon God redeemed with a great victim. By European writers it is called the *Leſſer Bairam,* as being leſs taken notice of by the generality of the people, who are not ſtruck with it, becauſe the ceremonies, it is obſerved withal, are performed at Mecca, the only ſcene of the ſolemnity.—On the feaſt of Bairam, after throwing little ſtones, one after another, into the valley of Mina, they uſually kill one or more ſheep, ſome a goat, bullock, or even a camel; and after giving a part thereof to the poor, eat the reſt with their friends. After this, they ſhave themſelves. The ſecond is a day of reſt. On the third, they ſet out on their return home.

BAIROUT. See Beeroot.

BAIT, among fiſhermen, implies a ſubſtance proper to be faſtened to a hook, in order to catch the different ſorts of fiſh. See Fishing.

BAITING, the act of ſmaller or weaker beaſts attacking and haraſſing greater and ſtronger. In this ſenſe we hear of the baiting of bulls or bears by maſtiffs, or bull-dogs with ſhort noſes, that they may take the better hold.

Utility is pled in juſtification of *bull-baiting.* This animal is rarely killed without being firſt baited; the chaffing and exerciſe whereof makes his fleſh tenderer and more digeſtible. In reality, it diſpoſes it for putrefaction; ſo that, unleſs taken in time, baited fleſh is ſoon loſt. But a ſpirit of barbariſm had the greateſt ſhare in ſupporting the ſport: bulls are kept on purpoſe, and exhibited as ſtanding ſpectacles for the public entertainment. The poor beaſts have not fair play: they are not only tied down to a ſtake, with a collar about their necks, and a ſhort rope, which gives them not above four or five yards play; but they are diſarmed too, and the tips of their horns cut off, or covered with leather, to prevent their hurting the dogs. In this ſport, the chief aim of the dog is to catch the bull by the noſe, and hold him down; to which end, he will even creep on his belly: the bull's aim, on the contrary, is, with equal induſtry, to defend his noſe; in order to which, he thruſts it cloſe to the ground, where his horns are alſo in readineſs to toſs the dog.—Bull-baiting was firſt introduced into England as an amuſement in the reign of king John, about 1209.

BAJULUS, an ancient officer in the court of the Greek emperors. There were ſeveral degrees of bajuli; as, the grand *Bajulus,* who was preceptor to the emperor; and the ſimple *bajuli,* who were ſub-preceptors. The word is derived from the Latin verb *bajulare,* "to carry or bear a thing on the arms or the ſhoulders;" and the origin of the office is thus traced by antiquaries. Children, and eſpecially thoſe of condition, had anciently, beſides their nurſe, a woman called *gerula,* as appears from ſeveral paſſages of Tertullian; when weaned, or ready to be weaned, they had men to carry them about and take care of them, who were called *geruli* and *bajuli, a gerendo et bajulando.* Hence it is, that governors of princes and great lords, were ſtill denominated *bajuli,* and their charge or government *bajulatio,* even after their pupils were grown too big to be carried about. The word paſſed in the ſame ſenſe into Greece.

Bajulus is alſo uſed by Latin writers in the ſeveral other ſenſes wherein Bailiff is uſed among us.

Bajulus was alſo the name of a conventual officer in the ancient monaſteries, to whom belonged the charge of gathering and diſtributing the money and legacies left for maſſes and obits; whence he was alſo denominated *bajulus obituum novorum.*

BAKAN, a large and handſome town of Aſia in the Eaſt Indies, in the kingdom of Ava. E. Long. 98. 0. N. Lat. 19. 35.

BAKER (Sir Richard), author of the Chronicle of the kings of England, was born at Siſſingherſt, in Kent, about the year 1568. After going through the uſual courſe of academical learning at Hart-hall, in Oxford, he travelled into foreign parts; and upon his return home was created maſter of arts, and ſoon after, in 1603, received from king James I. the honour of knighthood. In 1620, he was high ſheriff of Oxfordſhire; but engaging to pay ſome of the debts of his wife's family, he was reduced to poverty, and obliged to betake himſelf for ſhelter to the Fleet priſon, where he compoſed ſeveral books; among which are,
1. Meditations and Diſquiſitions on the Lord's Prayer.
2. Meditations, &c. on ſeveral of the Pſalms of David.
3. Meditations and Prayers upon the ſeven days of the Week. 4. *Cato Variegatus,* or Cato's Moral Diſtichs varied, &c.—Mr Granger obſerves, that his Chronicle of the Kings of England was ever more eſteemed by

by readers of a lower claſs than by ſuch as had a critical knowledge of hiſtory. The language of it was, in this reign, called polite; and it long maintained its reputation, eſpecially among country gentlemen. The author ſeems to have been ſometimes more ſtudious to pleaſe than to inform, and with that view to have ſacrificed even chronology itſelf to method. In 1658, Edward Philips, nephew to Milton, publiſhed a third edition of this work, with the addition of the reign of Charles I. It has been ſeveral times reprinted ſince, and is now carried as low as the reign of George I. Sir Richard alſo tranſlated ſeveral works from the French and Italian; and died very poor, in the Fleet priſon, on the 18th of February 1645.

Baker (Thomas), an eminent mathematician, was born at Ilton in Somerſetſhire, about the year 1625, and entered at Magdalen-hall, Oxon, in 1640; after which he was vicar of biſhop's-Nymmet, in Devonſhire, where he wrote The Geometrical Key, or the Gate of Equations unlocked; by which he gained a conſiderable reputation. A little before his death, the members of the Royal Society ſent him ſome mathematical queries, to which he returned ſo ſatisfactory an anſwer, that they preſented him a medal, with an inſcription full of honour and reſpect. He died at Biſhop's-Nymmet on the 5th of June 1690.

Baker (Thomas), a very ingenious and learned antiquary, deſcended from a family ancient and well eſteemed, diſtinguiſhed by its loyalty and affection for the crown, was born at Crook in 1656. He was educated at the free ſchool at Durham, and thence removed to St John's college Cambridge in 1674. He proceeded B. A. 1677; M. A. 1681; was elected fellow March 1679-80; ordained deacon by Biſhop Compton of London December 20. 1685; prieſt by Biſhop Barlow of Lincoln December 19. 1686. Dr Watſon, tutor of the college, who was nominated, but not yet conſecrated biſhop of St David's, offered to take him for his chaplain, which he declined, probably on the proſpect of a like offer from Lord Crew biſhop of Durham, which he ſoon after accepted. His Lordſhip collated him to the rectory of Long-Newton in his dioceſe, and the ſame county, June 1687; and, as Dr Grey was informed by ſome of the biſhop's family, intended to have given him that of Sedgefield, worth L. 600 or L. 700 a-year, with a golden prebend, had he not incurred his diſpleaſure and left his family for refuſing to read King James II.'s declaration for liberty of conſcience. The biſhop, who diſgraced him for this refuſal, and was excepted out of King William's pardon, took the oaths to that king, and kept his biſhopric till his death. Mr Baker reſigned Long-Newton Auguſt 1. 1690, refuſing to take the oaths; and retired to his fellowſhip at St John's, in which he was protected till January 20, 1716-17, when, with one and twenty others, he was diſpoſſeſſed of it. After the paſſing the Regiſtering Act 1723, he was deſired to regiſter his annuity of L. 40, which the laſt act required before it was amended and explained. Though this annuity, left him by his father for his fortune, with L. 20 *per annum* out of his collieries by his elder brother from the day of his death Auguſt 1699, for the remaining part of the leaſe, which determined at Whitſuntide 1723, was now his whole ſubſiſtence, he could not be prevailed on to ſecure himſelf againſt the act. He retained a lively reſentment of his deprivations; and wrote himſelf in all his books, as well as in thoſe which he gave to the college library, *ſocius ejectus*, and in ſome *ejectus rector*. He continued to reſide in the college as commoner-maſter till his death, which happened July 2. 1740, of a paralytic ſtroke, being found on the floor of his chamber. In the afternoon of June 29, being alone in his chamber, he was ſtruck with a ſlight apoplectic fit; which abating a little, he recovered his ſenſes, and knew all about him, who were his nephew Burton, Drs Bedford and Heberden. He ſeemed perfectly ſatisfied and reſigned; and when Dr Bedford deſired him to take ſome medicine then ordered, he declined it, ſaying, he would only take his uſual ſuſtenance, which his bed-maker knew the times and quantities of giving: he was thankful for the affection and care his friends ſhowed him; but, hoping the time of his diſſolution was at hand, would by no means endeavour to retard it. His diſorder increaſed, and the third day from this ſeizure he departed. Being appointed one of the executors of his eldeſt brother's will, by which a large ſum was bequeathed to pious uſes, he prevailed on the other two executors, who were his other brother Francis and the hon. Charles Montague, to lay out L. 1310 of the money upon an eſtate to be ſettled upon St John's college for ſix exhibitioners. He likewiſe gave the college L. 100 for the conſideration of L. 6 a-year (then only legal intereſt) for his life; and to the library ſeveral choice books, both printed and MS. medals, and coins; beſides what he left to it by his will; which were "all ſuch books, printed and MS. as he had, and were wanting there." All that Mr Baker printed was, 1. Reflections on Learning, ſhowing the inſufficiency thereof in its ſeveral particulars, in order to evince the uſefulneſs and neceſſity of Revelation, Lond. 1709-10" (which went through eight editions, and Mr Boſwell, in his "Method of Study," ranks it among the Engliſh claſſics for purity of ſtyle); and, 2. The Preface to Biſhop Fiſher's Funeral Sermon for Margaret Counteſs of Richmond and Derby, 1708;" both without his name. Dr Grey had the original MS. of both in his own hands. The latter piece is a ſufficient ſpecimen of the editor's ſkill in antiquities to make us regret that he did not live to publiſh his "Hiſtory of St John's college, from the foundation of old St John's houſe to the preſent time; with ſome occaſional and incidental account of the affairs of the univerſity, and of ſuch private colleges as held communication or intercourſe with the old houſe or college: collected principally from MSS. and carried on through a ſucceſſion of maſters to the end of Biſhop Gunning's maſterſhip, 1670." The original, fit for the preſs, is among the Harleian MSS. N° 7028. His MS. collections relative to the hiſtory and antiquities of the univerſity of Cambridge, amounting to 39 volumes in folio and three in quarto, are divided between the Britiſh Muſeum and the public library at Cambridge; the former poſſeſſes 23 volumes, which he bequeathed to the Earl of Oxford, his friend and patron; the latter 16 in folio, and three in quarto, which he bequeathed to the univerſity. Dr Knight ſtyles him "the greateſt maſter of the antiquities of this our univerſity;" and Hearne ſays, *Optandum eſt ut ſua quoque collectanea de antiquitatibus Cantabrigienſibus juris faciat publici Cl. Backerus, quippe qui erudi-*

tione ſumma judicioque acri et ſubacto polleat. Mr Baker intended ſomething like an *Athenæ Cantabrigienſes*, on the plan of the *Athenæ Oxonienſes.*

BAKER (Henry), an ingenious and diligent naturaliſt, was born in Fleet-ſtreet London, either near the end of the laſt, or very early in the beginning of the preſent century. His father's profeſſion is not known; but his mother was, in her time, a midwife of great practice. He was brought up under an eminent bookſeller who preceded the elder Dodſley to the buſineſs of a bookſeller; in which, however, he appears not to have engaged at all after his apprenticeſhip; or, if he did, it was ſoon relinquiſhed by him: for though it was in his power to have drawn away all his maſter's beſt cuſtomers, he would not ſet up againſt him. Mr Baker being of a philoſophical turn of mind, and having diligently attended to the methods which might be practicable and uſeful in the cure of ſtammering, and eſpecially in teaching deaf and dumb perſons to ſpeak, he made this the employment of his life. In the proſecution of ſo valuable and difficult an undertaking, he was very ſucceſsful; and ſeveral of his pupils, who are ſtill living, bear teſtimony to the ability and good effect of his inſtructions. He married Sophia, youngeſt daughter of the famous Daniel Defoe, who brought him two ſons, both of whom he ſurvived. On the 29th of January 1740, Mr Baker was elected a fellow of the Society of Antiquaries; and, on the 12th of March following, the ſame honour was conferred upon him by the Royal Society. In 1744, Sir Godfrey Copley's gold medal was beſtowed upon him, for having, by his microſcopical experiments on the cryſtallizations and configurations of ſaline particles, produced the moſt extraordinary diſcovery during that year. Having led a very uſeful and honourable life, he died at his apartments in the Strand on the 25th of November 1774, being then above 70 years of age. His wife had been dead ſome time before; and he only left one grandſon, William Baker, who was born February 17. 1763, and to whom, on his living to the age of 21, he bequeathed the bulk of his fortune, which he had acquired by his profeſſion of teaching deaf and dumb perſons to ſpeak. His furniture, printed books (but not MSS.), curioſities, and collections of every ſort, he directed ſhould be ſold, which was accordingly done. His fine collection of native and foreign foſſils, petrifactions, ſhells, corals, vegetables, ores, &c. with ſome antiquities and other curioſities, were ſold by auction March 13. 1775, and the nine following days. He was buried, as he deſired, in an unexpenſive manner, in the church-yard of St Mary-le-ſtrand; within which church, on the ſouth wall he ordered a ſmall tablet to be erected to his memory. "An inſcription for it (he ſaid) would probably be found among his papers; if not, he hoped ſome learned friend would write one agreeably to truth." This friendly office, however, remains as yet to be performed. Mr. Baker was a conſtant and uſeful attendant at the meetings of the Royal and Antiquarian Societies, and in both was frequently choſen one of the council. He was peculiarly attentive to all the new improvements which were made in natural ſcience, and very ſolicitous for the proſecution of them. Several of his communications are printed in the Philoſophical Tranſactions; and, beſides the papers written by himſelf, he was the means, by his extenſive correſpondence, of conveying to the Society the intelligence and obſervations of other inquiſitive and philoſophical men, both at home and abroad. The Society for the encouragement of arts, manufactures, and commerce, is under ſingular obligations to our worthy naturaliſt. As he was one of the earlieſt members of it, ſo he contributed in no ſmall degree to its riſe and eſtabliſhment. At its firſt inſtitution he officiated for ſome time *gratis* as ſecretary. He was many years chairman of the committee of accounts; and he took an active part in the general deliberations of the Society. He drew up a ſhort account of the original of this ſociety, and of the concern he himſelf had in forming it; which was read before the ſociety of antiquaries, and would be a pleaſing preſent to the public. Mr Baker was a poetical writer in the early part of his life. His *Invocation of Health* got abroad without his knowledge; but was reprinted by himſelf in his *Original Poems, ſerious and humorous*, Part I. 8vo, 1725. Part II. came out in 1726. Among theſe poems are ſome tales as witty and as looſe as Prior's. He was the author likewiſe of *The Univerſe*, a poem intended to reſtrain the pride of man; which has been ſeveral times reprinted. His account of the water polype, which was originally publiſhed in the Philoſophical Tranſactions, was afterwards enlarged into a ſeparate treatiſe, and hath gone through ſeveral editions. But his principal publications are, *The Microſcope made Eaſy*, and *Employment for the Microſcope.* The firſt of theſe, which was originally publiſhed in 1742, or 1743, hath gone through ſix editions. The ſecond edition of the other, which to ſay the leaſt of it, is equally pleaſing and inſtructive, appeared in 1764. Theſe treatiſes, and eſpecially the latter, contain the moſt curious and important of the obſervations and experiments which Mr Baker either laid before the Royal Society or publiſhed ſeparately. It has been ſaid of Mr Baker that *he was a philoſopher in little things.* If it was intended by this language to leſſen his reputation, there is no propriety in the ſtricture. He was an intelligent, upright, and benevolent man, much reſpected by thoſe who knew him beſt. His friends were the friends of ſcience and virtue: and it will always be remembered by his cotemporaries, that no one was more ready than himſelf to aſſiſt thoſe with whom he was converſant in their various reſearches and endeavours for the advancement of knowledge and the benefit of ſociety.

BAKER (David-Erſkine), ſon to the former, was a young man of genius and learning. Having been adopted by an uncle, who was a ſilk-throwſter in Spitalfields, he ſucceeded him in the buſineſs; but wanted the prudence and attention which are neceſſary to ſecure proſperity in trade. He married the daughter of Mr Clendon, a reverend empiric. Like his father, he was both a philoſopher and a poet; and wrote ſeveral occaſional poems in the periodical collections, ſome of which were much admired at the time; but ſo violent was his turn for dramatic performance, that he repeatedly engaged with the loweſt ſtrolling companies, in ſpite of every effort of his father reclaim him. The public was indebted to him for "The Companion to the Play-houſe," in two volumes, 1764, 12mo; a work which, though imperfect, had conſiderable merit, and ſhowed that he poſſeſſed a very extenſive knowledge of our dramatic authors; and which has ſince (under the title of "Biographia Dramatica") been conſiderably improved by the attention of a gentleman in every reſpect well qualified for the undertaking.

BAKER, a perſon whoſe occupation or buſineſs is to bake bread. See the articles BAKING and BREAD.

The learned are in great doubt about the time when baking firſt became a particular profeſſion and bakers were introduced. It is however generally agreed, that they had their riſe in the eaſt, and paſſed from Greece to Italy after the war with Pyrrhus, about the year of Rome 583. Till which time every houſewife was her own baker; for the word *piſtor*, which we find in Roman authors before that time, ſignified a perſon who ground or pounded the grain in a mill or mortar to prepare it for baking, as Varro obſerves. According to Athenæus, the Cappadocians were the moſt applauded bakers, after them the Lydians, then the Phœnicians.—To the foreign bakers brought into Rome, were added a number of freed-men, who were incorporated into a body, or as they called it, a *college;* from which neither they nor their children were allowed to withdraw. They held their effects in common, and could not diſpoſe of any part of them. Each bake-houſe had a patronus, who had the ſuperintendency thereof; and theſe patroni elected one out of their number each year, who had ſuperintendence over all the reſt, and the care of the college. Out of the body of the bakers were every now and then one admitted among the ſenators.—To preſerve honour and honeſty in the college of bakers, they were expreſsly prohibited all alliance with comedians and gladiators; each had his ſhop or bake-houſe, and they were diſtributed into fourteen regions of the city. They were excuſed from guardianſhips and other offices, which might divert them from their employment.—By our own ſtatutes bakers are declared not to be handicrafts. No man for uſing the myſteries or ſciences of baking, brewing, ſurgery, or writing, ſhall be interpreted a handicraft. The bakers were a brotherhood in England before the year 1155, in the reign of king Henry II. though the white bakers were not incorporated till 1337, by king Edward III. and the brown bakers not till 1621, in king James I.'s time. Their hall is in Harp-lane, Thames-ſtreet; and their court-day on the firſt Monday of the month.—They make the 19th company; and conſiſt of a warden, 4 maſters, 30 aſſiſtants, and 140 men on the livery, beſides the commonalty.—The French had formerly a great baker, *grand panetier de France*, who had the ſuperintendency of all the bakers of Paris. But ſince the beginning of this century, they have been put under the juriſdiction of the lieutenant-general *de police.* In ſome provinces of France, the lord is the only baker in his ſeigneury; keeping a public oven, to which all the tenants are obliged to bring their bread. This right is called *furnagium*, or *furnaticum*, and makes part of the *bannalite.*

BAKEWELL, a pretty large town of Derbyſhire, in England, ſeated on the river Wye, on the North-ſide of the Peak. It has a conſiderable trade in lead. W. Long. 2. 30. N. Lat. 55. 15.

BAKING, the art of preparing bread, or reducing meals of any kind, whether ſimple or compound, into bread. See the article BREAD.

The various forms of baking among us may be reduced into two, the one for unleavened, the other for leavened bread. For the firſt, the chief is manchet-baking; the proceſs whereof is as follows. The meal, ground and boulted, is put into a trough; and to every buſhel are poured in about three pints of warm ale, with barm and ſalt to ſeaſon it. This is kneaded well together, with the hands through the brake; or, for want thereof, with the feet, through a cloth: after which, having lain an hour to ſwell, it is moulded into manchets; which, ſcorched in the middle, and pricked up at top, to give room to riſe, are baked in the oven by a gentle fire.—For the ſecond, ſometimes called *cheat-bread baking*, it is thus: Some leaven (ſaved from a former batch) filled with ſalt, laid up to ſour, and at length diſſolved in water, is ſtrained through a cloth into a hole made in the middle of the heap of meal in the trough; then it is worked with ſome of the flour into a moderate conſiſtence: this is covered up with meal, where it lies all night; and in the morning the whole heap is ſtirred up, and mixed with a little warm water, barm, and ſalt, by which it is ſeaſoned, ſoftened, and brought to an even leaven: it is then kneaded, moulded, and baked, as before.

Method of raiſing a buſhel of flour, with a tea-ſpoonful of barm; by James Stone, of Amport, in Hampſhire.—Suppoſe you want to bake a buſhel of flour, and have but one tea-ſpoonful of barm. Put your flour into your kneading-trough or trendle; then take about three quarters of a pint of warm water, and take the tea-ſpoonful of thick ſteady barm and put it into the water, ſtir it until it is thoroughly mixed with the water: then make a hole in the middle of the flour large enough to contain two gallons of water, pour in your ſmall quantity; then take a ſtick about two feet long, (which you may keep for that purpoſe), and ſtir in ſome of the flour, until it is as thick as you would make batter for a pudding: then ſtrew ſome of the dry flour over it, and go about your uſual buſineſs for about an hour: then take about a quart of warm water more, and pour in; for in one hour you will find that ſmall quantity raiſed ſo, that it will break through the dry flour which you ſhook over it; and when you have poured in the quart of warm water, take your ſtick as before, and ſtir in ſome more flour, until it is as thick as before; then ſhake ſome more dry flour over it, and leave it for two hours more, and then you will find it riſe and break through the dry flour again; then you may add three quarts or a gallon of water more, and ſtir it in the flour and make it as thick as at firſt, and cover it with dry flour again; in about three or four hours more you may mix up your dough, and then cover it up warm; and in four or five hours more you may put it into the oven, and you will have as light bread as though you had put a pint of barm. It does not take above a quarter of an hour more time than the uſual way of baking, for there is no time loſt but that of adding water three or four times.

The author of this method aſſures us, that he conſtantly bakes this way in the morning about ſix or ſeven o'clock, puts the flour out, and puts this ſmall quantity of barm into the before-mentioned quantity of water, in an hour's time ſome more, in two hours more a greater quantity, about noon makes up the dough, and about ſix in the evening it is put into the oven, and he has always good bread, never heavy nor bitter.

When you find, he ſays, your body of flour ſpunged large enough, before you put in the reſt of your water, you ſhould, with both your hands, mix that which is ſpunged and the dry flour altogether, and then add the remainder of warm water, and your dough will riſe the better and eaſier.

The reaſon he aſſigns why people make heavy bread is, not becauſe they have not barm enough, but becauſe they do not know that barm is the ſame to flour as fire is to fuel; that, as a ſpark of fire will kindle a large body by only blowing of it up, ſo will a thimblefull of barm, by adding of warm water, raiſe or ſpunge any body of flour; for warm water gives freſh life to that which is before at work: ſo that the reaſon of making bread heavy is, becauſe the body ſpunged is not large enough, but was made up and put into the oven before it was ripe.

In regard to the difference of ſeaſons, he preſcribes, that in the ſummer you ſhould put your water bloodwarm; and in winter, in cold froſty weather, as warm as you can bear your hand in it without making it ſmart; being ſure you cover up your dough very warm in the winter, and your covering of it with dry flour every time you add warm water, will keep in the heat; when you have added ſix or eight quarts of warm water, as before mentioned, in ſuch a gradual way, you will find all that body of flour which is mixed with the warm water, by virtue of that one tea-ſpoonful of barm, brought into great agitation, waxing or fermenting; for it is to the flour what the ſpirit is to the body, it ſoon fills it with motion.

BAKOU, or Baku, a town of Perſia, in the province of Shirvan, ſituated at the extremity of the Gulf of Ghilan on the Caſpian Sea. It is eſteemed the moſt commodious haven in this ſea, as veſſels may there ride ſecurely at anchor in ſeven fathom water; but the number of ſhoals, iſlands, and ſand-banks, render the entrance in ſome places extremely difficult and dangerous, particularly to the Ruſſians, who are not very expert ſailors. Baku is a fortreſs ſurrounded with high brick walls; its inhabitants, like thoſe of Derbent, are Perſians, Tartars, and a few Armenian merchants. The principal articles of exportation which ſupport the trade of this place are naphtha, and the fineſt rock ſalt, of both which there are mines on the eaſt ſide of the bay. The inhabitants cultivate ſaffron and the cotton tree, but not to any conſiderable advantage. The trade of Baku, though more valuable than that of Derbent, is ſtill conſiderable, and chiefly carried on with Shamakee, from whence it draws raw ſilk and ſilken ſtuffs. A Ruſſian conſul is reſident at this place. In 1777 Baku belonged to Melik-Mehmed, who was tributary to Feth Ali, khan of Kuba; the latter poſſeſſed the whole province of Shirvan, and was the moſt powerful prince, next to the khan of Ghilan, upon the coaſt of the Caſpian. Before we quit the province of Shirvan, it may not be improper to mention its capital, the inland town of Shamakee, which is only 66 miles from Baku, and ſupplies that port with raw ſilk and ſilken ſtuffs. It owed its former commercial importance to the ſilk which is cultivated in the neighbouring diſtrict; this rich production ſtill preſerves the town from ruin; though its traffic is greatly reduced by the exorbitant exactions of the khan of Kuba. Formerly the Ruſſians had a factory at this place; and it was alſo crowded with Turkiſh and Greek merchants; but at preſent there are only a few Armenian and Indian traders. The inhabitants manufacture ſilk and cotton ſtuffs, but far inferior to thoſe made at this place in the beginning of the preſent century. The ſilk of this province is exported into the interior part of Perſia, Turkey, Georgia, and Ruſſia. E. Long. 51. 30. N. Lat. 40. 20.

BALAAM, a prophet and diviner of the city of Pethor upon the Euphrates, whoſe practices with Balak king of the Moabites are recorded in the book of Numbers, chap. xxii. It is a queſtion much debated among divines, whether Balaam was a true prophet of God, or no more than a magician or fortune-teller. The Jews indeed are generally of opinion, that he was a buſy and pretending aſtrologer, who, obſerving when men were under a bad aſpect of the ſtars, pronounced a curſe upon them; which ſometimes coming to paſs, gained him in ſome neighbouring nations, a reputation in his way. Several of the ancient fathers ſuppoſe him to be no more than a common ſoothſayer, who undertook to tell future events, and diſcover ſecrets, and by no very juſtifiable arts. Origen will needs have it, that he was no prophet, but only one of the devil's ſorcerers, and that of him he went to inquire; but that God was pleaſed to prevent him and put what anſwers he pleaſed into his mouth. It cannot be denied, however, that the ſcripture expreſsly calls him a prophet (2. Pet. ii. 16.); and therefore ſome later writers have imagined that he had once been a good man and true prophet, till loving the wages of iniquity, and proſtituting the honour of his office to covetouſneſs, he apoſtatiſed from God, and betaking himſelf to idolatrous practices, fell under the deluſion of the devil, of whom he learnt all his magical enchantments, though at this juncture, when the preſervation of his people was concerned, it might be conſiſtent with God's wiſdom to appear to him, and vouchſafe his revelations. As to what paſſed between him and his aſs, when that animal was miraculouſly enabled to ſpeak to its maſter; commentators are divided in their opinions concerning this fact, whether it really and literally happened as Moſes relates it; or whether it be an allegory only, or the mere imagination or viſion of Balaam. This indeed is ſo wonderful an inſtance, that ſeveral of the Jewiſh doctors, who, upon other occaſions are fond enough of miracles, ſeem as if they would hardly be induced to aſſent to this. Philo, in his *Life of Moſes*, paſſes it over in ſilence; and Maimonides pretends that it happened to Balaam in a prophetic viſion only. But St Peter (2 Pet. ii. 16.) ſpeaks of this fact as literal and certain, and ſo all interpreters explain it. St Auſtin, who underſtands it exactly according to the letter, finds nothing in the whole account more ſurpriſing than the ſtupidity of Balaam, who heard his aſs ſpeak to him, and anſwered it as if he talked with a reaſonable perſon. He is of opinion, that this diviner was accuſtomed to prodigies like this, or that he was ſtrangely blinded by his avarice, not to be ſtopped by an event of ſo extraordinary a nature. Le Clerc thinks, that Balaam might probably have imbibed the doctrine of tranſmigration of ſouls, which was certainly very common in the eaſt; and from thence he might be the leſs aſtoniſhed at hearing a brute ſpeak. And Dr Patrick thinks, that Balaam was in ſuch a rage and fury at the ſuppoſed perverſeneſs of his beaſt cruſhing his foot, that for the preſent he could think of nothing elſe; though the conciſeneſs of Moſes's relation, who muſt be preſumed to have omitted many circumſtances, which if rightly known would diſpel this and many more difficulties that may be imagined in this tranſaction, does certainly furniſh us with a better and more ſatisfactory anſwer. St Auſtin is of opinion, that God had not given the aſs a reaſonable ſoul; but permitted it to pronounce certain words, in order to reprove the prophet's covetouſneſs. Gregory of Nyſſa ſeems to think that the aſs did not utter any word articulately or diſtinctly; but that, having brayed as uſual, the diviner, whoſe practice it had been to draw preſages from the cries of beaſts and ſinging of birds, comprehended eaſily the aſs's meaning by its noiſe; Moſes deſigning to ridicule this ſuperſtitious art of augurs and ſoothſayers, as if the aſs really ſpoke in words articulate.

We muſt own, ſays Calmet, that this is a miraculous fact related by an inſpired writer, whoſe authority we are not allowed to call in queſtion in the leaſt particular: but we ſhould ſtudy ſuch ways of explaining it as are moſt conformable to reaſon, and moſt proper to ſolve the difficulties of it, without attacking the truth of the hiſtory. Now it is very poſſible for God to make an aſs ſpeak articulately; it is indeed miraculous, and above the ordinary faculty of this animal, but not againſt the laws of nature.

BALADAN, the ſcripture name for a king of Babylon (Iſa. xxxix. 1. 2 Kings xx. 12.), called by prophane authors *Beleſus* or *Beleſis*, *Nabonaſſar* or *Nanybrus*. Baladan at firſt was no more than governor of Babylon; but entering into a confederacy with Arbaces governor of Media, and rebelling againſt Sardanapalus king of Aſſyria, theſe two generals marched againſt him with an army of 400,000 men, and were beat in three different battles. But the Bactrians deſerting the king, and coming over to Baladan and Arbaces, the rebels attacked the enemy in the night, and made themſelves maſters of his camp. After this misfortune, Sardanapalus retreated to Nineveh, and left the command of his army to his brother-in-law Salamenes. The conſpirators attacked Salamenes, and defeated him in two great battles; after which they laid ſiege to Nineveh. Sardanapalus ſuſtained the ſiege for three years; but the Tigris, in the third year, overflowing its banks, beat down twenty furlongs of the walls; whereupon the conſpirators entered the city and took poſſeſſion of it, after Sardanapalus had burnt himſelf and all his moſt valuable effects upon a funeral pile erected for that purpoſe in his palace. Baladan was acknowledged king of Babylon, as Arbaces was of Media. Berodach-baladan, who ſent embaſſadors to Hezekiah (2 Kings xx.), was the ſon of Baladan.

BALA, a town of Merionethſhire in Wales. W. Long. 3. 37. N. Lat. 52. 54.

BALÆNA, or WHALE, in zoology, a genus of the mammalia claſs, belonging to the order of cete. The characters of this genus are theſe: the balæna, in place of teeth, has a horny plate on the upper jaw, and a double fiſtula or pipe for throwing out water. The ſpecies are four, *viz.*

1 Common whale.

1. The myſticetus, or common whale, which has many turnings and winding in its noſtrils, and has no fin on the back. This is the largeſt of all animals; it is even at preſent ſometimes found in the northern ſeas 90 feet in length; but formerly they there were taken of a much greater ſize, when the captures were leſs frequent, and the fiſh had time to grow. Such is their bulk within the arctic circle; but in thoſe of the torrid zone, where they are unmoleſted, whales are ſtill ſeen 160 feet long.

2 Deſcription, &c.

The head is very much diſproportioned to the ſize of the body, being one third the ſize of the fiſh: the under lip is much broader than the upper. The tongue is compoſed of a ſoft ſpongy fat, capable of yielding five or ſix barrels of oil. The gullet is very ſmall for ſo vaſt a fiſh, not exceeding four inches in width. In the middle of the head are two orifices, through which it ſpouts water to a vaſt height, and with a great noiſe, eſpecially when diſturbed or wounded. The eyes are not larger than thoſe of an ox, and when the cryſtalline humour is dried, it does not appear larger than a pea. They are placed towards the back of the head, being the moſt convenient ſituation for enabling them to ſee both before and behind; as alſo to ſee over them, where their food is principally found. They are guarded by eye-lids and eye-laſhes, as in quadrupeds; and they ſeem to be very ſharp-ſighted.

Nor is their ſenſe of hearing in leſs perfection; for they are warned at great diſtances of any danger preparing againſt them. It would ſeem as if nature had deſignedly given them theſe advantages, as they multiply little, in order to continue their kind. It is true, indeed, that the external organ of hearing is not perceptible, for this might only embarraſs them in their natural element; but as ſoon as the thin ſcarf-ſkin after mentioned is removed, a black ſpot is diſcovered behind the eye, and under that is the auditory canal, that leads to a regular apparatus for hearing. In ſhort, the animal hears the ſmalleſt ſounds at very great diſtances, and at all times, except when it is ſpouting water; which is the time that the fiſhers approach to ſtrike it. What is called *whalebone*, adheres to the upper jaw; and is formed of thin parallel laminæ, ſome of the longeſt four yards in length: of theſe there are commonly 350 on each ſide, but in very old fiſh more; about 500 of them are of length fit for uſe, the others being too ſhort. They are ſurrounded with long ſtrong hair, not only that they may not hurt the tongue, but as ſtrainers to prevent the return of their food when they diſcharge the water out of their mouths.—The real bones of the whale are hard, porous, and full of marrow. Two great ſtrong bones ſuſtain the upper lip, lying againſt each other in the ſhape of an half-moon.

The tail is broad and ſemilunar; and when the fiſh lies on one ſide, its blow is tremendous. The tail alone it makes uſe of to advance itſelf forward in the water; and it is ſurpriſing to ſee with what force and celerity its enormous bulk cuts through the ocean. The fins are only made uſe of for turning in the water, and giving a direction to the velocity impreſſed by the tail. The female alſo makes uſe of them, when purſued, to bear off her young, clapping them on her back, and ſupporting them by the fins on each ſide from falling. The whale varies in colour; the back of ſome being red, the belly generally white. Others are black, ſome mottled, others quite white; according to the obſervation of Martin, who ſays, that their colours in the water are extremely beautiful, and that their ſkin is very ſmooth and ſlippery. The outward or ſcarf ſkin of the whale is no thicker than parchment; but this removed, the real ſkin appears, of about an inch thick, and covering the fat or blubber that lies beneath: this is from eight to twelve inches in thickneſs; and is, when the fiſh is in health, of a beautiful yellow. The muſcles lie beneath; and theſe, like the fleſh of quadrupeds, are very red and tough. The penis is eight feet in length, incloſed in a ſtrong ſheath. The teats in the female are placed in the lower part of the belly.

3 Mutual fidelity of the male and female.

In copulation, the female joins with the male, as is aſſerted, *more humano;* and once in two years feels the acceſſes of deſire. Their fidelity to each other exceeds whatever we are told of, even the conſtancy of birds. Some fiſhers, as Anderſon informs us, having ſtruck one of two whales, a male and a female, that were in company together, the wounded fiſh made a long and terrible reſiſtance: it ſtruck down a boat with three men in it, with a ſingle blow of its tail, by which all went to the bottom. The other ſtill attended its companion, and lent it every aſſiſtance; till at laſt, the fiſh that was ſtruck, ſunk under the number of its wounds; while its faithful aſſociate, diſdaining to ſurvive the loſs, with great bellowing, ſtretched itſelf upon the dead fiſh, and ſhared his fate.—The whale goes with young nine or ten months, and is then fatter than uſual, particularly when near the time of bringing forth. It is ſaid that the embryo, when firſt preceptible, is about 17 inches long, and white; but the cub, when excluded, is black, and about 10 feet long. She generally produces one young one, and never above two. When ſhe ſuckles her young, ſhe throws herſelf on one ſide on the ſurface of the ſea, and the young one attaches itſelf to the teat.

4 Offspring; parental affection, &c.

Nothing can exceed the tenderneſs of the female for her offspring; ſhe carries it with her wherever ſhe goes, and, when hardeſt purſued, keeps it ſupported between her fins. Even when wounded, ſhe ſtill claſps her young one; and when ſhe plunges to avoid danger, takes it to the bottom; but riſes ſooner than uſual, to give it breath again. The young ones continue at the breaſt for a year; during which time, they are called by the ſailors, *ſhort-heads*. They are then extremely fat, and yield above 50 barrels of blubber. The mother at the ſame time is equally lean and emaciated. At the age of two years they are called *ſtunts*, as they do not thrive much immediately after quitting the breaſt: they then yield ſcarce above 20 or 24 barrels of blubber; from that time forward they are called *ſkull-fiſh*, and their age is wholly unknown.

5 Are gregarious.

6 Their food.

7 Inoffenſiveneſs.

Every ſpecies of whale propagates only with thoſe of its own kind, and does not at all mingle with the reſt: however, they are generally ſeen in ſhoals, of different kinds together, and make their migrations in large companies from one ocean to another. They are gregarious animals; which implies their want of mutual defence againſt the invaſions of ſmaller, but more powerful, fiſhes. It ſeems aſtoniſhing, therefore, how a ſhoal of theſe enormous animals find ſubſiſtence together, when it would ſeem that the ſupplying even one with food would require greater plenty than the ocean could furniſh. To increaſe our wonder, we not only ſee them herding together, but uſually find them fatter than any other animals of whatſoever element. We likewiſe know that they cannot ſwallow large fiſhes, as their throat is ſo narrow, that an animal larger than an herring could not enter. How then do they ſubſiſt and grow ſo fat? A certain ſort of ſmall ſnail, or (as Linnæus ſays) the *meduſa* * or ſea-blubber, is ſufficient for this ſupply. Content with this ſimple food, it purſues no other animal, leads an inoffenſive life in its element, and is harmleſs in proportion to its ſtrength to do miſchief.

8 Enemies.

As the whale is an inoffenſive animal, it is not to be wondered that it has many enemies, willing to take advantage of its diſpoſition, and inaptitude for combat. There is a ſmall animal, of the ſhell-fiſh kind, called the *whale-louſe*, that ſticks to its body, as we ſee ſhells ſticking to the foul bottom of a ſhip. This inſinuates itſelf chiefly under the fins; and whatever efforts the great animal makes, it ſtill keeps its hold, and lives upon the fat, which it is provided with inſtruments to arrive at.

6 Conflict with the ſword-fiſh.

The ſword-fiſh †, however, is the whale's moſt terrible enemy. "At the ſight of this little animal," ſays Anderſon, "the whale ſeems agitated in an extraordinary manner; leaping from the water as if with affright: wherever it appears, the whale perceives it at a diſtance, and flies from it in the oppoſite direction. I have been myſelf," continues he, "a ſpectator of their terrible encounter. The whale has no inſtrument of defence except the tail: with that it endeavours to ſtrike the enemy; and a ſingle blow taking place, would effectually deſtroy its adverſary: but the ſword-fiſh is as active as the other is ſtrong, and eaſily avoids the ſtroke; then bounding into the air, it falls upon its great ſubjacent enemy, and endeavours not to pierce it with its pointed beak, but to cut with its toothed edges. The ſea all about it is ſeen dyed with blood, proceeding from the wounds of the whale; while the enormous animal vainly endeavours to reach its invader, and ſtrikes with its tail againſt the ſurface of the water, making a report at each blow louder than the noiſe of a cannon." In calm weather, the fiſhermen lie upon their oars as ſpectators of this combat, until they perceive the whale at the laſt gaſp: then they row towards him; and his enemy retiring at their approach, they enjoy the fruits of the victory. This account, however, is different in ſeveral reſpects from that commonly given by ſeamen; who report, that a fiſh called the *Threſher* (a ſpecies of SQUALUS), is in league with the *ſword-fiſh;* and that the former keeps on the back of the whale, while the latter wounds it underneath in the belly, which occaſions him to riſe to the ſurface of the water, and to give the threſher an opportunity of aſſiſting in the combat. This he does by throwing himſelf into an erect poſture; and like a *boy* tumbling neck over heels, falls down with aſtoniſhing force on the back of his prey: And thus they go on till the poor whale is deſtroyed. The grampus, and other large fiſhes of the cetaceous order, are attaked and deſtroyed by the ſame enemies in a ſimilar manner.—The whale has another deſperate enemy, a kind of ſhark, of different ſizes from one to three fathoms; ſo voracious, that it tears large pieces of fleſh from the whale, as if they had been dug with ſhovels.

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* See *Meduſa*.

† See *Xiphias*.

10 Anecdotes of the whale-trade.

To view theſe animals in a commercial light, we muſt obſerve, that the Engliſh were late before they engaged in a whale-fiſhery: it appears by a ſet of queries, propoſed by an honeſt merchant in the year 1575, in order to get information in the buſineſs, that they were at that time totally ignorant of it, being obliged to ſend to *Biſkaie for men ſkilful in the catching of the whale, and ordering of the oil, and one cooper ſkilful to ſet up the ſtaved caſk.* This ſeems very ſtrange; for by the account Octher gives of his travels to King Alfred, near 700 years before that period, it is evident that he made that monarch acquainted with the Norwegians practiſing the whale-fiſhery; but it ſeems all memory of that gainful employ, as well as of that able voyager Octher, and all his important diſcoveries in the north, were loſt for near ſeven centuries.

Hackluyt's Col. of Voy. I. 414.

It was carried on by the Biſcayeners long before the Engliſh attempted the trade; and that for the ſake not only of the oil but alſo of the whalebone, which they ſeem to have long trafficked in. The earlieſt notice we find of that article in their trade is by Hackluyt, who ſays it was brought from the Bay of St Laurence by an Engliſh ſhip that went there for the *barbes* and *fynns* of whales and train oil, A. D. 1594, and who found there 700 or 800 *whale fynnes*, part of the cargo of two great *Biſkaine* ſhips, that had been wrecked there three years before. Previous to that, the ladies ſtays muſt have been made of ſplit cane, or ſome tough wood, as Mr Anderſon obſerves in his Dictionary of Commerce; it being certain that the whale fiſhery was carried on, for the ſake of the oil, long before the diſcovery of the uſe of whalebone.

The great reſort of theſe animals was found to be on the inhoſpitable ſhores of Spitzbergen, and the European ſhips made that place their principal fiſhery; and for numbers of years were very ſucceſsful: the Engliſh commenced that buſineſs about the year 1598, and the town of Hull had the honour of firſt attempting that profitable branch of trade. At preſent it ſeems to be on the decline, the quantity of fiſh being greatly reduced by the conſtant capture for ſuch a vaſt length of time: ſome recent accounts inform us, that the fiſhers, from a defect of whales, apply themſelves to ſeal fiſhery, from which animals they extract an oil. This we fear will not be of very long continuance; for theſe ſhy and timid creatures will ſoon be induced to quit thoſe ſhores by being perpetually harraſſed, as the morſe or walrus has already in a great meaſure done. We are alſo told, that the poor natives of Greenland begin even now to ſuffer from the decreaſe of the ſeal in their ſeas, it being their principal ſubſiſtence; ſo that, ſhould it totally deſert the coaſt, the whole nation would be in danger of periſhing through want.

Pennant's Brit. Zool. 8vo, III. 53. &c.

In old times the whale ſeems never to have been taken on the Britiſh coaſts, but when it was accidentally flung aſhore: it was then deemed a royal fiſh, and the king and queen divided the ſpoil; the king aſſerting his right to the head, her majeſty to the tail.—For the manner of taking whales, ſee *Whale Fishery*.

11 Other ſpecies.

2. The phyſalus, or fin-fiſh, is diſtinguiſhed from the common whale by a fin on the back, placed very low and near the tail. The length is equal to that of the common kind, but much more ſlender. It is furniſhed with whale-bone in the upper jaw, mixed with hairs, but ſhort and knotty, and of little value. The blubber alſo on the body of this kind is very inconſiderable. Theſe circumſtances, added to its extreme fierceneſs and agility, which renders the capture very dangerous, cauſe the fiſhers to neglect it. The natives of Greenland, however, hold it in great eſteem, as it affords a quantity of fleſh which to their palate is very agreeable. The lips are brown, and like a twiſted rope: the ſpout-hole is as it were ſplit in the top of its head, through which it blows water with much more violence, and to a greater height, than the common whale. The fiſhers are not very fond of ſeeing it, for on its appearance the others retire out of thoſe ſeas. Some writers conjecture this ſpecies to have been the Φυσαλος, and *phyſeter*, or blowing-whale of Oppian, Ælian, and Pliny: but ſince thoſe writers have not left the leaſt deſcription of it, it is impoſſible to judge which kind they meant; for in reſpect to the faculty of ſpouting out water, or blowing, it is not peculiar to any one ſpecies, but common to all the whale kind. The phyſalus inhabits the European and American oceans: it feeds upon herrings and other ſmall fiſh.

3. The boops, or pike-headed whale, has a double pipe in its ſnout, three fins like the former, and a hard horny ridge on its back. The belly is full of longitudinal folds or rugæ. It frequents the northern ocean. The length of that taken on the coaſt of Scotland, as remarked by Sir Robert Sibbald, was 46 feet, and its greateſt circumference 20. This ſpecies takes its name from the ſhape of its noſe, which is narrower and ſharper-pointed than that of other whales.

4. The muſculus has a double pipe in its front, and three fins; the under jaw is much wider than the upper one. It frequents the Scotch coaſts, and feeds upon herrings.

Linnæus makes the phyſeter and delphinus, which are ranked among the whales by ſome writers, two diſtinct genera. See Physeter and Delphinus.

BALAGATE, a province of the Mogul empire, and the largeſt of the three that compoſe the kingdom of Dekkan. It has Kandiſh and Barar to the north, Tellinga to the eaſt, Baglana with part of Guzerat to the weſt, and Viſiapur to the ſouth. It is a fruitful and pleaſant country, abounding with cotton and ſugar. Here they have ſheep without horns; but ſo ſtrong, that when bridled and ſaddled they will carry boys of ten years of age. Its preſent capital is Aurengabad, but formerly was Dowlet Abad; and from the latter the whole province is ſometimes called *Dowlet-Abad.*

Balagate Mountains, a chain of mountains which divides the coaſt of Malabar from that of Coromandel, running almoſt the whole length of the peninſula on this ſide the Ganges. Some parts of them are covered with fine red earth, which is blown by the ſtrong weſt winds as far as the iſland of Ceylon; and when the rays of the ſun are reflected from theſe mountains, they ſeem to be all on fire. They make ſurpriſing alterations in the ſeaſons; for on the north ſide of cape Comorin, it is winter in May, June, July, Auguſt, and September, in which months it is ſummer on the ſouth ſide of the cape; on one ſide there are continual tempeſts, thunder and lightning, while the other enjoys a conſtant ſerenity. When black clouds are gathered about the mountains, they are followed by ſudden rain, which cauſes the overflowing of the rivers, and choaks them up with ſand, inſomuch that they are unnavigable for ſome time afterwards. The buildings and clothes of the inhabitants are ſcarce ſufficient to defend them from the weather. They live upon rice, milk, roots, and herbs, with very little meat: they have likewiſe a ſort of ſmall arrac, but are never given to drunkenneſs; nor do they import foreign vices, for they never travel abroad.

BALAGNIA, a town of Muſcovy, in the province of little Novogorod, ſeated on the Wolga. E. Long. 45. 5. N. Lat. 50. 36.

BALAGUER, a city of Catalonia in Spain, ſeated on the north bank of the river Segra, at the foot of a high mountain, on which there was formerly a fortreſs. E. Long. 0. 48. N. Lat 41. 38.

BALAMBUAN, or PADAMBUAN, a ſtrong town of Aſia in the Indies on the eaſt end of the iſland of Java, and capital of a territory of the ſame name. E. Long. 115. 30. S. Lat. 7. 50.

BALANCE, or BALLANCE, one of the ſix ſimple powers in mechanics, principally uſed in determining the equality or difference of weights in heavy bodies, and conſequently their maſſes or quantity of matter.

The balance is of two kinds: the ancient and the modern. The ancient or Roman called alſo the *ſtatera Romana*, or ſteel-yard, conſiſts of a lever or beam, moveable on a centre, and ſuſpended near one of its extremities; the bodies to be weighed or applied on one ſide of the centre; and their weight is ſhown by the diviſion marked on the beam, where the weight, which is moveable along the lever, keeps the ſteel-yard *in equilibrio*. This balance is ſtill frequently uſed in weighing heavy bodies.

The modern balance now generally uſed conſiſts of a lever or beam ſuſpended exactly in the middle, having ſcales or baſons hung to each extremity. The lever is called the *jugum* or *beam*; and the two moieties thereof on each ſide the axis, the *brachia* or *arms*. The line on which the beam turns, or which divides its brachia, is called the *axis*; and when conſidered with regard to the length of the brachia, is eſteemed a point only, and called the *centre of the balance*; the handle whereby it is held, or by which the whole apparatus is ſuſpended, is called *trutina*; and the ſlender part perpendicular to the beam, whereby either the equilibrium or preponderancy of bodies is indicated, is called the *tongue* of the balance. Thus in fig. 3. *a b* is the beam, divided into two equal brachia or arms by the white ſpot in the centre, which is the axis or centre of the balance, and *c* is the tongue. The trutina, on which the axis is ſuſpended, is not repreſented in this figure, in order to render the other parts more conſpicuous.

Plate XCI.

It follows, from what has been obſerved, therefore, that in the Roman balance, the weight uſed for a counterpoiſe is the ſame, but the point of application varies; in the common balance the counterpoiſe is various, and the point of application the ſame. The principle on which each is founded, may be very eaſily underſtood from the following obſervations, and the general properties of the lever. See LEVER.

The beam A B (fig. 6), is a lever of the firſt kind; but inſtead of reſting on a fulcrum, is ſuſpended by ſomething faſtened to its centre of motion: conſequently the mechaniſm of the balance depends on the ſame theorems as the lever.

Hence as the quantity of matter in known weight is to its diſtance from the centre of motion, ſo its diſtance of the unknown weight to its quantity of matter. Hence the nature and uſe of the ſteel-yard is eaſily known. Let AB (fig. 6.) repreſent an inſtrument of this kind; *a*, the trutina or handle on which the beam turns; *k*, a ring on which the balance may be ſupended on a nail or hook; *f*, the hook on which the body to be weighed is hung; *c*, a collar or guard by which the hook *f* is faſtened to the beam; *g*, a moveable collar; *h*, a ſwivel; *i*, the counterpoiſe. From what has been ſaid it evidently follows, that if the body to be weighed be faſtened to the hook *f*, and the whole ſupended to the ring *k*, the diviſion on which the counterpoiſe is placed to maintain an equilibrium in the balance, will ſhow the weight of the body required; provided the weight of the counterpoiſe *i* be known, and the large diviſions, 1, 2, 3, &c. be equal to the diſtance between the centre of the balance and the ſcrew which faſtens the guard *c* to the ſhorter arm of the balance. It will alſo be neceſſary that the ſteel-yard itſelf, with its whole apparatus, excluſive of the counterpoiſe, be *in equilibrio*, when ſuſpended on the ring *k*. If the body to be weighed be heavier than the diviſions on the longer arm will indicate, the balance is turned the lower ſide upwards, and ſuſpended on the other ring *b*; by which means the diviſions become ſhorter, becauſe the diſtance between the trutina *d*, and the ſcrew on which the guard *c* moves, is leſs: the diviſions in the figure on this ſide extending to 17, whereas they extend only to 6 on the other. It will be unneceſſary perhaps to obſerve, that the ſame precaution, with regard to the centre of gravity when the balance is ſuſpended, is alſo neceſſary when this ſide of the balance is uſed, as we before mentioned with regard to the other.

We have already obſerved, that in the common ſcales the two brachia or arms of the balance, *e f*, *e g*, fig. 4. are equal to each other, and conſequently equal weights placed in the ſcales *d d*, will be *in equilibrio* when the balance is ſuſpended on its centre *e*, as in the figure, where the ring at the extremity of the trutina is hung on the tapering rod *a b*, fixed in the foot or baſis *c*.

The Deceitful BALANCE, or that which cheats by the inequality of its brachia, is founded on the ſame principle as the ſteel-yard. Let there be, for example, a balance ſo conſtructed, that both the brachia with their ſcales ſhould equiponderate, but that the length of the one arm ſhould be to that of the other as 10 to 9. In this caſe, a weight of nine pounds put into the longeſt arm, will counterpoiſe one of ten pounds put into the ſhorter one: but the cheat is immediately diſcovered by ſhifting the weight from one ſcale to the other; in which caſe, the balance will no longer remain in *equilibrio*.

Aſſay-BALANCE, a very nice balance uſed in docimaſtical operations, to determine exactly the weight of minute bodies; ſee fig. 7. This balance ſhould be made of the beſt ſteel, and of the hardeſt kind; becauſe that metal is not ſo eaſily ſpoiled with ruſt as iron; and it is more apt than any other to take a perfect poliſh, which at the ſame time prevents the ruſt.

The ſtructure of the aſſayer's ſcale is little different from that of common ſcales, otherwiſe than by its nicety and ſmallneſs. The longer the beam of it is, the more exact may the weight of a body be found; however, 10 or 12 inches are a ſufficient length. Let the thickneſs of it be ſo little, that two drams may hardly be hung at either of its extremities without its bending; for the largeſt weight put upon it ſeldom exceeds one dram. The whole ſurface of this beam muſt be altogether without ornaments, which only increaſe the weight and gather duſt, &c. The beam is ſuſpended in a fork, the two legs of which are ſteel ſprings joined at top, but kept together below with a braſs pliant claſp, parallel, and two lines and a half diſtant from each other. This claſp being taken off, and the legs of the fork being ſtretched out, the axis of the beam may be put into two holes made for that purpoſe at the ends of the legs, or be taken away from them. Let a very ſharp needle be fixed in the head of the fork, ſtanding perpendicularly downwards, if the fork is ſuſpended, and ſo long, as that it may almoſt touch the top of the tongue of the beam put into the fork when in equilibrio. This needle is the mark of the equilibrium; and that the artiſts may be able to obſerve this, the legs of the fork muſt be broader in that place, and have an opening two or three lines wide; this fork may be adorned at pleaſure, provided the motion of the balance is not hindered by ſuch ornaments; then take two ſcales made of thin plate of ſilver, one inch and a half in diameter, hanging on three ſmall ſilk ſtrings, almoſt as long as the beam tied together at top, with a ſilver hook in form of an S, and hang them to the extremities of the beam: a ſmaller ſilver diſh or blued ſteel, ſomewhat leſs than one inch in diameter, belongs to each of theſe ſcales. You firſt put into theſe diſhes, with a pair of pincers, the bodies to be weighed, or with a ſpoon or ſmall ſhovel, when they are pounded, and then you put them into the ſcales; therefore the ſmall diſhes muſt be perfectly equal in weight. We uſe them, that bodies may be more conveniently put into and taken out of the ſcales, and that theſe which are vaſtly thin may not be bent or ſoiled, and thence rendered falſe by wiping.

This balance is ſuſpended on a moveable braſs or copper ſupport, which conſiſts of a pedeſtal, and of a column ſet upon it about 20 inches high, at the top of which comes out at right angles an arm one inch long. At the extremity of this arm, put a ſmall pulley three lines in diameter, another at the top of the column, and a third near the bottom of it; all which pullies muſt turn very eaſily on their axes. At the diſtance of one inch and a half below the upper arm, let another arm one inch and a half long come out of the column at right angles, having a hole through it two lines long, a quarter of a line broad, and placed perpendicularly below the pulley of the upper arm, to receive a ſmall plate, one inch and a half long; and of ſuch breadth and thickneſs as that it may freely move up and down, and yet not have too much play within the hole. This plate muſt alſo have a ſmall hook at each extremity.

And as ſuch a balance will hardly ſtand ſtill in the open air, and becomes falſe when ſpoiled with duſt; it muſt be put, together with its ſupports, into a ſmall caſe as repreſented in fig. 7. having glaſſes, *a*, *a*, *a*, at top, and all round it, that you may ſee what is within.

*Manner of uſing the aſſay-*BALANCE.—Paſs a ſilk ſtring over the three pullies of the ſupport, and tie it at its upper extremity to the ſmall hook introduced into the hole of the inferior arm; then put the ſupport in the middle of the ſmall caſe, and paſs the other extremity of the ſilk ſtring below, through a hole bored in the middle of the lower part of the frame, containing the window in the fore part of the caſe, and faſten it to a ſmall weight of a cubic form. Suſpend the fork of the balance on the inferior hook of the plate. By this means if you move backwards and forwards the weight faſtened to the ſtring, placed upon the top of the drawer jutting out beyond the fore-part of the caſe, the balance within is either lifted up or let down. But you muſt put the bodies to be weighed, and the weights themſelves, in the ſmall ſilver diſhes; and theſe, when loaded, into the ſcales, thro' the ſide-windows, which muſt be opened for that purpoſe. When any thing is to be added to or taken out of them, you do it with the ſmall pincers; or, if it is powder, with the ſmall ſhovel or ſpoon: but you muſt let the balance down every time any thing is to be added or taken away, that the ſcales may reſt upon the bottom of the caſe; and ſhut the windows before the balance is lifted up again, eſpecially if the air is not perfectly calm.

Hydroſtatic BALANCE, an inſtrument contrived to determine accurately the ſpecific gravity of both ſolid and fluid bodies. It is conſtructed in various forms; but we ſhall content ourſelves here with deſcribing that which appears of all others the moſt accurate.

VCG, (fig. 5) is the ſtand or pillar of this hydroſtatic balance, which is to be fixed in a table. From the top A, hangs, by two ſilk ſtrings, the horizontal bar B B, from which it is ſuſpended by a ring *i*, the fine beam of a balance *b*; which is prevented from deſcending too low on either ſide by the gently ſpringing piece *t x y z*, fixed on the ſupport M. The harneſs is annulated at *o*, to ſhow diſtinctly the perpendicular poſition of the examen, by the ſmall pointed index fixed above it.

The ſtrings by which the balance is ſuſpended, paſſing over two pullies, one on each ſide the piece at A, go down to the bottom on the other ſide, and are hung over the hook at *v*; which hook, by means of a ſcrew P, is moveable about one inch and a quarter, backward and forward, and therefore the balance may be raiſed or depreſſed ſo much. But if a greater elevation or depreſſion be required, the ſliding piece S, which carries the ſcrew P, is readily moved to any part of the ſquare braſs rod VK, and fixed by means of a ſcrew.

The motion of the balance being thus adjuſted, the reſt of the apparatus is as follows. HH is a ſmall board, fixed upon the piece D, under the ſcales d and e, and is moveable up and down in a low ſlit in the pillar above C, and faſtened at any part by a ſcrew behind. From the point in the middle of the bottom of each ſcale, hangs, by a fine hook, a braſs wire *ad* and *a c*. Theſe paſs through two holes *m m* in the table. To the wire ad is ſuſpended a curious cylindric wire, rs, perforated at each end for that purpoſe: this wire rs is covered with paper, graduated by equal diviſions, and is about five inches long.

In the corner of the board at E, is fixed a braſs tube, on which a round wire hl is ſo adapted as to move neither too tight nor too free, by its flat head I. Upon the lower part of this moves another tube Q, which has ſufficient friction to make it remain in any poſition required: to this is fixed an index T, moving horizontally when the wire hl is turned about, and therefore may be eaſily ſet to the graduated wire rs. To the lower end of the wire rs hangs a weight L; and to that a wire pn, with a ſmall braſs ball g about one-fourth of an inch diameter. On the other ſide, to the wire ac, hangs a large glaſs bubble R, by a horſe-hair.

Let us firſt ſuppoſe the weight L taken away, and the wire pn ſuſpended from S: and, on the other ſide, let the bubble R be taken away, and the weight F ſuſpended at c, in its room. This weight F we ſuppoſe to be ſufficient to keep the ſeveral parts hanging to the other ſcale in equilibrium; at the ſame time that the middle point of the wire pn is at the ſurface of the water in the veſſel N. The wire pn is to be of ſuch a ſize, that the length of one inch ſhall weigh four grains.

Now it is evident, ſince braſs is eight times heavier than water, that for every inch the wire ſinks in the water it will become half a grain lighter, and half a grain heavier for every inch it riſes out of the water: conſequently, by ſinking two inches below the middle point, or riſing two inches above it, the wire will become one grain lighter or heavier. Therefore, if, when the middle point is at the ſurface of the water in equilibrium, the index T be ſet to the middle point a of the graduated wire rs, and the diſtance on each ſide ar and as contains 100 equal parts; then if, in weighing bodies the weight is required to the hundredth part of a grain, it may be eaſily had by proceeding in the following manner.

Let the body to be weighed be placed in the ſcale d. Put the weight X in the ſcale e; and let this be ſo determined, that one grain more ſhall be too much, and one grain leſs too little. Then the balance being moved gently up or down, by the ſcrew P, till the equilibrium be nicely ſhown at o; if the index T be at the middle point a of the wire rs, it ſhows that the weights put into the ſcale e are juſt equal to the weight of the body. By this method we find the abſolute weight of the body: the relative weight is found by weighing it hydroſtatically in water, as follows.

Inſtead of putting the body into the ſcale e, as before, let it hang with the weight F, at the hook c, by a horſe-hair, as at R, ſuppoſing the veſſel O of water were away. The equilibrium being then made, the index T ſtanding between a and r, at the 36 diviſion, ſhows the weight of the body put in to be 1095,36 grains. As it thus hangs, let it be immerſed in the water of the veſſel O, and it will become much lighter: the ſcale e will deſcend till the beam of the balance reſt on the ſupport z. Then ſuppoſe 100 grains put into the ſcale d reſtore the equilibrium preciſely, ſo that the index T ſtand at the 36 diviſion above a; it is evident that the weight of an equal bulk of water would, in this caſe be exactly 100 grains.

After a like manner this balance may be applied to find the ſpecific gravity of liquids as is eaſy to conceive from what has been ſaid.

Balance of Trade. That which is commonly meant by the balance of trade, is the equal importing of foreign commodities with the exporting of the native. And it is reckoned that nation has the advantage in the balance of trade, which exports more of the native commodities, and imports leſs of the foreign. The reaſon of this is, that, if the native commodities be of a greater value than are imported, the balance of that account muſt be made up in bullion or money: and the nation grows ſo much richer, as the balance of that account amounts to.

Balance of a Clock, or *Watch,* is that part which regulates the beats. See *Clock-Making.*

Balance-Fiſh. See Squalus.

BALANCER, in the hiſtory of inſects, a ſtyle, or oblong body, ending in a protuberance or head, found under each wing of the two-winged flies; theſe ſerve to poiſe the body of the fly.

BALANCING, among ſeamen, the contracting a ſail into a narrower compaſs, in a ſtorm, by retrenching, or folding up a part of it at one corner: this method is uſed in contradiſtinction to reefing, which is common to all the principal ſails; whereas balancing is peculiar to few, ſuch as the mizen of a ſhip, and the main-ſail of thoſe veſſels wherein it is extended by a boom. See Boom and Reef.—The balance of the mizen is thus performed: the mizen yard is lowered a little, then a ſmall portion of the ſail is rolled up at the peek or upper corner, and faſtened to the yard about one-fifth inward from the outer end or yard-arm toward the maſt. See Mizen.—A boom main-ſail is balanced, after all its reefs are taken in, by rolling up a ſimilar portion of the hindmoſt or aftmoſt lower corner called the *clue*, and faſtening it ſtrongly to the boom, having previouſly wrapped a piece of old canvas round the part (which is done in both caſes) to prevent the ſail from being fretted by the cord which faſtens it.

BALANUS, in zoology, the trivial name of a ſpecies of lepas. See Lepas.

BALANSTINES, in botany. See Punica.

BALAYAN, a province of the iſland of Manila in the Eaſt Indies, belonging to the Spaniards.—It lies next to the city of Manila, and extends along the coaſt on the eaſt ſide of the iſland, a little beyond the bay of Batangas. There were formerly gold mines in it, but they have been long ſince abandoned. It is inhabited by about 2500 tributary Indians, and abounds in cotton, rice, and palm-trees. The province is well cultivated; and the Spaniards, generally ſpeaking, have country-houſes in it.

BALBASTRO, a principal town of Spain, in the kingdom of Arragon, and capital of a diſtrict of the ſame name. E. Long. 0. 20. N. Lat. 41. 50.

BALBEC, a city of Aſia in Syria, anciently called *Heliopolis*, and by the Arabians the *wonder of Syria.* It is ſituated at the foot of Anti-Lebanon, preciſely on the laſt riſing ground where the mountain terminates in the plain. As we arrive from the ſouth we diſcover the city only at the diſtance of a league and a half, behind a hedge of trees over the verdant tops of which appears a white edging of domes and minarets. After an hour's journey we reach theſe trees, which are very fine walnuts; and ſoon after, croſſing ſome ill-cultivated gardens, by winding paths, arrive at the entrance of the city. We there perceive a ruined wall flanked with ſquare towers, which aſcends the declivity to the right, and traces the precincts of the ancient city. This wall, which is only ten or twelve feet high, permits us to have a view of thoſe void ſpaces and heaps of ruins which are the invariable appendage of every Turkiſh city; but what principally attracts our attention is a large edifice on the left, which, by its lofty walls and rich columns, manifeſtly appears to be one of thoſe temples which antiquity has left for our admiration. Theſe ruins, which are ſome of the moſt beautiful and beſt preſerved of any in Aſia, merit a particular deſcription.

To give a juſt idea of them, we muſt ſuppoſe ourſelves deſcending from the interior of the town. After having croſſed the rubbiſh and huts with which it is filled, we arrive at a vacant place which appears to have been a ſquare; there, in front, towards the weſt, we perceive a grand ruin, which conſiſts of two pavilions ornamented with pilaſters, joined at their bottom angle by a wall 160 feet in length. This front commands the open country from a ſort of terrace, on the edge of which we diſtinguiſh with difficulty the baſes of twelve columns, which formerly extended from one pavilion to the other and formed a portico. The principal gate is obſtructed by heaps of ſtones; but, that obſtacle ſurmounted, we enter an empty ſpace, which is an hexagonal court of 180 feet diameter. This court is ſtrewed with broken columns, mutilated capitals, and the remains of pilaſters, entablatures, and cornices; around it is a row of ruined edifices which diſplay all the ornaments of the richeſt architecture. At the end of this court, oppoſite the weſt, is an outlet, which formerly was a gate through which we perceive a ſtill more extenſive range of ruins, whoſe magnificence ſtrongly excites curioſity. To have a full proſpect of theſe, we muſt aſcend a ſlope, up which were the ſteps to this gate; and we then arrive at the entrance of a ſquare court, much more ſpacious than the former, being 350 wide and 336 in length. The eye is at firſt attracted by the end of this court, where ſix enormous and majeſtic columns render the ſcene aſtoniſhingly grand and pictureſque. Another object not leſs intereſting is a ſecond range of columns to the left, which appear to have been part of the periſtyle of a temple; but before we paſs thither, we cannot refuſe particular attention to the edifices which incloſe this court on each ſide. They form a ſort of gallery which contains various chambers, ſeven of which may be reckoned in each of the principal wings, viz. two in a ſemicircle and five in an oblong ſquare. The bottom of theſe apartments ſtill retains pediments of niches and tabernacles, the ſupporters of which are deſtroyed. On the ſide of the court they are open, and preſent only four and ſix columns totally deſtroyed. It is not eaſy to conceive the uſe of theſe apartments; but this does not diminiſh our admiration at the beauty of their pilaſters and the richneſs of the frize of the entablature. Neither is it poſſible to avoid remarking the ſingular effect which reſults from the mixture of the garlands, the large foliage of the capitals, and the ſculpture of wild plants with which they are every where ornamented. In traverſing the length of the court, we find in the middle a little ſquare eſplanade, where was a pavilion, of which nothing remains but the foundation. At length we arrive at the foot of the ſix columns; and then firſt conceive all the boldneſs of their elevation and the richneſs of their workmanſhip. Their ſhafts are 21 feet eight inches in circumference and 58 high; ſo that the total height, including the entablature, is from 71 to 72 feet. The ſight of this ſuperb ruin, thus ſolitary and unaccompanied, at firſt ſtrikes us with aſtoniſhment; but, on a more attentive examination, we diſcover a ſeries of foundations which mark an oblong ſquare of 268 feet in length and 146 wide, and which, it ſeems probable, was the periſtyle of a grand temple, the primary purpoſe of this whole ſtructure. It preſented to the great court, that is to the eaſt, a front of ten columns, with 19 on each ſide, which with the other ſix make in all 54. The ground on which it ſtood was an oblong ſquare, on a level with this court, but narrower than it, ſo that there was only a terrace of 27 feet wide round the colonnade; the eſplanade this produces fronts the open country toward the weſt, by a ſloping wall of about 30 feet. This deſcent as you approach the city becomes leſs ſteep, ſo that the foundation of the pavilion is on a level with the termination of the hill; whence it is evident that the whole ground of the courts has been artificially raiſed. Such was the former ſtate of this edifice; but the ſouthern ſide of the grand temple was afterwards blocked up to build a ſmaller one, the periſtyle and walls of which are ſtill remaining. This temple, ſituated ſomewhat lower than the other, preſents a ſide of 13 columns by eight in front (in all 34), which are likewiſe of the Corinthian order; their ſhafts are 15 feet eight inches in circumference, and 44 in height. The building they ſurround is an oblong ſquare, the front of which, turned towards the eaſt, is out of the line of the left wing of the great court. To reach it you muſt croſs trunks of columns, heaps of ſtone, and a ruinous wall by which it is now hid. After ſurmounting theſe obſtacles you arrive at the gate, where you may ſurvey the incloſure which was once the habitation of a god; but inſtead of the awful ſcene of a proſtrate people and ſacrifices offered by a multitude of prieſts, the ſky, which is open from the falling in of the roof, only lets in light to ſhow a chaos of ruins covered with duſt and weeds. The walls, formerly enriched with all the ornaments of the Corinthian order, now preſent nothing but pediments of niches and tabernacles, of which almoſt all the ſupporters are fallen to the ground. Between theſe niches is a range of fluted pilaſters, whoſe capitals ſupport a broken entablature; but what remains of it diſplays a rich frize of foliage reſting on the heads of ſatyrs, horſes, bulls, &c. Over this entablature was the ancient roof, which was 57 feet wide and 110 in length. The walls which ſupported it are 31 feet high, and without a window. It is impoſſible to form any idea of the ornaments of this roof, except from the fragments lying on the ground; but it could not have been richer than the gallery of the periſtyle: the principal remaining parts contain tablets in the form of lozenges, on which are repreſented Jupiter ſeated on his eagle; Leda careſſed by the ſwan; Diana with her bow and creſcent; and ſeveral buſts which ſeem to be figures of emperors and empreſſes. It would lead us too far to enter more minutely into the deſcription of this aſtoniſhing edifice. The lovers of the arts will find it deſcribed with the greateſt truth and accuracy in a work publiſhed at London in 1757 under the title of *Ruins of Balbec.* This work, compiled by Mr Robert Wood, the world owes to the attention and liberality of Mr Dawkins, who in 1751 viſited Balbec and Palmyra. But ſeveral changes, however, have taken place ſince their journey: for example, they found nine large columns ſtanding, and in 1784 Mr Volney found but ſix. They reckoned 29 at the leſſer temple, but there now remain but 20; the others have been overthrown by the earthquake of 1759. It has likewiſe ſo ſhaken the walls of the leſſer temple, that the ſtone of the ſoffit, or croſs ſtone at the top, of the gate was ſlid between the two adjoining ones, and deſcended eight inches; by which means the body of the bird ſculptured on that ſtone is ſuſpended detached from its wings and the two garlands which hung from its beak and terminated in two genii. Nature alone has not effected this devaſtation; the Turks have had their ſhare in the deſtruction of the columns. Their motive is to procure the iron cramps, which ſerve to join the ſeveral blocks of which each column is compoſed. Theſe cramps anſwer ſo well the end intended, that ſeveral of the columns are not even disjointed by their fall; one, among others, as Mr Wood obſerves, has penetrated a ſtone of the temple wall without giving way; nothing can ſurpaſs the workmanſhip of theſe columns; they are joined without any cement, yet there is not room for the blade of a knife between their interſtices. After ſo many ages, they in general ſtill retain their original whiteneſs. But what is ſtill more aſtoniſhing, is the enormous ſtones which compoſe the ſloping wall. To the weſt the ſecond layer is formed of ſtones which are from 28 to 35 feet long, by about nine in height. Over this layer, at the north-weſt angle, there are three ſtones which alone occupy a ſpace of 175½ feet; viz. the firſt 58 feet ſeven inches: the ſecond 58 feet 11, and the third exactly 58 feet; and each of theſe are 12 feet thick. Theſe ſtones are of a white granite, with large ſhining flakes like gypſe; there is a quarry of this kind of ſtone under the whole city and in the adjacent mountain, which is open in ſeveral places, and among others on the right, as we approach the city. There is ſtill lying there a ſtone, hewn on three ſides, which is 69 feet two inches long, 12 feet 10 inches broad, and 13 feet three in thickneſs. By what means could the ancients move theſe enormous maſſes? This is doubtleſs a problem in mechanics curious to reſolve. The inhabitants of Balbec have a very commodious manner of explaining it, by ſuppoſing theſe edifices to have been conſtructed by *Djenoun*, or genii, who obeyed the orders of King Solomon; adding, that the motive of ſuch immenſe works was to conceal in ſubterraneous caverns vaſt treaſures, which ſtill remain there. To diſcover theſe, many have deſcended into the vaults which range under the whole edifice; but the inutility of their reſearches, added to the oppreſſions and extortions of the governors, who have made their ſuppoſed diſcoveries a pretext, have at length diſheartened them; but they imagine the Europeans would be more ſucceſsful, nor would it be poſſible to perſuade them but what we are poſſeſſed of the magic art of deſtroying taliſmans. It is in vain to oppoſe reaſon to ignorance and prejudice: and it would be no leſs ridiculous to attempt to prove to them that Solomon never was acquainted with the Corinthian order, which was only in uſe under the Roman emperors. But their tradition on the ſubject of this prince may ſuggeſt three important obſervations. Firſt, That all tradition relative to high antiquity is as falſe among the Orientals as the Europeans. With them, as with us, facts which happened 100 years before, when not preſerved in writing, are altered, mutilated, or forgotten. To expect information from them with reſpect to events in the time of David or Alexander, would be as abſurd as to make inquiries of the Flemiſh peaſants concerning Clovis or Charlemagne. Secondly, That throughout Syria, the Mahometans, as well as the Jews and Chriſtians, attribute every great work to Solomon: not that the memory of him ſtill remains by tradition in thoſe countries, but from certain paſſages in the Old Teſtament; which, with the goſpel, is the ſource of almoſt all their tradition, as theſe are the only hiſtorical books read or known; but as their expounders are very ignorant, their applications of what they are told are generally very remote from truth: by an error of this kind they pretend Balbec is *the houſe of the foreſt of Lebanon* built by Solomon; nor do they approach nearer probability when they attribute to that king the well of Tyre and the buildings of Palmyra. Thirdly, That the belief in hidden treaſures has been confirmed by diſcoveries which have been really made from time to time. It is not many years ſince a ſmall coffer was found at Hebron full of gold and ſilver medals, with an ancient Arabic book on medicine. In the country of the Druzes an individual diſcovered likewiſe, ſome time ſince, a jar with gold coin in the form of a creſcent; but as the chiefs and governors claim a right to theſe diſcoveries, and ruin thoſe who have made them, under pretext of obliging them to make reſtoration, thoſe who find any thing endeavour carefully to conceal it; they ſecretly melt the antique coins, nay, frequently bury them again in the ſame place where they found them, from the ſame fears which cauſed their firſt concealment, and which prove the ſame tyranny formerly exiſted in theſe countries.

When we conſider the extraordinary magnificence of the temple of Balbec, we cannot but be aſtoniſhed at the ſilence of the Greek and Roman authors. Mr Wood, who has carefully examined all the ancient writers, has found no mention of it except in a fragment of John of Antioch, who attributes the conſtruction of this edifice to Antoninus Pius. The inſcriptions which remain corroborate this opinion, which perfectly accounts for the conſtant uſe of the Corinthian order, ſince that order was not in general uſe before the third age of Rome; but we ought by no means to allege as an additional proof the bird ſculptured over the gate; for if his crooked beak, large claws, and the caduceus he bears, give him the appearance of an eagle, the tuft of feathers on his head, like that of certain pigeons, proves that he is not the Roman eagle: beſides that the ſame bird is found in the temple of Palmyra; and is therefore evidently an Oriental eagle, conſecrated to the ſun, who was the divinity adored in both theſe temples. His worſhip exiſted at Balbec in the moſt remote antiquity. His ſtatue, which reſembled that of Oſiris, had been tranſported there from the Heliopolis of Egypt, and the ceremonies with which he was worſhipped there have been deſcribed by Macrobius, in his curious work entitled *Saturnalia.* Mr Wood ſuppoſes with reaſon, that the name of Balbec, which in Syriac ſignifies *City of Bal,* or of the ſun, originated in this worſhip. The Greeks, by naming it *Heliopolis,* have in this inſtance only given a literal tranſlation of the oriental word; a practice to which they have not always adhered. We are ignorant of the ſtate of this city in remote antiquity; but it is to be preſumed, that its ſituation, on the road from Tyre to Palmyra, gave it ſome part of the commerce of theſe opulent capitals. Under the Romans, in the time of Auguſtus, it is mentioned as a garriſon town; and there is ſtill remaining, on the wall of the ſouthern gate, on the right as we enter, an inſcription which proves the truth of this, the words KENTURIA PRIMA, in Greek characters, being very legible. One hundred and forty years after, Antoninus built there the preſent temple, inſtead of the ancient one, which was doubtleſs falling into ruins: but Chriſtianity having gained the aſcendency under Conſtantine, the modern temple was neglected, and afterwards converted into a church; a wall of which is now remaining, that hid the ſanctuary of the idols. It continued thus until the invaſion of the Arabs, when it is probable, they envied the Chriſtians ſo beautiful a building. The church being leſs frequented fell to decay; wars ſucceeded; and it was converted into a place of defence; battlements were built on the wall which ſurrounded it, on the pavilions and at the angles, which ſtill ſubſiſt; and from that time, the temple, expoſed to the fate of war, fell rapidly to ruin. The ſtate of the city is not leſs deplorable. The wretched government of the emirs of the houſe of Harfouſhe had already greatly impared it, and the earthquake of 1759 completed its deſtruction. The wars of the Emir Youſef and Djezzar have rendered it ſtill more deſerted and ruinous. Of 5000 inhabitants, at which number they were eſtimated in 1751, not 1200 are now remaining; and all theſe poor, without induſtry or commerce, and cultivating nothing but a little cotton, ſome maize, and water-melons.

BALBINUS (Decimus Cœlius), the Roman emperor, being choſen by the ſenate in 237, was maſſacred by the ſoldiers, who had a diſlike to ſuch emperors as were elected only by the ſenators. This prince was eloquent, and wrote pretty good verſes.

BALBOA (Vaſco Nugnes de), a Caſtilian; a celebrated navigator, and one of the firſt diſcoverers of South America. He was beheaded by the Spaniſh governor of St Mary, through jealouſy of his growing reputation, in 1517, aged 42.

BALBUS (Lucius Cornelius Theophanes), was born at Cadiz, and diſtinguiſhed himſelf by his valour in the war carried on by the Romans in Spain againſt Sertorius and the Luſitanians, on which account Pompey gave him the privileges of a Roman citizen. He was conſul in the 714th year of Rome, and was the firſt foreigner on whom that dignity was conferred. He was the friend of Pompey, Cæſar, Craſſus, and Cicero.—There were many other illuſtrious Romans of the name of *Balbus.*

BALCONY, in architecture, a projecture in the front of a houſe, or other building, ſupported by pillars or conſoles, and encompaſſed with a baluſtrade.

BALDACHIN, or BALDAQUIN, in architecture, a building in form of a canopy, ſupported by pillars, and frequently uſed as a covering to inſulated altars. Some alſo uſe the term *baldachin* for the ſhell over a door.

BALDINUCCI (Philip), of Florence; a connoiſſeur in the polite arts, and the continuator of Vaſar's lives of the painters. He died in 1696, aged 72.

BALDIVIA, or VALDIVIA, a ſea-port town of Chili, in America, belonging to the Spaniards. It is ſituated between the rivers Callaculles and Portero, where they fall into the South Sea. W. Long. 80. 5. S. Lat. 40. 5. It was built in 1551 by the Spaniſh general Baldivia, from whom it takes its name. We may judge of its importance from the ſum granted annually by the king for maintaining the garriſon and keeping the fortifications in repair, being no leſs than 300,000 pieces of eight. It is defended by four ſtrong caſtles, mounting 100 pieces of fine braſs cannon. Notwithſtanding which, however, as the garriſon is compoſed moſtly of tranſported criminals, on whom no dependance can be placed, and generally ill ſupplied with ammunition, &c. it could make but a poor defence. In 1643 it was eaſily taken by the Dutch, who would probably have maintained their conqueſt againſt all the power of the Spaniſh viceroy, had they not been obliged to relinquiſh it through ſickneſs and famine. The inhabitants of Baldivia amount to about 2000. The trade is leſs conſiderable than formerly, becauſe the gold mines in the neighbourhood are ſhut up; yet ſeveral large ſhips are employed in the trade between this port and that of Lima, which conſiſts of gold, corn, hides, and ſalt proviſions, which are exchanged for ſlaves, ſugar, chocolate, and European commodities and manufactures.

BALDNESS, a defect of hair, chiefly on the ſinciput. It differs from *alopecia, area, ophiaſis,* and *tinea,* as theſe all ariſe from ſome vice in the nutritious humour; *baldneſs,* from the defect of it. When the eyelids ſhed their hair, it is called a *ptiloſis.* Among the cauſes of baldneſs, immoderate venery is reputed one of the chief: old age uſually brings it on of courſe. Some will have the proximate cauſe of baldneſs to be the dryneſs of the brain, and its ſhrinking from the cranium; it having been obſerved, that in bald perſons there is always a vacuity or empty ſpace between the ſkull and the brain.—*Calvus, bald-pate,* was a frequent term of reproach among the Romans; among whom this defect was in great diſcredit. Hence divers arts to conceal it, as falſe hair, a *galericulus* contrived on purpoſe. The later Romans, however, ſeem to have been reconciled to baldneſs ; for we find among them a kind of officers, or ſervants, called *glabratores*, or *glabrarii*, whoſe buſineſs was to take off the hair from all parts, even from the head. In an ancient inſcription, there is mention of one Diophantus, TI. CÆSARIS ORNATOR GLABR. that is, *Ornator Glabrarius*.

BALDOC, a town of Hertfordſhire, in England, chiefly noted for its trading in malt. W. Long. 0. 10. N. Lat. 51. 55.

BALDOCK (Ralph de), biſhop of London in the reigns of Edward I. and II. was educated at Moreton-college, in Oxford ; became dean of St Paul's ; was afterwards promoted to the ſee of London ; and at laſt was made lord high chancellor of England. He had a very amiable character both for morals and learning ; and wrote *Hiſtoria Anglica*, or An Hiſtory of the Britiſh Affairs down to his own time ; and, A Collection of the Statutes and Conſtitutions of the church of St Paul. Biſhop Baldock died at Stepney, July 24. 1313.

BALDWIN, archbiſhop of Canterbury, was born of obſcure parents at Exeter, where in the early part of his life, he taught a grammar-ſchool ; after which he took orders, and was made archdeacon of Exeter : but he reſigned that dignity, and became a Ciſtertian monk in the monaſtery of Ford in Devonſhire, of which in a few years he was made abbot. In the year 1180, he was conſecrated Biſhop of Worceſter. In 1184, he was promoted to the ſee of Canterbury by Pope Lucius III. and, by his ſucceſſor Urban III. was appointed legate for that dioceſe. He laid the foundation of a church and monaſtery in honour of Thomas Becket, at Hackington, near Canterbury, for ſecular prieſts ; but, being oppoſed by the monks of Canterbury and the Pope, was obliged to deſiſt. In 1190 he crowned King Richard I. at Weſtminſter ; and ſoon after followed that prince to the holy land, where he died at the ſiege of Ptolemais. Giraldus Cambrenſis, who accompanied him in this expedition, ſays he was of a mild diſpoſition, and of great abſtinence. He wrote various tracts on religious ſubjects, which were collected and publiſhed by Bertrand Tiſſier in 1662.

BALE (John), biſhop of Oſſory in Ireland, was born at Cove, near Dunwich in Suffolk, in the year 1495. At 12 years of age he was entered in the monaſtery of Carmelites at Norwich, and was thence ſent to Jeſus-college in Oxford. He was educated a Roman catholic, but was converted to the Proteſtant religion by Thomas Lord Wentworth. On the death of Lord Cromwell, favourite of Henry VIII. who protected him from the perſecutions of the Romiſh clergy, he was obliged to retire into the Low Countries, where he continued eight years. Soon after the acceſſion of Edward VI. he was recalled ; and being firſt preſented to the living of Biſhop's Stocke in Hampſhire, in 1552, he was nominated to the ſee of Oſſory. During his reſidence in Ireland he was remakably aſſiduous in propagating the Proteſtant doctrines ; but to very little purpoſe, and frequently at the hazard of his life. Once, in particular, they murdered five of his domeſtics, who were making hay in a meadow near his houſe ; and would probably have done the ſame by him, if the ſovereign of Kilkenny had not come to his aſſiſtance with 100 horſe and 300 foot. On the acceſſion of Queen Mary, the tide of oppoſition became ſo powerful, that, to avoid aſſaſſination, he embarked for Holland, but was very unfortunate in his eſcape. Firſt he was taken by a Dutch man of war, and robbed by the captain of all his effects. Then, being forced by ſtreſs of weather into St Ive's in Cornwall, he was confined on ſuſpicion of treaſon. Being however releaſed after a few days confinement, the ſhip anchored in Dover road, where he was again ſeized on a falſe accuſation. After his arrival in Holland, he was kept priſoner for three weeks, and at length obtained his liberty on paying 30 l. From Holland he travelled to Baſil in Switzerland, where he continued till Queen Elizabeth aſcended the throne. After his return to England, he was in 1560 made prebendary of Canterbury, probably not chooſing to return to his former flock of wolves. He died in November 1563, at Canterbury, in the 68th year of his age. He was ſo ſevere a writer againſt the church of Rome, that his books are particularly prohibited in the expurgatory index publiſhed at Madrid, in folio, in the year 1667. He is the earlieſt dramatic writer in the Engliſh language, or at leaſt author of the firſt pieces of that kind that we find in print. Of his writings in that way no fewer than 21 have been enumerated ; only three of them, however, have been ſeen in print, *viz.* 1. God's Promiſes, an interlude ; 2. St John Baptiſt, an interlude ; 3. Concerning the Laws of Nature corrupted : the firſt of which has been reprinted by Dodſley in the firſt volume of his collection of old plays, and the only copy extant of the laſt is preſerved in St Sepulchre's library in Dublin. As to the reſt, they are mentioned by himſelf, as his own, in his account of the writers of Britain before mentioned. He alſo tranſlated the tragedies of Pammachius. His other works are very numerous ; but the chief is his catalogue of Britiſh Authors : a book of ſome merit, as it contains ſome information which is not elſewhere to be found ; but he has deſtroyed his credit by his intemperate Billingſgate abuſe of all thoſe who differed from him in religion. The authentic part of his work is tranſcribed from Leland. The title of it is, *Illuſtrium Majoris Britanniæ ſcriptorum catalogus, a Japheto ſanctiſſimi Noa filio ad an. Dom.* 1557.

BALE, in commerce. Any goods packed up in cloth, and corded round very tight, in order to keep them from breaking, or preſerve them from the weather, is called *a bale*.—A bale of cotton yarn is from 300 to 400 weight ; of raw ſilk, is from 100 to 400 ; of lockram or dowlas, either three, three and a half, or four pieces.

BALE-goods, among the Engliſh merchants are, all ſuch as are imported or exported in bales ; but the French give that name to certain hardwares, and other ſorts of merchandize, which come to Paris, and are commonly made by bad workmen of indifferent materials.

BALEARES INSULÆ, or the *Balearic Iſlands*. The apellation is commonly derived from Βαλλειν, becauſe the inhabitants were excellent ſlingers. But Bochart makes the name of Punic or Phœnician original, as were the people : *Baal-jare*, a maſter, or ſkilful at throwing ; the Phœnicians and Hebrews being dexterous at the uſe of the ſling. The Greeks called theſe iſlands *Gymneſiae* (Strabo) ; becauſe in ſummer the inhabitants went naked (Diodorus, Livy), or rather becauſe only armed with a ſling in war (Heſychius). They are two in number, the Greater and the Leſs, or Major and Minor; and hence the modern names *Majorca* and *Minorca*. The Major is diſtant from the Minor 30 miles to the weſt, in length 40 miles, and in circuit 150 (Pliny). They were ſubdued by Quintus Metellus, thence ſurnamed *Balearicus*, in the year 120 B. C. The Baleares, together with the adjacent iſlands, were a part of the Provincia Citerior or Tarraconenſis, and of the reſort of the Conventus Carthaginienſis of New Carthage. Theſe iſlands are called *Choearades* by Apollonius, and *Choeradades* by Strabo, *i. e.* "rocky." See MAJORCA and MINORCA.

BALEARIC ISLANDS. See the preceding article.

BALECHOU (John Joſeph), a very celebrated and well known French engraver, flouriſhed about 1750. He died, according to Baſan, ſome few years ſince at Avignon. This extraordinary artiſt worked entirely with the graver; and he was perfectly maſter of that inſtrument. The clearneſs of his ſtrokes, and the depth of colour which he produced, are far beyond any production prior to his own. The two large plates which he did from Vernet, one repreſenting a *ſtorm*, the other a *calm*, muſt ever be conſidered as very aſtoniſhing exertions of the artiſt. They are too well known, and too much admired, to need any further eulogium; and were never equalled, until they were perhaps ſurpaſſed by an Engliſhman, Mr Woollet.

BALEN (Hendrick Van), hiſtory and portrait painter, was born at Antwerp, in 1560, and was a diſciple of Adam Van Oort; but he quitted that maſter to acquire a better taſte of deſign and compoſition, by purſuing his ſtudies at Rome, where he reſided for a conſiderable time. He copied the antiques; he attended to the works of the moſt memorable modern artiſts; and at his return to his own country, the viſible improvement of his taſte recommended him to the favour and eſteem of the ableſt judges of the art. He diſtinguiſhed himſelf by a good manner of deſigning, and his works are admitted into the cabinets of the curious, among thoſe of the principal painters. He particularly excelled in the naked, and gave to his figures ſo much truth, roundneſs, and correctneſs of outline, that few of his cotemporaries could enter into competition with him. Several fine portraits of his hand are at the Hague; among which there is one adorned with allegorical figures of Wiſdom and Juſtice, which extorts commendation from all who attentively conſider it. He died in 1632. All the hiſtorical ſubjects painted by Van Balen have abundant merit. His deſigns of the Deluge, of Moſes ſtriking the Rock, and the drowning of Pharaoh, are grand and noble compoſitions. Houbraken obſerves, that Van Balen, with great judgment, hath introduced the Iſraelites in a clear light in the back-ground, but the Egyptians in a ſtrong ſhadow in the fore-ground, which had a very fine effect; the figures being well deſigned, the attitudes and draperies well choſen, and the number of the figures being very conſiderable. Of this painter's hand alſo, the judgment of Paris is accounted a maſterly performance; in which the figure of Venus is ſo elegantly deſigned, ſo full of life, and ſo round, that it ſeems to ſtand forth from the ſurface. The landſcapes and back-grounds of the pictures compoſed by Van Balen, were generally painted by the Velvet Breughel.

BALEN (John Van), painter of hiſtory, landſcapes, and boys, was born at Antwerp in 1611; and derived his knowledge of the art, and his fine taſte of drawing and deſign, from his father Hendrick Van Balen; but, as ſoon as he had made a competent progreſs, he travelled to Rome, and lived for ſeveral years in that and other cities of Italy. There he acquired a good guſto of deſign, though he was ſometimes incorrect; and his particular merit was ſhown in his naked figures of boys, cupids, nymphs bathing or hunting, of which ſubjects he painted a conſiderable number; and he procured both praiſe and riches by his landſcapes and hiſtories. His pictures were well handled, his trees touched with ſpirit, and his herbage and verdure looked natural and lively. The carnations of his figures were clear and freſh; his colouring in general was tranſparent; and the airs of his heads were in the manner of Albano.

BALES (Peter), a very extraordinary perſon in his way, and fit to be recorded in a work of this nature. He was a moſt famous maſter in the art of Penmanſhip, or fair writing; and one of the firſt inventors (for there ſeems to have been more than one) of ſhort-hand writers. He was born in 1547, and is ſtyled by Anthony Wood "a moſt dexterous perſon in his profeſſion, to the great wonder of ſcholars and others;" who adds, that "he ſpent ſeveral years in ſciences among the Oxonians, particularly as it ſeems in Glouceſter hall: but that ſtudy, which he uſed for a diverſion only, proved at length an employment of profit." He is recorded for his ſkill in micrography, or miniature-writing, in Hollinſhed's Chronicle, anno 1575; and Mr Evelyn alſo hath celebrated his wonderful ſkill in this delicate operation of the hand. "Hadrian Junius ſpeaking as a miracle of ſomebody, who wrote the Apoſtle's Creed, and the beginning of St John's Goſpel, within the compaſs of a farthing; what would he have ſaid," ſays Mr Evelyn, "of our famous Peter Bales; who in the year 1575, wrote the Lord's Prayer, the Creed, Decalogue, with two ſhort prayers in Latin, his own name, motto, day of the month, year of the Lord, and reign of the Queen, to whom he preſented it at Hampton Court, all of it written within the circle of a ſingle penny, inchaſed in a ring and borders of gold; and covered with a chryſtal ſo accurately wrought, as to be very plainly legible, to the great admiration of her Majeſty, the whole Privy Council, and ſeveral ambaſſadors then at Court?" He was farther very dexterous in imitating hand-writing, and, about 1586, was employed by Secretary Walſingham in certain political manœuvres. We find him at the head of a ſchool, near the Old Bailey, London, in 1590; in which year he publiſhed his "Writing Schoolmaſter, in three parts: the firſt teaching ſwift writing, the ſecond, true writing, the third, fair writing." In 1595, he had a great trial of ſkill in the Black-friars with one Daniel Johnſon, for a golden pen of 20 l. value, and won it; and a contemporary author farther relates, that he had alſo the arms of Caligraphy given him, which are Azure, a Pen, Or, as a prize, at a trial of ſkill in this art among the beſt penmen in London. In 1597, he republiſhed his "Writing

Schoolmaſter," which was in ſuch high reputation, that no leſs than eighteen copies of commendatory verſes, compoſed by learned and ingenious men of that time, were printed before it. Wood ſays, that he was engaged in Eſſex's treaſons in 1600; but Wood was miſtaken: he was only engaged, and very innocently ſo, in ſerving the treacherous purpoſes of one of that Earl's mercenary dependents. We know little more of this curious perſon, but that he ſeems to have died about the year 1610.

BALESTRA (Antonio), an excellent hiſtorical painter, was born at Verona in 1666. At the age of 21 he went to Venice, where he entered himſelf in the ſchool of Antonio Bellucci, and continued for three years under his direction; but from thence he viſited Bologna and Rome, and at the latter became the diſciple of Carlo Maratti. Under the tuition of ſo eminent a genius, he made a very great proficiency, and exerted himſelf for ſome hours of each day, in deſigning after the antiques, after Raphael, Correggio, Annibal Carracci and other admired painters; by which conduct he ſo effectually confirmed his taſte and freedom of hand, that he obtained the prize of merit in the academy of St Luke, in the year 1694, when he was only 28 years of age. From that time his reputation was eſtabliſhed, and he received ſufficient encouragement; being engaged to work for moſt of the churches, and in the palaces of the nobility, and his paintings were admired in every part of Europe. His ſtyle is ſweet and agreeable, not unlike that of Maratti; and the judicious obſerve in the works of Baleſtra, a certain mixture of the ſeveral manners of Raphael, Correggio, and Carracci. He died in 1740. In the Church of Santa Maria Mater Domini at Venice, there is one of the moſt capital performances of Baleſtra, repreſenting the nativity of our Saviour. It is deſigned in a grand ſtyle, the compoſition is excellent, and has a great deal of grace. The heads are peculiarly fine; and the whole has a noble effect, with remarkable harmony. In a chapel belonging to the church of S. Geminiano, in the ſame city, there is a dead Chriſt in the arms of the Virgin, painted by this maſter in a grand taſte; and although the compoſition conſiſts but of a few figures, they are finely deſigned; and in every part of it there is a ſufficient merit to claim and juſtify applauſe.

BALEY (Walter), the ſon of Henry Baley of Warnwell in Dorſetſhire, was born at Potſham in the ſame county, and educated at Wincheſter ſchool. From thence he was ſent to Oxford; and, after two years probation, was admitted perpetual fellow of New College in the year 1550. Having taken his degrees in arts, he practiſed phyſic, and in 1558 was proctor of the univerſity. About this time he obtained a prebend of Wells, which he reſigned in 1579. In the year 1561 he was appointed queen's profeſſor of phyſic, in 1563 proceeded doctor in that Faculty, and afterwards became one of her majeſty's phyſicians in ordinary. He was thought ſkilful in his profeſſion, and had conſiderable practice. He died in 1592, aged 63; and was buried in the inner chapel of New College. His works are, 1. *A diſcourſe of three kinds of pepper in common uſe*, 1588, 8vo. 2. *Brief treatiſe of the preſervation of the eye-ſight.* Firſt printed in the reign of Elizabeth, in 12mo; afterwards at Oxford in 1616 and 1654, 8vo. 3. *Directions for health, natural and artificial; with medicines for all diſeaſes of the eyes*, 1626, 4to. 4. *Explicatio Galeni de potu convalaſcentium et ſenum*, &c. manuſcript, formerly in Lord Ayleſbury's library.

BALI, an iſland of Aſia, in the Eaſt-Indies, forming the north ſide of the ſtraits of Java, through which the Eaſt-India ſhips ſometimes return from China to Europe: but the paſſage is commonly difficult on account of contrary winds. The iſland is extremely populous, and abounds in rice and other productions proper to the climate. The inhabitants are Pagans, and very warlike. E. Long. 115. 30. S. Lat. Lat. 9. 0.

BALIOL, or BALLIOL, (Sir John de), founder of Baliol-college, in Oxford, was the ſon of Hugh Baliol, of Bernard's caſtle, in the dioceſe of Durham; and was a perſon very eminent for his power and riches. During the conteſts and wars between King Henry III. and his barons, he firmly adhered to the king. In 1263, he began the foundation and endowment of Baliol-college, which was afterwards perfected by his widow. He died in the year 1269.

BALIOL, BALLIOL, or BOILLIOL, (John), the brother of Alexander king of Scotland, and competitor with Robert Bruce for that crown. See SCOTLAND.

BALISORE, a ſea-port town of Aſia, in the Eaſt Indies, to the northweſt of the bay of Bengal. It is about four miles from the ſea by land, but 20 by the river; ſeated in a very fruitful ſoil, producing rice, wheat, aromatic ſeeds, tobacco, &c. The inhabitants make ſeveral ſort of ſtuffs of cotton, ſilk, and a kind of graſs. The Engliſh, French, and Dutch, have factories here; but they are now of no great account. E. Long. 85. 20. N. Lat. 21. 30.

BALISTES, in ichthyology, a genus of fiſhes belonging to the order of amphibia nantes. The characters are theſe: The head is flat; there are eight teeth in each ſide, and the two anterior ones are longeſt; in the place of gills, the baliſtes has an aperture immediately above the pectoral fins; the body is flat, the ſcales are joined together by the ſkin, and the belly is keeled. The ſpecies of this genus are eight, *viz.* 1. The monoceros, whoſe head-fin conſiſts of but one ray, and the tail-rays are carinated. It is called the *unicorn-fiſh* by Cateſby; who informs us, that the guts of this fiſh are full of ſmall ſhells and coralline ſubſtances, which by the ſtrength and hardneſs of its jaws it is enabled to grind very ſmall. Theſe fiſh, he adds, are not eat, being accounted poiſonous. They moſt frequent thoſe ſeas, amongſt the Bahama iſlands, where the corals are in great plenty. 2. The hiſpidus, whoſe head-fin is uniradiated; and there is a round black ſpot in the tail-fin. The body is rough, and briſtly towards the tail. The ſpine or horn is ſituated between the eyes; the ſnout is ſubulated; and inſtead of a belly-fin, it has a jagged ſharp ſpine. This ſpecies is a native of Carolina. 3. The tomentoſus, whoſe head fin is biradiated, and the body of it towards the hind part is hairy. It is a native of America. 4. The papilloſus, has a biradiated back-fin, and a papillous body. 5. The verrucoſus, has a triradiated back-fin; and the tail is full of little warts. In the place of a belly-fin, this ſpecies has a large, thick, warty ray. It has 25 ſmall reverſed ſharp ſpines at the ſide of the tail, diſpoſed in four rows. It is a native of India. 6. The aculeatus has a triradiated back-fin; and the ſpines of the tail lean upon each other. It is alſo a native of India. 7. The vetula, or old wife, has a triradiated back-fin; the belly-fin is longitudinal, and ſomewhat carinated; and the tail-fin is forked. It is found at Aſcenſion iſland. 8. The ringens, has a triradiated back-fin; there are three folds on each ſide of the head, and the tail-fin is forked. This ſpecies is likewiſe found at Aſcenſion iſland.

BALIVO AMOVENDO, in law, was a writ for removing a bailiff from his office, for want of having ſufficient land in his bailiwick to anſwer the king and his people, according to the ſtatute of Weſtminſter, 2 reg. Orig. 78.

BALK, among builders, is ſometimes uſed for the ſummer-beam of a houſe; ſometimes for the poles and rafters, which ſupport the roofs of barns, &c.; and ſometimes for the beams uſed in making ſca-holds.

BALK, or *Balkh*, a province of Great Buckharia in Aſia, about 360 miles long and 250 broad, ſituated to the ſouth of the province of Samarkand, and to the eaſt of Bukharia Proper. It is the leaſt of the three provinces that make up what is called *Great Buckharia*; but being extremely fertile and well cultivated, the prince draws a great revenue from it. The country particularly abounds with ſilk, of which the inhabitants make pretty manufactures. The Uzbecks ſubject to the khan of Balkh are the moſt civilized of all the Tartars inhabiting Great Bukharia, owing probably to their commerce with the Perſians: they are likewiſe more induſtrious, and more honeſt, than the reſt; but in other reſpects have the ſame cuſtoms with the reſt of the Tartars. The province is ſubdivided into ſeveral counties; the moſt remarkable of which are Khotlan or Katlan, Tokhareſtan, and Badagſhan. Its chief cities are Balk, Fariyab, Talkhan, Badagſhan, and Anderab.

BALK, the capital of the abovementioned province, ſituated on the frontiers of Perſia, in E. Long. 65. 20. N. Lat. 37. 0. It is probably the ancient Bactra, capital of the kingdom of Bactria; and is ſaid by the Perſians to have been founded by Kay-umarraz the firſt king of Perſia, becauſe he met his brother upon the ſpot where it ſtood, after he had been loſt for a long time; *balkhiden*, or *balghiden*, in the Perſic language, ſignifying to receive and embrace a friend. The firſt kings of Perſia who reſided in the province of Media or *Aderbijan*, conſidered this city as one of their principal frontiers on the ſide of Scythia. In the 27th year of the Hegira, of Chriſt 647, Balk was reduced by the Arabs, under the command of Abdallah Ebn Amer. It continued ſubject to Arab princes till the year of the Hegira 432, of Chriſt 1041; when it was reduced by Togrol Beg, the Tangrolipix of the Greeks, and prince of the Seljukian dynaſty. It was taken by Jenghiz Khan, A. D. 1221, who with his uſual and unparalleled cruelty cauſed all the inhabitants to be brought without the walls and maſſacred without mercy. In 1369, Sultan Hoſein, the laſt of the race of Jenghiz Khan was driven from Balkh by Tamerlane, whoſe ſucceſſors were driven out by the Uzbecks in the 15th century. It was afterwards redeemed by Shah Iſmael Sufi; but finally wreſted out of his hands by the Uzbeck Tartars, between whom and the Perſians it is the occaſion of almoſt continual wars. It was, not long ſince, the reſidence of a khan of Tartars. It is the moſt conſiderable city poſſeſſed in theſe parts by the Mahometan Tartars, is large, well built and populous, the houſes conſiſting for the moſt part of ſtone or brick. The fortifications conſiſt of bulwarks of earth, fenced without with a ſtrong wall high enough to cover the ſoldiers employed in defence of thoſe fortifications. As this place is the reſort of all the buſineſs tranſacted between the Indies and Great Bukharia, trade flouriſhes extremely at Balkh; eſpecially as it has a fine river paſſing through its ſuburbs, which is of vaſt ſervice to the town. This river falls into the Amu, in N. Lat. 38. 30. upon the confines of Great Bukharia and Kowarazm. The khan's palace, or caſtle, is a large edifice built after the oriental manner; and conſiſts almoſt entirely of marble, of which there are fine quarries in the neighbourhood. The khan of Balk, however, was obliged in 1739 to ſubmit to the Perſians under Khouli Kan; but ſince that time has moſt probably regained his independency.

BALKERS, in the fiſhery, perſons placed on rocks, and eminences at ſea, to ſpy the herring droves, and give notice to the fiſhermen, by waving boughs, what way they go, and where they may be found.

BALL, in a general ſenſe, a ſpherical and round body, whether naturally ſo, or formed into that figure by art.

BALL, in the military art, comprehends all ſorts of bullets for fire-arms, from the cannon to the piſtol. Cannon-balls are of iron; muſket-balls, piſtol-balls, &c. are of lead. The experiment has been tried of iron balls for piſtols and fuſees; but they are juſtly rejected, not only on account of their lightneſs, which prevents them from flying ſtraight, but becauſe they are apt to furrow the barrel of the piſtol, &c.

BALL of a Pendulum, the weight at the bottom. In ſhorter pendulums, this is called the *bob*.

BALL, in pyrotechnics, is alſo a compoſition of various combuſtible ingredients, ſerving to burn, ſmoke, give light, &c. In this ſenſe we read of fire-balls, light-balls, ſmoke-balls, ſtink-balls, ſky-balls, water-balls, land-balls.

BALL, among the Corniſh miners, ſignifies a tin-mine.

BALL, among printers, a kind of wooden tunnel ſtuffed with wool, contained in a leather cover, which is nailed to the wood, with which the ink is applied on the forms to be wrought off. See PRINTING.

Horſe-BALLS, among farriers. Horſes have a very nice taſte; it is therefore proper to give the more diſagreeable drugs in the form of balls, and to make drenches of the more palatable. Balls ſhould be of an oval ſhape, not exceeding the ſize of a pullets egg; and ſhould be dipped in ſweet oil to make them ſlip down the eaſier. Some horſes have a ſtrait gullet, which makes them very averſe to a ball being thruſt down their throats; ſuch horſes had better have drenches given them, or their medicines may be mixed with bran, or in their maſhes. See FARRIERY, *Paſſim.*

BALL Vein, in mineralogy, a name given by the miners of Suſſex to a ſort of iron ore, common there, and wrought to conſiderable advantage. It yields not any great quantity of metal, but what it has runs freely in the fire; it is uſually found in looſe maſſes, not in the form of a ſtratum, and is often covered with one or more cruſts. It generally contains ſome ſparkling particles; and is uſually of a circular form in the perfect maſſes, thickeſt in the middle, and gradually thinner as it approaches the ſides. The ores of Suſſex in general are poor, but they require very little trouble in the working; ſo that a conſiderable profit is made annually from them.

Ball and Socket is an inſtrument made of braſs, with a perpetual ſcrew, ſo as to move horizontally, vertically, and obliquely; and is generally uſed for the managing of ſurveying and aſtronomical inſtruments.

Puff-Ball, the Engliſh name of the lycoperdon. See Lycoperdon.

Martial Balls, in pharmacy, are a mixture of filings of iron and cream of tartar, formed into a ſolid conſiſtence and form of a ball, which is uſed to impregnate water or other liquids with iron diſſolved by the tartareous acid. To make theſe balls, one part of filings of iron and two parts powdered cream of tartar are mixed well together, and put into an earthen or iron veſſel with ſome water. The mixture is to be ſtirred from time to time till it becomes almoſt dry; and then it is to receive more water, and to be ſtirred as before. This treatment is to be continued till it acquires, when nearly dry, ſomewhat of the conſiſtence and tenacity of ſoftened roſin. Then it is to be rolled up in the form of a ball, which is generally kept tied up in a rag; and when intended to be uſed, it is to be infuſed in water, till it gives ſome colour to that liquid. The infuſion of martial balls is tonic, vulnerary, diſcutient and aperitive; and is employed both internally and externally*. Iron being ſoluble in all acids, is attacked in this preparation by the tartareous acid, which reduces it to a kind of neutral ſalt not cryſtallizable. This ſalt would remain liquid, and would form a ſoluble martial tartar, called *tartariſed tincture of Mars*. If proper proportions of filings of iron and cream of tartar be uſed, and treated long enough for an entire and complete combination, nothing would be obtained but a liquor or magma, which could not be preſerved in a ſolid form, but would be continually moiſt. Therefore, in the martial ball there is a good deal of the cream of tartar and filings of iron not combined together, by which its ſolidity is preſerved.

Mercurial Balls, in pharmacy, are an amalgam of mercury and tin, ſufficiently ſolid to be moulded, and to preſerve a given form. The method of making them is by adding mercury to melted tin, and pouring the fluid maſs into a round hollow mould.—Theſe balls are employed to purify water, in which they are boiled; for which purpoſe travellers often carry ſome along with them. Nothing, however, can be more pernicious than ſuch a practice, ſhould the water contain any nitrous acid, which it very often does.

Balls of Silk worms and Spiders, are little caſes or cones of ſilk, wherein thoſe inſects depoſite their eggs. Spiders are extremely tender of their balls, which they carry about with them adhering to the papillæ about their anus. Grew mentions balls or bags of a ſpecies of ſilk-worms in Virginia, as big as hens eggs, and containing each four aurelias.

Zoologiſts ſpeak of a ſort of balls of hair covered over with a ſmooth ſhining coat, or ſhell found in the ſtomachs of oxen, cows, calves, horſes, ſheep, and goats. See the article Bezoar.

Balls of Fire, in meteorology. See Fire *(Balls of)*.

Balls in electricity, are two pieces of cork, or pith of elder, nicely turned in a lathe to the ſize of a ſmall pea, and ſuſpended by fine linen threads; intended as electrometers, and of excellent uſe to diſcover ſmall degrees of electricity, to obſerve the changes of it from poſitive to negative, and *vice verſa;* and to eſtimate the force of a ſhock before the diſcharge, ſo that the operator ſhould always be able to tell very nearly before the diſcharge, by knowing how high he has charged his jars, what the exploſion will be.

Fire-Balls, are bags of canvas filled with gunpowder, ſulphur, ſaltpetre, pitch, &c. to be thrown by the ſoldiers, or out of mortars, in order to fire the houſes incommoding trenches, advanced poſts, or the like.—The Greeks had divers kinds of fire-balls, or Πυροβολοι λιθοι; one kind called more particularly, σκυταλια, or σκυταλιδες, made of wood, ſometimes a foot, or even a cubit long; their heads being armed with ſpikes of iron, beneath which were hemp, pitch, and other combuſtibles, which being ſet on fire, they were caſt among the enemy. The preparations of fire-balls, among the moderns, conſiſt of ſeveral operations, viz. making the bag, preparing the compoſition, tying, and, laſtly, dipping the ball. 1. The bags for this purpoſe are either oval or round. 2. The compoſition wherewith fire-balls are filled is various: To ten pounds of meal-gunpowder add two of ſaltpetre, one of ſulphur, and one of colophony; or, to ſix pounds of gunpowder, add four of ſaltpetre, four of ſulphur, one of powdered glaſs, half a pound of antimony, as much camphor, an ounce of ſal-ammoniac, and four of common ſalt, all pulveriſed. Sometimes they even fill fire-balls with hand granadoes. 3. For tying the fire-balls, they prepare two iron rings, one fitted round the aperture, where the ball is to be lighted, the other near its baſe. A cord is tied to theſe rings in ſuch a manner, as that the ſeveral turns repreſent ſemicircles of the ſphere cutting the globe through the poles: over the cords, extended according to the length of the ball, others are tied, cutting the former at right angles, and parallel to each other, making a knot at each interſection: laſtly, after putting in a leaden bullet, the reſt of the ſpace is filled with tow or paper. 4. Thus completed, the fire-ball remains to be dipped in a compoſition of melted pitch four pounds, colophony two, and linſeed oil or oil of turpentine two; after dipping, they cover it round with tow, and dip again, till it be brought to the juſt diameter required.

Light-Balls, are ſuch as diffuſe an intenſe light around; or they are balls which, being caſt out of the hand or a mortar, burn for ſome time, and illuminate the adjacent parts. 1. Luminous or light-balls for the hand, are made of ground powder, ſaltpetre, brimſtone, camphor, and borax, all ſprinkled with oil, and moulded into a maſs with ſuet; and this is wrapped up in tow, with a ſheet of ſtrong paper over it. To fire it, they make a hole into it with a bodkin, into which they put ſome priming that will burn ſlow. Its uſe is to be caſt into any works they would diſcover in the night-time. 2. For the larger light-balls, or

* See *Iron*.

thoſe to be thrown to a greater diſtance, they melt equal quantities of ſulphur, turpentine, and pitch; and herein dip an earthen or ſtone-ball, of a diameter much leſs than that of the mortar out of which the fire-ball is to be caſt; then rolling it in gun-powder, and covering it round with gauze, they dip it again, and repeat the reſt till it come to fit the cavity of the mortar: laſtly, they ſprinkle it around with gun-powder. This, being once kindled, will ſtrongly illuminate all around the place where it is thrown, and give opportunity to examine the ſtate and condition thereof.

Smoke or Dark BALLS, thoſe which fill the air with ſmoke, and thus darken a place to prevent diſcoveries. To prepare a darkening ball, make an oval or ſpherical bag, melt roſin over the coals, and add an equal part of ſaltpetre not purified, alſo of ſulphur, and a fifth part of charcoal. The whole being well incorporated, put in tow firſt ſhred, and fill the bags with this compoſition, and dip it after the ſame manner as a fire-ball.

*Stink-*BALLS, thoſe which yield a great ſtench where fired to annoy the enemy. Their preparation is thus: Melt ten pounds of pitch, ſix of roſin, twenty of ſaltpetre, eight of gun-powder, and four of colophony; to theſe add two of charcoal, ſix of horſe-hoofs cut ſmall, three of aſſafœtida, one of ſtinking-ſaracen, and any other offenſive ingredients. The reſt as in the former.

*Sky-*BALLS, thoſe caſt on high out of mortars, and which, when arrived at their height, burſting like rockets, afford a ſpectacle of decoration. Sky-balls are made of a wooden ſhell, filled with various compoſitions particularly that of the ſtars of rockets. Theſe are ſometimes intermixed with crackers and other combuſtibles, making rains of fire, &c.

*Water-*BALLS, thoſe which ſwim and burn a conſiderable time in the water, and at length burſt therein. Theſe are made in a wooden ſhell, the cavity of which is filled with refined ſaltpetre, ſulphur, ſaw-duſt boiled in water of ſaltpetre, and dried; to which ſometimes other ingredients are added, as iron-filings, Greek pitch, amber duſt, powdered glaſs, and camphor. The ingredients are to be ground, mixed up, and moiſtened with linſeed oil, nut oil, olive oil, hempſeed oil, or petrol. At the bottom is placed an iron coffin, filled with whole gunpowder, that the ball may at laſt burſt with a greater noiſe: and, laſtly, the ball is, by the addition of lead or otherwiſe, made of the ſame ſpecific gravity with water.

*Land-*BALLS are thoſe which, being thrown out of a mortar, fall to the ground, burn, and burſt there. The ingredients are much the ſame as in the *water-balls*, only the ſpecific gravity is not attended to.

BALLAGHAN, a town of Ireland, in the county of Sligo, and province of Connaught. W. Long. 9. 50. N. Lat. 53. 48.

BALLAN, a town of France, in the dioceſe of Mons, with the title of a marquiſate, ſeated on the river Orne. E. Long. 0. 20. N. Lat. 48. 10.

BALLAD, a kind of ſong, adapted to the capacity of the lower claſs of people; who, being mightily taken with this ſpecies of poetry, are thereby not a little influenced in the conduct of their lives. Hence we find, that ſeditious and deſigning men never fail to ſpread ballads among the people, with a view to gain them over to their ſide.

BALLAST, an heavy matter, as ſtone, gravel, iron, &c. thrown into the hold of a ſhip, in order to make her ſink a proper depth in the water, that ſhe may be capable of carrying a ſufficient quantity of ſail without overſetting.

There is often great difference in the proportion of ballaſt required to prepare ſhips of equal burden for a voyage; the quantity being always more or leſs according to the ſharpneſs or flatneſs of the ſhip's bottom, which ſeamen call the *floor.*

The knowledge of ballaſting a ſhip with propriety, is certainly an article that deſerves the attention of the ſkilful mariner: for although it is known, that ſhips in general will not carry a ſufficient quantity of ſail till they are laden ſo deep that the ſurface of the water will nearly glance on the extreme breadth amidſhips, yet there is more than this general knowledge required; ſince, if ſhe has a great weight of heavy ballaſt, as lead, iron, &c. in the bottom, it will place the centre of gravity too low in the hold; and although this will enable her to carry a great ſail, ſhe will nevertheleſs ſail very heavily, and run the riſk of being diſmaſted by her violent rolling.

To ballaſt a ſhip, therefore, is the art of diſpoſing thoſe materials ſo that ſhe may be duly poiſed, and maintain a proper equilibrium on the water, ſo as neither to be too *ſtiff* nor too *crank*, qualities equally pernicious: as in the firſt, although the ſhip may be fitted to carry a great ſail, yet her velocity will not be proportionably increaſed; whilſt her maſts are more endangered by her ſudden jerks and exceſſive labouring: and in the laſt, ſhe will be incapable of carrying ſail, without the riſk of overſetting.

Stiffneſs, in ballaſting, is occaſioned by diſpoſing a great quantity of heavy ballaſt, as lead, iron, &c. in the bottom, which naturally places the centre of gravity very near the keel; and that being the centre, about which the vibrations are made, the lower it is placed, the more violent will be the motion of rolling.

Crankneſs, on the other hand, is occaſioned by having too little ballaſt, or by diſpoſing the ſhip's lading ſo as to raiſe the centre of gravity too high, which alſo endangers the maſt in carrying ſail when it blows hard: for when the maſts loſe their perpendicular height, they ſtrain on the ſhrouds in the nature of a lever, which encreaſes as the ſine of their obliquity; and a ſhip that loſes her maſts is in great danger of being loſt.

The whole art of ballaſting, therefore, conſiſts in placing the centre of the gravity to correſpond with the trim and ſhape of the veſſel, ſo as neither to be too high nor too low; neither too far forward nor too far aft, and to lade the ſhip ſo deep, that the ſurface of the water may nearly riſe to the extreme breadth amidſhips; and thus ſhe will be enabled to carry a good ſail, incline but little, and ply well to the windward.

Ships are ſaid to be *in ballaſt* when they have no other loading. Maſters of veſſels are obliged to declare the quantity of ballaſt they bear, and to unload it at certain places. They are prohibited unloading their ballaſt in havens, roads, &c. the neglect of which has ruined many excellent ports.—Ships and veſſels taking in ballaſt in the river Thames, are to pay ſo much a tun to Trinity-houſe, Deptford; who ſhall employ ballaſtmen, and regulate them; and their lighters to be marked, &c. on pain of 10l.

BALLATOONS, large heavy luggage-boats uſed for carrying wood by the river from Aſtracan and the Caſpian ſea from Moſcow. Theſe will carry from 100 to 200 ton, and have from 100 to 120 men employed to row and tow them along.

BALLENDEN (Sir John), a Scottiſh poet, in the reign of James V. of Scotland, was deſcended from an ancient family in that kingdom. His father, Mr Thomas Ballenden of Auchinoul, was director to the chancery in the year 1540, and clerk-regiſter in 1541. Where our poet was educated, we are not informed; but from one of his poems we learn, that in his youth he had ſome employment at the court of king James V. and that he was in great favour with that prince. Having taken orders, and being created doctor of divinity, at the Sorbonne, he was made canon of Roſs, and archdeacon of Murray. He likewiſe obtained the place of clerk-regiſter, but was afterwards deprived of that employment by the factions of the times; however, in the ſucceeding reign, of Mary, he recovered that office, and was one of the lords of ſeſſion. Being a zealous papiſt, he, in conjunction with Dr Laing, was extremely aſſiduous in retarding the progreſs of the reformation; till at laſt, finding the oppoſition too powerful, he quitted Scotland, and went to Rome, where he died in the year 1550. He is generally eſteemed one of the beſt Scottiſh poets of that age. His works are, 1. *The hiſtory and chronicles of Scotland of Hector Boëis* (Boethius), *tranſlated by Mr John Ballenden*, Edinb. 1536. This is not a mere traſlation, Ballenden having corrected ſeveral miſtakes of his author, and made large additions. It is in folio, and black letter. 2. *Coſmography to the hiſtory of Scotland*, with a poetical proem. 3. *A deſcription of Albany*. 4. *Tranſlation of Boethius's deſcription of Scotland*. 5. *Epiſtles to king James* V. Bale ſays he had ſeen theſe letters. 6. Several poems in Carmichael's collection of Scottiſh poems; beſides many others in manuſcript, in private libraries in Scotland. 7. *Virtue and vyce*, a poem addreſſed to king James V.

BALLET, Balet, or Baletto, a kind of dramatic poem, repreſenting ſome fabulous action or ſubject divided into ſeveral entries; wherein ſeveral perſons appear, and recite things under the name of ſome deity, or other illuſtrious character.

Ballet is more particularly uſed for a kind of comic dance, conſiſting of a ſeries of ſeveral airs of different kinds of movements, which together repreſent ſome ſubject or action. They are performed chiefly by maſks repreſenting ſylvans, tritons, nymphs, ſhepherds, and the like; and conſiſt of three parts, the entry, figure, and the retreat. The word is of Greek origin, formed from βαλλειν, *jacere*, to caſt, throw, or toſs; whence alſo in writers of the middle age, we find *ballationes* for *ſaltationes*, dancings; and *ballare* for *ſaltare*, to dance.

BALLIAGE, or Bailiage, in commerce, a ſmall duty paid to the city of London by aliens, and even denizens, for certain commodities exported by them.

BALLICONNEL, a town of Ireland, in the county of Cavan, and province of Ulſter. W. Long. 7. 45. N. Lat. 54. 6.

BALLISHANNON, a large town of Ireland, in the county of Donegal, or Tyrconnel, with a good haven. W. Long. 8. 25. N. Lat. 54. 25.

BALLISTA, a machine uſed by the ancients for ſhooting darts; it reſembled in ſome meaſure our croſs-bow. The word is Latin, ſignifying a croſs-bow; and is derived foom the Greek, βαλλω, to *ſhoot*, or *throw*.

Vegetius informs us, that the balliſta diſcharged darts with ſuch rapidity and violence, that nothing could reſiſt their force: and Athenæus adds, that Agiſtratus made one of little more than two feet in length, which ſhot darts 500 paces.

In Plate XCVII. is repreſented the balliſta uſed in ſieges, according to the chevalier Folard: 2, 2, the baſe of the balliſta; 3, 4, upright beams; 5, 6, tranſverſe beams; 7, 7, the two capitals in the upper tranſverſe beam, (the lower tranſverſe beam has alſo two ſimilar capitals, which cannot be ſeen in this tranſverſe figure); 9, 9, two poſts or ſupports for ſtrengthening the tranſverſe beams; 10, 10, two ſkains of cords faſtened to the capitals; 11, 11, two arms inſerted between the two ſtrands, or parts of the ſkains; 12, a cord faſtened to the two arms; 13, darts which are ſhot by the balliſta; 14, 14, curves in the upright beams, and in the concavity of which cuſhions are faſtened, in order to break the force of the arms which ſtrike againſt them with great force when the dart is diſcharged; 16, the arbor of the machine, in which a groove or canal perfectly ſtraight is formed, and in which the darts are placed in order to their being ſhot by the balliſta; 17, the nuts of the trigger; 18, the roll or windlaſs, about which the cord is wound; 19, an hook, by which the cord is drawn towards the centre, and the balliſta cocked; 20, a ſtage or table on which the arbor is in part ſuſtained.

BALLISTEUM, or Ballistræa, in antiquity, a military ſong or dance uſed on occaſions of victory. Vopiſcus has preſerved the *balliſteum* ſung in honour of Aurelian, who, in the Sarmatian war, was ſaid to have killed 48 of the enemy in one day with his own hand. *Mille, mille, mille, mille, mille, mille decollavimus: Unus homo mille, mille, mille, mille decollavit; mille, mille, mille vivat, qui mille, mille occidit. Tantum vini habet nemo, quantum fudit ſanguinis.* The ſame writer ſubjoins another popular ſong of the ſame kind: *Mille Francos, mille Sarmatas, ſemel occidimus; mille, mille, mille, mille, mille Perſas quærimus.* It took the denomination *balliſteum* from the Greek βαλλω *jacio*, or *jacto*, to caſt or toſs, on account of the motions uſed in this dance, which was attended with great elevations and ſwingings of the hands. The *balliſtea* were a kind of popular ballads, compoſed by poets of the lower claſs, without much regard to the laws of metre.

BALLOON, or Ballon, in a general ſenſe, ſignifies any ſpherical hollow body, of whatever matter it be compoſed, or for whatever purpoſes it be deſigned. Thus, with chemiſts, balloon denotes a round ſhort-necked veſſel, uſed to receive what is diſtilled by means of fire; in architecture, a round globe on the top of a pillar; and among engineers, a kind of bomb made of paſteboard, aud played off in fire-works, either in the air or on the water, in imitation of a real bomb.

Air-Balloon. See Aerostation and *Air-balloon.*

Balloon alſo denotes a kind of game ſomething reſembling tennis. The balloon is played in the open field, with a great round ball of double leather blown up with wind, and thus driven to and fro with the ſtrength of a man's arm, fortified with a brace of wood.

Balloon, or Balloen, is more particularly uſed among voyagers for the ſtate-barges of Siam. The balloons are a kind of brigantine, managed with oars, of very odd figures, as ſerpents, ſea-horſes, &c. but, by their ſharpneſs and number of oars, of incredible ſwiftneſs. The balloons are ſaid to be made of a ſingle piece of timber, of uncommon length; they are raiſed high, and much decorated with carving at head and ſtern: ſome are gilt over, and carry 120 or even 150 rowers on each ſide. The oars are either plated over with ſilver, or gilt, or radiated with gold; and the dome or canopy in the middle, where the company is placed, is ornamented with ſome rich ſtuff, and furniſhed with a balluſtrade of ivory, or other coſtly matter, enriched with gilding. The edges of the balloon juſt touch the water, but the extremities riſe with a ſweep to a great height. Some are adorned with variety of figures, made of pieces of mother of pearl inlaid: the richer ſort, inſtead of a dome, carry a kind of ſteeple in the middle; ſo that, conſidering the ſlenderneſs of the veſſel, which is uſually 100 or 120 feet long, and ſcarce ſix broad, the height of the two ends, and of the ſteeple, with the load of decorations, it is a kind of miracle they are not overſet.

Balloon, in the French paper-trade, is a term for a quantity of paper, containing 24 reams.

Balloon, Ballon, or Ballot, in the French glaſs-trade, ſignifies a certain quantity of glaſs-plates, ſmaller or greater according to their quality. The ballon of white glaſs contains 25 bundles, of ſix plates per bundle; but the ballon of coloured glaſs is only of 12½ bundles, and of three plates to a bundle.

BALLOTA, white horehound: A genus of the gymnoſpermia order, belonging to the didynamia claſs of plants: and in the natural method ranking under the 42d order, *Verticillatæ.* The calyx has 5 teeth, with 10 ſtriæ; and the upper lip of the corolla is crenated. It is a common weed growing on the ſides of banks in moſt parts of England, as alſo in walk-places near towns and villages in Scotland; ſo is ſeldom admitted into gardens. The flowers grow in whorls, upon branched peduncles, and lean on one ſide of the ſtalk; they are commonly of a dull red colour, but ſometimes white. It was formerly uſed in hyſteric caſes, but is now fallen into diſuſe. The Swedes reckon it almoſt an univerſal remedy in the diſeaſes of their cattle. Horſes, cows, ſheep, and goats, refuſe to eat it.

BALLOTADE, in the menage, the leap of a horſe between two pillars, or upon a ſtraight line, made with juſtneſs of time, with the aid of the hand and the calves of the legs: and in ſuch a manner, that when his fore-feet are in the air, he ſhows nothing but the ſhoes of his hinder-feet without yerking out.

BALLOTING, a method of voting at elections, &c. by means of little balls uſually of different colours, by the French called *ballots;* which are put into a box privately.

BALLS, or Ballets, in heraldry, a frequent bearing in coats of arms, uſually denominated, according to their colours, bezants, plates, hurts, &c.

BALLUSTER, a ſmall kind of pillar uſed for balluſtrades.

BALLUSTRADE, a ſeries or row of balluſters, joined by a rail; ſerving as well for a reſt to the elbows as for a fence or incloſure to balconies, altars, ſtair-caſes, &c. See Architecture, n° 74.

BALM, in botany. See Melissa.

Balm, or Balsam. See Balsam.

Balm of Gilead. See Amyris.

BALNAVES (Henry), a Scottiſh proteſtant divine, born in the ſhire of Fife, in the reign of James V. and educated at the univerſity of St Andrew's. He went afterwards to France in order to finiſh his ſtudies; and returning to Scotland, was admitted into the family of the earl of Arran, who at that time governed the kingdom: but in the year 1542 the earl diſmiſſed him for having embraced the Proteſtant religion. In 1564, he joined, ſays Mackenzie, the murderers of cardinal Beaton; for which he was declared a traitor, and excommunicated. Whilſt that party were beſieged in the caſtle of St Andrew's, they ſent Balnaves to England, who returned with a conſiderable ſupply of proviſions and money; but being at laſt obliged to ſurrender to the French, he was ſent with the reſt of the garriſon to France. He returned to Scotland about the year 1559; and having joined the congregation, he was appointed one of the commiſſioners to treat with the duke of Norfolk on the part of queen Elizabeth. In 1563 he was made one of the lords of ſeſſion, and appointed by the general aſſembly, with other learned men, to reviſe the Book of Diſcipline. Knox, his cotemporary, and fellow-labourer, gives him the character of a very learned and pious divine. He died at Edinburgh in the year 1579. He wrote, 1. *A Treatiſe concerning Juſtification.* Edinb. 1550. 8vo. 2. *A Catechiſm, or Confeſſion of Faith.* Edinb. 1584, 8vo.

BALNEARII servi, in antiquity, ſervants or attendants belonging to the baths. Some were appointed to heat them, called *fornicatores;* others were denominated *capſarii,* who kept the cloaths of thoſe that went into them; others *aliptæ,* whoſe care it was to pull off the hair; others *unctuarii,* who anointed and perfumed the body.

BALNEARIUS fur, in antiquity, a kind of thief who practiſed ſtealing the cloaths of perſons in the baths; ſometimes alſo called *fur balnearum.* The crime of thoſe thieves was a kind of ſacrilege; for the hot baths were ſacred: hence they were more ſeverely puniſhed than common thieves who ſtole out of private houſes. The latter were acquitted with paying double the value of the thing ſtolen; whereas the former were puniſhed with death.

BALNEUM, a term uſed by the chemiſts to ſignify a veſſel filled with ſome matter, as ſand, water, or the like, in which another is placed that requires a more gentle heat than the naked fire. See Chemistry, n° 79.

BALSA, an ancient town of Luſitania in the Ager, Cunæus; now *Tavira,* capital of Algarva.

BALSAM, or Native Balsam, an oily, reſinous, liquid ſubſtance, flowing either ſpontaneouſly, or by means of inciſion, from certain plants. There are a great variety of balſams, generally denominated from the ſubſtances from which they are obtained; and which are explained under their names as they occur.

BALSAMICS. *Balſamica* is a Latin word which ſignifies *mitigating*. The term *balſamic* is a very lax one; it includes medicines of very different qualities, as emollients, detergents, reſtoratives, &c. but in medicines of all theſe kinds there ſeems to be this requiſite in them, *viz.* that they be ſoft, yielding, and adheſive, alſo that by their ſmallneſs they have a ready diſpoſition to motion. Medicines of this tribe are generally required for complaints whoſe ſeat is in the viſcera; and as they cannot be conveyed there but by the common road of the circulation, it follows, that no great effects can be expected from them but by their long continuation. Hoffman calls by the name of *balſamics* thoſe medicines which are hot and acrid, alſo the natural balſams, gums, &c. by which the vital heat is increaſed.

Motherby's Med. Dict.

BALSORA. See BASSORA.

BALTAGI, among the Turks, porters, and hewers of wood, in the court of the grand ſignior; who alſo mount on horſeback when the emperor rides out. Part of them alſo, who, for that purpoſe, muſt be caſtrated, keep watch at the gates of the firſt and ſecond courts of the ſeraglio. Theſe laſt are called *capigi*, and their commander *capigi paſcha*.

BALTIC SEA, a great gulph ſurrounded by Sweden, Ruſſia, Courland, Pruſſia, Pomerania, and Denmark. The king of Denmark levies a tax at Elſineur on every ſhip that enters the Baltic ſea. It is remarkable that this ſea never ebbs nor flows, and there is always a current ſets through the ſound into the ocean. It is generally frozen over three or four months in the year. Yellow amber is found in plenty on this coaſt.

BALTIMORA, in botany: a genus of the polygamia neceſſaria order, belonging to the ſyngeneſia claſs of plants. The receptaculum is chaffy; there is no pappus; the calyx is cylindrical and polyphyllous; and the ray of the corolla is quinqueflorous. There is but one ſpecies, the recta, a native of Maryland.

BALTIMORE, a large and flouriſhing town of Maryland, in North America, ſituated on the north ſide of Patapſco river around the baſon, in which the water riſes to the depth of about ſix feet in common tides, but at Fell's Point the water is deep enough for ſhips of burden to come up. The trade and conſequent improvement of Baltimore has been more rapid than that of any town in the United States: the principal trade of Maryland centers here, and its exports to Europe and the Weſt Indies are extenſive. The ſtreets are well built and handſome: and the inhabitants are hoſpitable to ſtrangers, and maintain a friendly ſocial intercourſe with one another. The town ſtands low and was formerly unhealthy, which the great increaſe of buildings and improvements, particularly the paving of the ſtreets have contributed to remedy. Its ſituation is favourable for defence againſt a naval force, as the entrance to the harbour, about a mile below Fell's Point, is not more than a piſtol ſhot acroſs. W. Long. 76. 30. N. Lat. 39. 21.

BALTIMORE, a town of Ireland in the county of Corke, and province of Munſter, with the title of a barony. It is ſeated on a headland which runs into the ſea, five miles north-eaſt of Cape Clear. W. Long. 9. 10. N. Lat. 51. 15.

BALTIMORE-Bird. See ORIOLUS.

BALUCLAVO, or JAMBOL, a ſea-port town of Crimea on the Black Sea, where they build ſhips for the Grand Signior. E. Long. 35. 15. N. Lat. 44. 50.

BALUZE (Stephen), a French writer, born in 1651, and ſometime librarian to M. Colbert. In 1693 he obtained a penſion, with the poſt of director of the royal college, for writing the lives of the popes of Avignon; both which advantages he ſoon loſt in the fluctuation of court parties. M. Baluze is much more noted for collecting ancient MSS. and illuſtrating them by notes, than famed for his own compoſitions.

BALYUR, or BALIUR, a ſea-port of Africa in the kingdom of Dancali, about 14 hours journey weſt from Babel-Mandel. It is remarkable only for being the landing place of the Abyſſinian Patriarch Alphonſus Mendez, with his Jeſuits and Portugueſe, on April 3d, 1724. The king, who had received orders from the Abyſſinian emperor to give them a proper reception, diſpatched his ſon to meet them and conduct them to him. The royal palace they found to conſiſt of about half a dozen of tents, and a ſcore of huts, fenced about with a thorn hedge, and ſhaded by ſome wild kinds of trees. Near the palace was a river, which was then quite dried up, and no water to be found but what was digged for in the channel. The hall of audience was only a large tent about a muſket-ſhot from the reſt. At the upper end was a kind of throne made of ſtones and clay, covered with a carpet, and two velvet cuſhions. At the other end was his majeſty's horſe with the ſaddle and other accoutrements hanging on one ſide; it being the cuſtom of this country for the maſter and horſe to lie together, whether king or ſubject. Around the hall were about 50 young men ſitting croſs-legged; and when the Portugueſe ambaſſadors were admitted, they were made to ſit down in the ſame poſture. Soon after came the king preceded by ſome of his domeſtics, one having an earthen pitcher full of hydromel, another a cup made of porcelane, a third carrying a cocoa ſhell full of tobacco, and a fourth bringing a ſilver tobacco-pipe with ſome fire. Next to them was the king, dreſſed in a light ſilk ſtuff, having on his head a turban, from the rims of which hung a parcel of rings nicely wrought, which dangled before his face. He had in his hand a ſhort kind of javelin, and was followed by all the chief officers of his court and houſehold. The reſpect paid him at his coming in was by ſtanding on their feet, and ſquatting down again twice, after which they went forward to kiſs his hand.

BALZAC (John Lewis Guez de), born at Angouleme in 1595. Voltaire allows him the merit of having given numbers and harmony to the French proſe, but cenſures his ſtyle as ſomewhat bombaſt. The critics of his own time gave him no little diſquiet; and he gave them no little advantage over him by his ſallies of vanity, and ſome particular propoſitions which were a little dangerous. Mr Balzac, getting rid of theſe diſputes by his moderation, ſettled at his country ſeat; refined his ſtyle and genius; and got by his letters and other writings which he publiſhed from time to time, the reputation of being the firſt writer in France. He was at length drawn from his retirement by the hopes of making his fortune under cardinal Richlieu, who had formerly courted his friendſhip; but in a few years he retired again, diſguſted with the ſlaviſh dependence of a court life. All he obtained from the court was a penſion of 2000 livres, with the titles of councellor of ſtate and hiſtoriographer of France. He died in 1654; and was buried in the hoſpital of Notre Dame des Anges, to which he bequeathed 12,000 livres. He left an eſtate of 100 franks *per ann.* for a gold medal to be beſtowed every two years for the beſt diſcourſe on ſome moral ſubject.—Beſides his letters, he wrote a work called *Oeuvres Diverſes*, i. e. on various ſubjects; The Prince; The Chriſtian Socrates, &c. and many other pieces; all of which have been publiſhed in two volumes folio.

BAMBA, a province of the kingdom of Congo in Africa.—It is ſituated between the rivers of Ambriſi and Loſe; the laſt of which parts it from Pemba on the eaſt, as the Ambriſi does from the province of Soguo on the north. Along the ſea-coaſts it extends itſelf northward to the river Lelunda; and on the ſouth to that of Danda, which parts it from the kingdom of Angola. The governors of this province bear the title of *dukes*, and are always ſome of the princes of the royal family. They are as deſpotic and arbitrary as if they were really kings, notwithſtanding the care and pains their monarchs have taken to keep them within due bounds. The ſoil of this province is very fertile; and would produce all the neceſſaries of life in great plenty, were the inhabitants but induſtrous in its cultivation. The ſea-coaſts produce a vaſt quantity of ſalt, which could be purified with little trouble, and would yield an extraordinary revenue if the duties were duly paid; but theſe the governors find means to ſink moſtly into their own coffers.—Here is alſo the fiſhery of the zimbis, or little ſea-ſnail, whoſe ſhell is the current coin not only in this and the neighbouring kingdom, but alſo in the moſt diſtant parts of Africa. Here are alſo ſaid to be mines of gold, ſilver, quickſilver, copper, tin, and iron; but none except the iron mines are allowed to be worked.

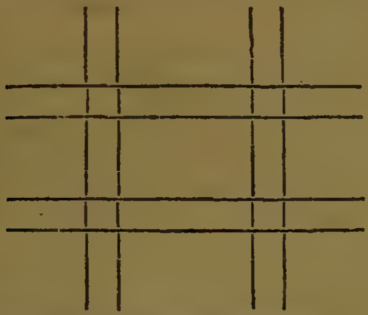
BAMBERG, a large handſome town of Franconia in Germany, and capital of a biſhopric of the ſame name. It was formerly imperial, but is now ſubject to the biſhop. The country about it produces plenty of corn, fruits, and liquorice. It has an univerſity, founded in 1585; and is ſituated at the confluence of the rivers Main and Reidnitz. E. Long. 10. 15. N. Lat. 50. 10.

BAMBERG, a town of Bohemia, ſituated at the foot of a mountain. E. Long. 16. 50. N. Lat. 49. 53.

BAMBOCCIO, a celebrated painter of converſations, landſcapes, cattle, &c. was born at Laeren, near Narden, in 1613. His name was Peter Van Laer; but in Italy they gave him the name of Bamboccio, on account of the uncommon ſhape of his body, the lower part being one third part longer than the upper, and his neck ſo ſhort that it was buried between his ſhoulders. He had, however, an ample amends for the unſeemlineſs of his limbs, in the ſuperior beauties of his mind: he was endowed with an extenſive genius; and, indeed, had an univerſal taſte for every part of painting. He reſided at Rome for ſixteen years ſucceſſively; every day ſtudying to improve himſelf by thoſe beautiful models which were continually open to his obſervation, and by the lovely ſcenery in the environs of that city. He was held in the higheſt eſteem by all ranks of men, as well as by thoſe of his own profeſſion; not only on account of his extraordinary abilities, but alſo for the amiable qualities of his mind. He ſtudied nature inceſſantly; obſerving with a curious exactneſs every effect of light on different objects, at different hours of the day; and whatſoever incident afforded pleaſure to his imagination, his memory for ever perfectly retained. His ſtile of painting is ſweet and true; and his touch delicate, with great tranſparency of colouring. His figures are always of a ſmall ſize, well proportioned, and correctly deſigned; and altho' his ſubjects are taken but from the lower kind of nature, ſuch as plunderings, playing at bowls, inns, farrier ſhops, cattle, or converſations; yet whatever he painted was ſo excellently deſigned, ſo happily executed, and ſo highly finiſhed, that his manner was adopted by many of the Italian painters of his time. His works are ſtill univerſally admired, and he is juſtly ranked among the firſt claſs of the eminent maſters. His hand was as quick as his imagination, ſo that he rarely made ſketches or deſigns for any of his works; he only marked the ſubject with a crayon on the canvas, and finiſhed it without more delay. His memory was amazing: for whatever objects he ſaw, if he conſidered them with any intention to inſert them in his compoſitions, the idea of them was ſo ſtrongly impreſſed on his mind, that he could repreſent them with as much truth as if they were placed before his eyes. Sandrart obſerves, that although painters who are accuſtomed to a ſmall ſize are frequently inaccurate in the diſpoſition of the different parts of their ſubject, ſeeming content if the whole appears natural; yet Bamboccio was as minutely exact in having his figures, trees, grounds, and diſtances, determined with the utmoſt preciſion and perſpective truth, as the beſt maſters uſually are in pictures of the largeſt ſize; which is one circumſtance that cauſes the eye to be ſo agreeably deluded by the paintings of Bamboccio. In the latter part of his life, he was ſeverely tormented with an aſthmatic complaint, which he endured with much impatience; and it is reported, that as the diſorder ſeemed to him unſupportable, he threw himſelf into a canal to ſhorten his miſery, and was drowned. His death happened in 1673.

BAMBOE, in botany, the trivial name of a ſpecies of arundo. See ARUNDO.

BAMBOE-Habit; a Chineſe contrivance by which a perſon who does not know how to ſwim may eaſily keep himſelf above water. The following account of it is from a letter to the author of the *Seaman's Preſervative*. "In the year 1730, I was paſſenger in a ſhip from Batavia to China, burden about 400 tons, called the *Pridae*, Franciſco Xavier commander, freighted by Engliſh, Chineſe, and Portugueſe. Near the coaſt of China we met one of thoſe ſtorms called a *Tuftoon (Tau fong)*, or a great wind, which carried away all our maſts, bowſprit, and rudder; and in our hold we had ſix feet of water, expecting every moment the ſhip would founder.—We conſequently were conſulting our preſervation: the Engliſh and Portugueſe ſtood in their ſhirts only, ready to be thrown off; but the Chineſe merchants came upon deck, not in a cork-jacket, but I will call it a *bamboe-habit*, which had lain ready in their cheſts againſt ſuch dangers; and it was thus conſtructed; four bamboes, two before and two behind their bodies, were placed horizontally, and projected about 28 inches. Theſe were croſſed on each ſide by two others, and the whole properly ſecured, leaving a ſpace for their body; ſo that they had only to put it over their heads, and tie the ſame ſecurely, which was done in two minutes, and we were ſatisfied they could not poſſibly ſink." The ſhape is here ſubjoined.



BAMBOROUGH. See *Holy-Iſland*.

BAMBUCK, a country of Africa, of which the following account is given by the Abbe Raynal, on the credit of a modern traveller whom he does not name. "In the interior part of Africa, under the 12th or 13th degree of north latitude, there is (ſays a modern traveller) a pretty large country, known by the name of *Bambuck*. It is not ſubject to a particular king; but governed by village lords, called *farims*. Theſe hereditary and independent chiefs are all obliged to unite for the defence of the ſtate, when it is either attacked as a community, or only in one of its branches.

"The territory of this ariſtocratical ſtate is dry and barren. It produces neither maize, rice, nor pulſe. The inſupportable heat it is ſubject to, proceeds in part from its being ſurrounded by high mountains, which prevent the wind from refreſhing the air. The climate is as unwholeſome as it is diſagreeable: vapours, which continually iſſue from the bowels of a ſoil replete with minerals, render this country unfit to live in, eſpecially to ſtrangers.

"It is gold that hath made this miſerable country an object worthy of notice: gold, which in the eyes of the covetous man ſeems to compenſate for all the evils of nature, tho' in reality it increaſes them all. This metal is ſo common in this country, that it is found almoſt indiſcriminately every where. To obtain it, ſometimes it is ſufficient to ſcrape the ſurface of the earth, which is clayiſh, light, and mixed with ſand. When the mine is very rich, it is digged only to the depth of a few feet, and never deeper; though it has been obſerved, that the lower it was digged, the more gold the ſoil afforded. The miners are too indolent to purſue a toil which conſtantly becomes more tedious, and too ignorant to perceive the inconveniences it would be attended with. Their negligence and their folly are in this inſtance ſo extraordinary, that in waſhing the gold, in order to ſeparate it from the earth, they only preſerve the larger pieces: the light parts paſs away with the water, which flows down an inclined plain.

"The inhabitants of Bambuck do not work theſe mines at all times, nor are they at liberty to do it when they pleaſe. They are obliged to wait till private or public wants determine the farims to grant this permiſſion. When it is proclaimed, all who are able to avail themſelves of this advantage meet at the appointed place. When their work is finiſhed, a diviſion is made. Half of the gold goes to the lord, and the remainder is equally diſtributed among the labourers. Thoſe who want gold at any other time than that of the general digging, ſearch for it in the beds of the rivers, where it is very common.

"The French and Engliſh have ſucceſſively been deſirous of appropriating to themſelves theſe real or imaginary riches. Some thought they could reach this country by the Niger, others by the Salum. Far from having ſucceeded in their attempts of becoming maſters of this country, they have not yet aſcertained its exiſtence. The unſucceſsfulneſs of paſt efforts hath redoubled the activity of ſanguine minds; ſenſible and judicious merchants have choſen to limit themſelves to a commerce much more important, which is that of ſlaves."

BAMFF, a ſhire of Scotland, comprehending part of Buchan, with the countries of Strathdovern, Boyn, Enzie, Strathaven, and Balvenie, extends 32 miles from eaſt to weſt, and 13 in breadth from north to ſouth. On the ſouth, it is ſeparated from part of Buchan by the river Ugie; on the eaſt it is watered by the Dovern and the German Ocean; on the weſt it is bounded by the Spey and the county of Murray; on the ſouth-weſt, it borders on Badenoch and the Braes of Mar; and on the north, it is confined by the Murray Frith. The face of the country is agreeably diverſified with hill and dale, not without woods, well watered with rivers, and exhibiting many ſeats and plantations. The air is pure and keen, the climate healthy, and the ſoil fertile, producing plentiful crops of corn. The country of Buchan, extending northwards from the river Ugie to the ſea, and weſtward as far as Devron, comprehending a tract of 20 miles in length and nine in breadth, is more free from hills and mountains than any other county of the ſame extent in the kingdom of Scotland. It is inhabited chiefly by Lowlanders, and gives the title of *earl* to the family of Erſkine; of which family, however, Erſkine of Mar is the chief. The county of Bamff abounds with the neceſſaries and comforts of life. The paſture-grounds yield ſheep, cattle, and horſes: the arable lands produce plenty of corn; while the rivers and ſea ſupply great quantities of fiſh. Various minerals have been found in different parts of the ſhire; and a piece of amber, as large as a horſe, was once caſt aſhore on the beach. In the mountainous diſtrict of Balvenie, on the weſtern ſide of the ſhire, watered by the Spey, there is a noted rock, which produces hones and whetſtones ſufficient to ſupply the whole iſland. Here are alſo veins of alum ſtone, and ſprings of alum water. Strathallan, another diſtrict to the north-eaſt of Balvenie, abounds with ſuch plenty of lime-ſtone, that the inhabitants uſe it as common ſtone in building their houſes; and moreover burn a great quantity of it into lime, which they ſell to good advantage in the village of Keith, on the river Dovern. Along this whole coaſt, there are ancient Daniſh monuments, ſuch as cairns, tumuli, and huge ſtones ſtanding erect. In Strathaven, a hilly country, lying along the limpid river Avin, which falls into the Spey, we meet with Gordon Caſtle, belonging to the Duke of Gordon, the moſt princely edifice in the north of Scotland, conſiſting of noble apartments magnificently furniſhed, and environed with fine gardens and parks well ſtored with fallow-deer. The ſame nobleman poſſeſſes ſeveral other ſeats in this county.

Bamff, the capital of the ſhire of that name in Scotland, is pleaſantly ſituated on the ſide of a hill, at the mouth of the river Devron. It has ſeveral ſtreets; of which that with the town-houſe in it, adorned with a new ſpire, is very handſome. This place was erected into a borough by virtue of a charter from Robert II. dated October 7. 1372, endowing it with the ſame privileges, and putting it on the ſame footing, with the burgh of Aberdeen; but tradition ſays it was founded in the reign of Malcolm Canmore. It gives title of *baron* to a branch of the Ogilvie family. The harbour is very bad, as the entrance at the mouth of the Devron is very uncertain, being often ſtopped by the ſhifting of the ſands, which are continually changing in great ſtorms; the pier is therefore placed on the outſide. Much ſalmon is exported from hence. About Troophead ſome kelp is made; and the adventurers pay the lord of the manor 50 l. *per annum* for the liberty of collecting the materials. Near the town is a moſt magnificent ſeat lately built by the Earl of Fife. It lies in a beautiful plain waſhed by the Devron, the lofty banks of which clothed with wood on the oppoſite ſide, afford a delightful contraſt to the ſoft vale beneath. W Long. 2. 5. N. Lat. 57. 40.

BAMIER, the name of a plant common in Egypt. It produces a pyramidal huſk, with ſeveral compartments, of the colour of a lemon, and filled with muſky ſeeds. This huſk dreſſed with meat is a wholeſome food, and has a very agreeable flavour. The Egyptians make great uſe of it in their ragouts.

BAMIYAN, a city of Aſia, ſituated in the province of Zableſtan, 10 days journey from Balkh, and eight from Gazna. It is remarkable only for its dreadful cataſtrophe when taken by Jenghiz Khan in 1221. At that time the city belonged to Sultan Jalalodin, the laſt of the famous Mahmud Gazni's race. Jenghiz Khan was at that time about to attack Gazna, that prince's capital; but was ſtopped by the garriſon of Gazna, which he had hoped would give him no trouble. In this, however, he was diſappointed. The people had for a long time expected an attack; and had therefore ruined the country for five or ſix leagues round, while the peaſants had carried away the ſtones, and every thing that could be of uſe to the beſiegers. Accordingly, Jenghiz Khan having erected wooden towers, and planted his engines upon them, was in a ſhort time obliged to give over his attacks till millſtones and other materials could be brought from a great diſtance. The walls of the city were very ſtrong, ſo that the engines of the Moguls made but little impreſſion; and the garriſon making frequent and furious ſallies cut off whole ſquadrons of their enemies, and frequently overthrew their towers and engines. This exceedingly chagrined Jenghiz Khan; who one day returning from a fruitleſs attack, and hearing of the defeat of one of his generals by Jalallodin, ſwore to be revenged on Bamiyan. This fury coſt the life of one of his grandchildren; who expoſing himſelf too much, to pleaſe his grandfather, was ſlain with an arrow.—At laſt, however, by the numberleſs multitude of the Moguls, who continued the attacks without intermiſſion, the city was taken, after its walls had been ruined in many places, and the braveſt ſoldiers and officers of the garriſon ſlain in its defence. The mother of the young prince who had been killed entering with the troops, and more deſerving the name of a fiend than a woman, cauſed the throats of all the inhabitants to be cut, without excepting one. She even gave orders to rip up the bellies of all the women with child, that not an infant might be left alive. In ſhort, to gratify the rage of this inhuman monſter, the buildings were all levelled with the ground; the cattle, and every living creature, deſtroyed; inſomuch that the hardened Moguls themſelves gave this place the name of *Maubalig*, which in their language ſignifies *the unfortunate city*. A ſtrong caſtle has ſince been built out of its ruins.

BAMOTH-BALL (anc. geog.), one of the towns of the tribe of Reuben, which ſeems alſo to have had a temple of Baal on an eminence; lying eaſtwards, and not far from the river Arnon, and the territory of Moab. Jerome calls it *Bamoth*, a city of the Amorrites, beyond Jordan, in the poſſeſſion of the ſons of Reuben. Whether the ſame with that mentioned Numb. xxi. is doubtful, from the diſagreement of interpreters; and yet we may admit it to be the place of encampment of the Iſraelites, and of Balaam's firſt ſtation, or where he had the firſt view of the rear of the people.

BAMPTON, a town of Devonſhire, ſituated in a bottom ſurrounded with high hills. W. Long. 4. 25. N. Lat. 51. 5.

BAN, or BANS. See BANN.

BAN, in commerce, a ſort of ſmooth fine muſlin, which the Engliſh import from the Eaſt Indies. The piece is almoſt a yard broad, and runs about 20 yards and a half.

BANANA-TREE, a ſpecies of the muſa or plantain. See MUSA.

BANARES, or BENARES, a handſome town of Aſia, in the dominions of the Great Mogul, greatly celebrated for its ſanctity, and being the univerſity of the Indian Bramins. See OBSERVATORY. It is ſeated on the north ſide of the river Ganges, in E. Long. 82. 30. N. Lat. 26. 20.

BANBURY, a town of Oxfordſhire in England, ſituated on the river Charwell, in W. Long. 1. 20. N. Lat. 52. 0.

BANC, or BENCA, in law, denotes a tribunal, or judgment-ſeat: hence *king's banc* is the ſame with the *court of king's bench*, and *common banc* with that of *common pleas*.

BANCI JUS, or the privilege of having a bench, was anciently only allowed to the king's judges, *qui ſummam adminiſtrant juſtitiam*. Inferior courts, as courts-baron, hundred-courts, &c. were not allowed that prerogative: and even at this day the hundred-court at Freibridge in Norfolk is held under an oak at Gey-wood; and that of Woolfry, in Herefordſhire, under an oak near Aſhton in that county, called *Hundred-oak*.

BANCA, an iſland of Aſia, in the Eaſt Indies, between Sumatra and Borneo; from the firſt of which it is ſeparated only by a narrow channel. E. Long. 105. 10. N. Lat. 13. 25.

BANCALIS, a ſea-port town on the eaſt coaſt of the iſland of Sumatra, where the Dutch have a ſettlement. E. Long. 99. 7. N. Lat. 1. 5.

BANCK (Peter Vander), an engraver of conſiderable repute, was born at Paris, and received his inſtructions in the art from the celebrated Francois de Poilly. He came over into England with Gaſcar the painter about the year 1674; and married the ſiſter of a gentleman of eſtate in Hertfordſhire, named Foreſter. He was a laborious artiſt: but the pay he received for his plates being by no means adequate to the time he beſtowed upon them, he was reduced to want; and, retiring from buſineſs, ſought an aſylum in the houſe of his brother-in-law. He died in Bradfield, and was buried in the church there, in 1674; leaving his widow in poſſeſſion of the chief part of his plates, which ſhe diſpoſed of to Brown, a printſeller, to great advantage, and left an eaſy fortune.—His chief employment was engraving of portraits; and, according to Virtue's account of this artiſt publiſhed by the Hon. Mr Walpole, he was the firſt in England who engraved them on ſo large a ſcale. But even the novelty, it ſeems, added to their merit, could not ſufficiently recommend them to ſupport the artiſt. Like many of Poilly's diſciples, his great merit, according to Mr. Strutt, conſiſts in the laboured neatneſs and management of the mechanical part of the art. Freedom, harmony, and chaſteneſs of outline, are by no means the characteriſtic of his prints. However, tho' they cannot rank with the ſuperior productions of Edelink or Nantueil, &c. they have their ſhare of merit; and doubtleſs will be always eſteemed in England as preſerving the beſt reſemblance of many eminent perſons who were living at that time.

BANCO, an Italian word which ſignifies *bank*. It is commonly uſed to ſignify the Bank of Venice.

BANCOCK, a town of the kingdom of Siam in Aſia, with a fort, which was once in the poſſeſſion of the French, but they were driven from it in 1688. E. Long. 101. 5. N. Lat. 13. 25.

BAND, in a general ſenſe, ſome ſmall narrow ligament, wherewith any thing is bound, tied, or faſtened.

BAND, in architecture, a general name for any flat low member, or moulding, that is broad but not very deep.

BAND of Soldiers, in military affairs, thoſe who fight under the ſame flag or enſign.

BAND of Penſioners, a company of 120 gentlemen, who receive a yearly allowance of 100l. for attending on his majeſty on ſolemn occaſions.

BAND is alſo the denomination of a military order in Spain, inſtituted by Alphonſus XI. king of Caſtile, for the younger ſons of the nobility; who, before their admiſſion, muſt ſerve 10 years at leaſt, either in the army or at court; and are bound to take up arms for the catholic faith againſt the infidels.

BAND, in ſurgery. See BANDAGE.

BANDA ISLANDS, the general name of five iſlands in the Eaſt-Indies, belonging to the Dutch. Two of them are uncultivated, and almoſt entirely uninhabited; the other three claim the diſtinction of being the only iſlands in the world that produce the nutmeg.

If we except this valuable ſpice, the iſlands of Banda, like all the Moluccas, are barren to a dreadful degree. What they produce in ſuperfluities they want in neceſſaries. The land will not bring forth any kind of corn; and the pith of the ſago ſerves the natives of the country inſtead of bread.

As this food is not ſufficient for the Europeans who ſettle in the Moluccas, they are allowed to fetch proviſions from Java, Maſſacar, or the extremely fertile iſland of Bali. The company itſelf carries ſome merchandiſe to Banda.

This is the only ſettlement in the Eaſt-Indies that can be conſidered as an European colony; becauſe it is the only one where the Europeans are proprietors of lands. The company finding that the inhabitants of Banda were ſavage, cruel, and treacherous, becauſe they were impatient under their yoke, reſolved to exterminate them. Their poſſeſſions were divided among the white people, who got ſlaves from ſome of the neighbouring iſlands to cultivate the lands. Theſe white people are for the moſt part Creoles, or malecontents who have quitted the ſervice of the company. In the ſmall iſland of Roſinging, there are likewiſe ſeveral banditti, whom the laws have branded with diſgrace; and young men of abandoned principles, whoſe families wanted to get rid of them: ſo that Banda is called the *iſland of correction*. The climate is ſo unhealty, that theſe unhappy men live but a ſhort time. It is on account of the loſs of ſo great a number of hands, that attempts have been made to transfer the culture of the nutmeg to Amboyna; and the company were likewiſe probably influenced by two other ſtrong motives of intereſt, as their trade could be carried on with leſs expence and greater ſafety. But the experiments that have been made have proved unſucceſsful, and matters remain in their former ſtate.

BANDAGE, in ſurgery, a fillet, roller, or ſwath, uſed in dreſſing and binding up wounds, reſtraining dangerous hemorrhagies, and in joining fractured and diſlocated bones.

BANDALEER, or BANDELEER, in military affairs, a large leathern belt, thrown over the right ſhoulder, and hanging under the left arm; worn by the ancient muſqueteers, both for the ſuſtaining of their fire-arms, and for the carriage of their muſket-charges, which being put up in little wooden caſes, coated with leather, were hung, to the number of twelve, to each bandaleer.

BANDELET, or BANDLET, in architecture, any little band, or flat moulding, as that which crowns the Doric architrave.

BANDER-CONGO, a ſmall ſea-port town in Aſia, ſeated on the Perſian Gulph. E. Long. 54. 10. N. Lat. 19. 0.

BANDERET, a general, or one of the commanders in chief of the forces.—This appellation is given to the principal commanders of the troops of the canton of Bern in Switzerland, where there are four banderets, who command all the forces of that canton.

BANDEROLL, a little flag, in form of a guidon, extended more in length than in breadth, uſed to be hung out on the maſts of veſſels, &c.

BANDITTI, from the Italian *bandito*; perſons proſcribed, or, as we call it, outlawed: ſometimes denominated *banniti* or *forris banniti*. It is alſo a denomination given to highwaymen or robbers who infeſt the roads in troops, eſpecially in Italy, France, and Sicily. Mr Brydone, in his Tour through Sicily, informs us, that in the eaſtern part, called *Val Demoni* from the devils that are ſuppoſed to inhabit Mount Ætna, it has ever been found altogether impracticable to extirpate the banditti; there being numberleſs caverns and ſubterraneous paſſages round that mountain, where no troops could poſſibly purſue them; beſides, they are known to be perfectly determined and reſolute, never failing to take a dreadful revenge on all who have offended them. Hence the prince of Villa Franca has embraced it, not only as the ſafeſt, but likewiſe as the wiſeſt and moſt political ſcheme, to become their declared patron and protector: and ſuch of them as think proper to leave their mountains and foreſts, though perhaps only for a time, are ſure to meet with good encouragement and a certain protection in his ſervice, where they enjoy the moſt unbounded confidence, which, in no inſtance, they have ever yet been found to make an improper or a diſhoneſt uſe of. They are clothed in the prince's livery, yellow and green, with ſilver lace; and wear likewiſe a badge of their honourable order, which intitles them to univerſal fear and reſpect from the people.

In ſome circumſtances, theſe banditti are the moſt reſpectable people of the iſland, and have by much the higheſt and moſt romantic notions of what they call their point of honour. However criminal they may be with regard to ſociety in general; yet, with reſpect to one another, and to every perſon to whom they have once profeſſed it, they have ever maintained the moſt unſhaken fidelity. The magiſtrates have often been obliged to protect them, and pay them in court, as they are known to be perfectly determined and deſperate, and ſo extremely vindictive that they will certainly put any perſon to death that has ever given them juſt cauſe of provocation. On the other hand, it never was known that any perſon who had put himſelf under their protection, and ſhowed that he had confidence in them, had cauſe to repent of it, or was injured by any of them in the moſt minute trifle; but, on the contrary, they will protect him from impoſitions of every kind, and ſcorn to go halves with the landlord, like moſt other conductors and travelling ſervants, and will defend him with their lives if there is occaſion. Thoſe of their number who have thus enliſted themſelves in the ſervice of ſociety, are known and reſpected by the other banditti all over the iſland; and the perſons of thoſe they accompany are ever held ſacred. For theſe reaſons, moſt travellers chooſe to hire a couple of them from town to town; and may thus travel over the whole iſland in ſafety.

BANDORA, the capital of the iſland of Salſet, on the weſt coaſt of the peninſula on this ſide the Ganges. It is ſeparated from the iſland of Bombay by a narrow channel, and ſubject to the Portugueſe. E. Lon. 72. 30. N. Lat. 19. 0.

BANDORE, the name of a muſical inſtrument with ſtrings, reſembling a lute, and ſaid to be invented in the fourth year of Queen Elizabeth, by John Roſe, a citizen of London.

BANDY-LEGS, from the French *bander*, 'to bend,' a diſtortion of the legs, when they turn either inward or outward on either ſide; ariſing from ſome defect in the birth or imprudence in the nurſe, endeavouring to make a child ſtand or walk before his legs were ſtrong enough to ſuſtain the weight of his body. See VALGUS.

BANE (from the Sax. *bana*, a murderer), ſignifies deſtruction or overthrow. Thus, "I will be the *bane* of ſuch a man," is a common ſaying. So, when a perſon receives a mortal injury by any thing, we ſay, "it was his *bane*:" and he who is the cauſe of another man's death, is ſaid to be *le bane*, i. e. a malefactor.

BANFF. See BAMFF.

BANGHIR, a town of Ireland, in king's county in the province of Leinſter, ſeated on the river Shannon. W. Long. 8. 5. N. Lat. 53. 10.

BANGLE EARS, an imperfection in a horſe, remedied in the following manner. Place his ears in ſuch a manner as you would have them ſtand; bind them with two little boards ſo faſt that they cannot ſtir, and then clip away all the empty wrinkled ſkin cloſe by the head.

BANGIUS (Thomas), a Daniſh divine, and an elegant Latin writer on the origin of languages and a variety of other ſubjects. He died in 1661.

BANGOR, an epiſcopal city of Carnarvonſhire in North Wales. In ancient times it was ſo conſiderable, that it was called *Bangor the Great*, and defended by a ſtrong caſtle: but it is now a very mean place; the principal buildings being the cathedral, the biſhop's palace, and a free ſchool. The ſee is of very great antiquity, and its founder unknown. The church is dedicated to St. Daniel, who was biſhop here about the year 516; but for near 500 years afterwards, there is no certainty of the names of his ſucceſſors. Owen Glendower greatly defaced the cathedral church; but Biſhop Dean repaired it again. This ſee met a ſtill more cruel ravager than Owen Glendower, in the perſon of Biſhop Bulkeley; who not only alienated many of the lands belonging to it, but even ſold the bells of the church. This dioceſe contains the whole of Carnarvonſhire except three pariſhes, the ſhire of Angleſey, and part of the ſhires of Denbigh, Merioneth, and Montgomery, in which are 107 pariſhes, whereof 36 impropriated. It has three archdeaconries, viz. Bangor, Angleſey, and Merioneth; of which the two firſt are commonly annexed to the biſhopric for its better ſupport. This ſee is valued in the king's books at L. 131 : 16 : 4, and is computed to be worth annually L. 1200. The tenths of the clergy are L. 151 : 14 : 3¼. To the cathedral there belong a biſhop, a dean, an archdeacon, a treaſurer, and two prebendaries, endowed; a precentor, a chancellor, and three canons, not endowed; three vicars coral, an organiſt, lay-clerks, choriſters, and two officers. W. Long. 4. 10. N. Lat. 53. 20.

BANGOR, a town of Ireland, in the county of Down and province of Ulſter. It is ſeated on the ſouth ſhore of the bay of Carrick Fergus, oppoſite to the town of that name; and ſends two members to parliament. W. Long. 6. N. Lat. 54. 42.

BANGUE, a ſpecies of opiate, in great uſe throughout the eaſt, for drowning cares and inſpiring joy.—This by the Perſians is called *beng*; by the Arabs, *eſſrar*, corruptly *aſſeral*, and *aſſarth*; by the Turks, *bengitie*, and vulgarly called *maſtack*; by the European naturaliſts, *bangue* or *bange*.—It is the leaf of a kind of wild hemp, growing in the countries of the

Levant; it differs little, either as to leaf or ſeed, from our hemp, except in ſize. Some have miſtaken it for a ſpecies of althæa.

There are divers manners of preparing it, in different countries. Olearius deſcribes the method uſed in Perſia. Mr Sale tells us, that, among the Arabs, the leaf is made into pills, or conſerves. But the moſt diſtinct account is that given by Alexander Maurocordato counſellor and phyſician of the Ottoman Porte, in a letter to Wedelius. According to this author, bangue is made of the leaves of wild hemp, dried in the ſhade, then ground to powder; and put into a pot wherein butter has been kept; ſet in an oven till it begin to torrify; then taken out, and pulverized again; thus to be uſed occaſionally, as much at a time as will lie on the point of a knife. Such is the Turkiſh bangue.—The effects of this drug are, To confound the underſtanding; ſet the imagination looſe; induce a kind of folly, and forgetfulneſs, wherein all cares are left, and joy and gaiety take take place thereof. Bangue in reality, is a ſuccedaneum to wine, and obtains in thoſe countries where Mahometaniſm is eſtabliſhed; which prohibiting the uſe of that liquor abſolutely, the poor muſſelmans are forced to have recourſe to ſuccedanea, to rouſe their ſpirits. The principal are *opium* and this bangue. As to the opinion among Europeans, that the Turks prepare themſelves for battle by a doſe of bangue, which rouſes their courage, and drives them, with eagerneſs, to certain death; Dr Maurocordato aſſures us, that it is a popular error: the Turks think they are then going aſſuredly to receive the crown of martyrdom; and would not, for any conſideration, loſe the merit of it, which they would do, by eating the bangue, as being held unlawful by their apoſtle, among other things which intoxicate.

BANIALUCH, or Bagnaluch, a city of European Turkey, the capital of Boſnia, upon the frontiers of Dalmatia, near the river Setina. E. Long. 18. 20. N. Lat. 44. 20.

BANIANS, a religious ſect in the empire of the Mogul, who believe a metempſychoſis; and will therefore eat no living creature, nor kill even noxious animals, but endeavour to releaſe them when in the hands of others. The name of *Banian* is uſed with ſome diverſity, which has occaſioned much confuſion, and many miſtakes. Sometimes it is taken in a leſs proper ſenſe, and extended to all the idolaters of India, as contradiſtinguiſhed from the Mahometans: in which ſenſe, Banians include the Bramins and other caſts. *Banians*, in a more proper ſenſe, is reſtrained to a peculiar caſt, or tribe, of Indians, whoſe office or profeſſion is trade and merchandize; in which ſenſe, *Banians* ſtand contradiſtinguiſhed from *Bramins*, *Cuttery*, and *Wyſe*, the three other caſts, into which the Indians are divided. The four caſts are abſolutely ſeparate as to occupation, relation, marriage, &c. though all of the ſame religion; which is more properly denominated the religion of the Bramins, who make the eccleſiaſtical tribe, than of the *Banians*, who make the mercantile. The proper *Banians* are called, in the *ſhaſter*, or book of their law, by the name of *Shuddery*; under which are comprehended all who live after the manner of merchants, or that deal and tranſact for others, as brokers; excluſive of the mechanics, or artificers, who make another caſt, called *Wyſe*. Theſe *Banians* have no peculiar ſect or religion, unleſs it be, that two of the eight general precepts given by their legiſlator Bremaw to the Indian nation, are, on account of the profeſſion of the *Banians*, ſuppoſed more immediately to relate to them, viz. thoſe which enjoin veracity in their words and dealings, and avoiding all practices of circumvention in buying and ſelling.—Some of the *Banians*, quitting their poſſeſſion, and retiring from the world commence religious, aſſume a peculiar habit, and devote themſelves, more immediately to God, under the denomination of *Vertea*. Theſe, though they do not hereby change their caſt, are commonly reckoned as bramins of a more devout kind; much as monks in the Romiſh church, though frequently not in orders, are reputed as a more ſacred order than the regular clergy. The name *Banian* imports as much, in the Bramin language (wherein their law is written), as a people innocent and harmleſs; void of all guile; ſo gentle, that they cannot endure to ſee either a fly or a worm injured; and who, when ſtruck, will patiently bear it, without reſiſting or returning the blow.—Their mein and appearance is deſcribed by Lord *, in terms a little preciſe, but very ſignificant: "A people preſented themſelves to my eyes clothed in linen garments, ſomewhat low deſcending, of a geſture and garb, as I may ſay, maidenly, and well nigh effeminate, of a countenance ſhy and ſomewhat eſtranged."—Gemelli Careri divides the Banians into 22 tribes, all diſtinct, and not allowed to marry with each other. Lord aſſures us they are divided into 82 caſts or tribes, correſpondent to the caſts or diviſions of the Banians or prieſts, under whoſe diſcipline they are, as to religious matters; tho' the generality of the Banians chooſe to be under the direction of the two Bramin tribes, the Viſalnagranaugers and the Vulnagranaugers.

The Banians are the great factors, by whom moſt of the trade of India is managed; in this reſpect, comparable to the Jews and Armenians, and not behind either, in point of ſkill and experience, in whatever relates to commerce. Nothing is bought but by their mediation. They ſeem to claim a kind of *jus divinum* to the adminiſtration of the traffic of the nation, grounded on their ſacred books, as the Bramins do to that of religion. They are diſperſed, for this purpoſe, through all parts of Aſia, and abound in Perſia, particularly at Iſpahan and Gombroon, where many of them are extremely rich, yet not above acting as brokers, where a penny is to be got. The chief agents of the Engliſh, Dutch, and French Eaſt India companies are of this nation: they are faithful, and are generally truſted with the caſh of thoſe companies in their keeping. They act alſo as bankers, and can give bills of exchange for moſt cities in the Eaſt Indies. Their form of contract in buying and ſelling is remarkable, being done without words, in the profoundeſt ſilence, only by touching each other's fingers: the buyer looſening his pamerin or girdle, ſpreads it on his knee, and both he and the ſeller having their hands underneath by the intercourſe of the fingers, mark the price of pounds, ſhillings, &c. demanded, offered, and at length agreed on. When the ſeller takes the buyer's whole hand, it denotes a thouſand; and as many times as he ſqueezes it, as many thouſand pagods, or roupees, according to the ſpecies in queſtion are, demanded: when he only takes the five fingers, it denotes five hundred, and when only one, one hundred: taking only half a finger, to the ſecond joint, denotes fifty; the ſmall end of the finger, to the firſt joint, ſtands for ten.

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* *Diſcov. Relig. Banian.*

BANIER (Anthony), licentiate in laws, member of the academy of inſcriptions and belles lettres, and eccleſiaſtic of the dioceſe of Clermont in Auvergne; died in November 1741, aged 69. He is principally celebrated for his tranſlation of the Metamorphoſes of Ovid, with hiſtorical remarks and explanations; which was publiſhed in 1732, at Amſterdam, in folio, finely ornamented with copperplates, by Picart; and reprinted at Paris, 1738, in two vols. 4to: and for his Mythology, or fables of the ancients explained by hiſtory; a work full of the moſt important information, which was tranſlated into Engliſh, and printed at London in 1741, in 4 vols. 8vo.

BANISHMENT, exile, among us is of two kinds: the one voluntary, and upon oath; the other by compulſion, for ſome offence or crime. The former properly called *abjuration*, is now ceaſed; the latter is chiefly enjoined by judgment of Parliament. Yet outlawing and tranſportation may alſo be conſidered as ſpecies of exile.

BANISTER (John), a phyſician and ſurgeon in the reign of queen Elizabeth, was educated at Oxford where, ſays Anthony Wood, he ſtudied logicals for a time; but afterwards applied himſelf ſolely to phyſic and ſurgery. In 1573 he took the degree of bachelor of phyſic; and obtaining a licence from the univerſity to practiſe, ſettled at Notingham, where he lived many years in great repute, and wrote ſeveral medical treatiſes. His works were collected and publiſhed in 1633, 4to.

BANISTERIA, in botany; a genus of the trigynia order, belonging to the decandria claſs of plants; and in the natural method ranking under the 23d order, *Trihilatæ*. The calyx is quinquepartite, with nectarious pores on the outſide of the baſe; the petals are roundiſh and ungulated; the ſeeds are three, with membranaceous wings. There are ſeven ſpecies, all natives of warm countries, but poſſeſſing no remarkable properties.

BANK, in commerce, a common repoſitory, where many perſons agree to keep their money, to be always ready at their call or direction: or, Certain ſocieties or communities, who take the charge of other people's money, either to improve it, or to keep it ſecure.

The firſt inſtitution of banks was in Italy, where the Lombard Jews kept benches in the market-places, for the exchange of money and bills; and *banco* being the Italian name for *bench*, banks took their title from this word.

I. Company-banks.

Banks are of two principal kinds. 1. One ſort is either *public*, conſiſting of a company of monied men, who being duly eſtabliſhed and incorporated by the laws of their country, agree to depoſite a conſiderable fund, or joint ſtock, to be employed for the uſe of the ſociety, as lending money upon good ſecurity, buying and ſelling bullion, diſcounting bills of exchange, &c.: or *private*, i. e. ſet up by private perſons, or partnerſhips, who deal in the ſame way as the former upon their own ſingle ſtock and credit.

Bank of England; its eſtabliſhment, regulations, importance, &c.

The greateſt bank of circulation in Europe, is the *Bank of England*. The company was incorporated parliament in the fifth and ſixth years of king William and queen Mary, by the name of *The Governors and Company of the Bank of England;* in conſideration of the loan of 1,200,000l. granted to the government; for which the ſubſcribers received almoſt 8 *per cent.* By this charter, the company are not to borrow under their common ſeal, unleſs by act of parliament; they are not to trade, or ſuffer any perſon in truſt for them to trade in any goods or merchandize; but they may deal in bills of exchange, in buying or ſelling bullion, and foreign gold and ſilver coin, &c.

By an act of parliament paſſed in the 8th and 9th year of William III. they were empowered to enlarge their capital ſtock to 2,201,171l. 10s. It was then alſo enacted, that bank-ſtock ſhould be a perſonal, and not a real eſtate; that no contract either in word or writing, for buying or ſelling bank-ſtock, ſhould be good in law, unleſs regiſtered in the books of the bank within 7 days, and the ſtock transferred in 14 days; and that it ſhall be felony, without benefit of clergy, to counterfeit the common ſeal of the bank, or any ſealed bank-bill, or any bank-note, or to alter or eraſe ſuch bills or notes. By another act paſſed in the 7th of queen Anne, the company were empowered to augment their capital to 4,402,343l. and they then advanced 400,000l. more to the government; and in 1714, they advanced another loan of 1,500,000l.

In the third year of the reign of king George I. the intereſt in their capital ſtock was reduced to 5 *per cent.* when the bank agreed to deliver up as many exchequer bills as amounted to 2,000,000l. and to accept an annuity of 100,000l. and it was declared lawful for the bank to call from their members, in proportion to their intereſts in the capital ſtock, ſuch ſums of money as in a general court ſhould be found neceſſary. If any member ſhould neglect to pay his ſhare of the moneys ſo called for, at the time appointed by notice in the London Gazette, and fixed upon the Royal Exchange, it ſhould be lawful for the bank, not only to ſtop the dividend of ſuch member, and to apply it towards payment of the money in queſtion, but alſo to ſtop the transfers of the ſhare of ſuch defaulter, and to charge him with an intereſt of 5 *per cent. per annum*, for the money ſo omitted to be paid: and if the principal and intereſt ſhould be three months unpaid, the bank ſhould then have power to ſell ſo much of the ſtock belonging to the defaulter as would ſatisfy the ſame. After this, the bank reduced the intereſt of the 2,000,000l. lent to the government, from 5 to 4 *per cent.* and purchaſed ſeveral other annuities, which were afterwards redeemed by the government, and the national debt due to the bank reduced to L.1,600,000. But in 1742, the company engaged to ſupply the government with 1,600,000l. at 3 *per cent.* which is now called the 3 *per cent. annuities;* ſo that the government was now indebted to the company L.3,200,000, the one half carrying 4, and the other 3 *per cent.*

In the year 1746, the company agreed that the ſum of L.986,800 due to them in the exchequer bills unſatiſfied, on the duties for licences to ſell ſpirituous liquors by retail, ſhould be cancelled, and in lieu thereof to accept of an annuity of L.39,442, the intereſt of that ſum at 4 *per cent.* The company alſo agreed to advance the further ſum of L.1,000,000 into the exchequer, upon the credit of the duties ariſing by the malt and land tax at 4 *per cent.* for exchequer bills to be iſſued for that purpoſe ; in conſideration of which, the company were enabled to augment their capital with L.986,800; the intereſt of which, as well as that of the other annuities, were reduced to 3½ *per cent.* till the 25th of December 1757, and from that time to carry only 3 *per cent.*

And in order to enable them to circulate the ſaid exchequer bills, they eſtabliſhed what is now called *bank circulation.* The nature of which may be underſtood from what follows.

The company of the bank are obliged to keep caſh ſufficient not only to anſwer the common, but alſo any extraordinary demand that may be made upon them ; and whatever money they have by them, over and above the ſum ſuppoſed neceſſary for the purpoſes, they employ in what may be called the *trade of the company ;* that is to ſay, in diſcounting bills of exchange, in buying of gold and ſilver, and in government ſecurities, &c. But when the bank entered into the abovementioned contract, as they did not keep unemployed a larger ſum of money than what they deemed neceſſary to anſwer their ordinary and extraordinary demands, they could not conveniently take out of their current caſh ſo large a ſum as a million, with which they were obliged to furniſh the government, without either leſſening that ſum they employed in diſcounting, buying gold and ſilver, &c. (which would have been very diſadvantageous to them), or inventing ſome method that ſhould anſwer all the purpoſes of keeping the million in caſh. The method which they choſe, and which fully anſwers their end, was as follows :

They opened a ſubſcription, which they renew annually, for a million of money ; wherein the ſubſcribers advance 10 *per cent.* and enter into a contract to pay the remainder, or any part thereof, whenever the bank ſhall call upon them, under penalty of forfeiting the 10 *per cent.* ſo advanced ; in conſideration of which, the bank pays the ſubſcribers 4 *per cent.* intereſt for the money paid in, and ¼ *per cent.* for the whole ſum they agree to furniſh ; and in caſe a call ſhall be made upon them for the whole, or any part thereof, the bank further agrees to pay them at the rate of 5 *per cent. per annum* for ſuch ſum till they repay it, which they are under an obligation to do at the end of the year. By this means the bank obtains all the purpoſes of keeping a million of money by them ; and though the ſubſcribers, if no call is made upon them (which is in general the caſe), receive 6½ *per cent.* for the money they advance, yet the company gains the ſum of L.23,500 *per annum* by the contract ; as will appear by the following account :

	£.
The bank receives from the government for the advance of a million - - -	30,000
The bank pays the ſubſcribers who advance L.100,000 and engage to pay (when called for) L.900,000 more - -	6,500
The clear gain to the bank therefore is	23,500

This is the ſtate of the caſe, provided the company ſhould make no call on the ſubſcribers; which they will be very unwilling to do, becauſe it would not only leſſen their profit, but affect the public credit in general.

Bank-ſtock may not improperly be called a *trading ſtock,* ſince with this they deal very largely in foreign gold and ſilver, in diſcounting bills of exchange, &c. Beſides which, they are allowed by the government very conſiderable ſums annually for the management of the annuities paid at their office. All which advantages render a ſhare in their ſtock very valuable ; though it is not equal in value to the Eaſt India ſtock. The company make dividends of the profits half-yearly, of which notice is publicly given ; when thoſe who have occaſion for their money may readily receive it ; but private perſons, if they judge convenient, are permitted to continue their funds, and to have their intereſt added to the principal.

This company is under the direction of a governor, deputy-governor, and 24 directors, who are annually elected by the general court, in the ſame manner as in the Eaſt India company. Thirteen, or more, compoſe a court of directors for managing the affairs of the company. The officers of this company are very numerous.

The ſtability of the bank of England is equal to that of the Britiſh government. All that it has advanced to the public muſt be loſt before its creditors can ſuſtain any loſs. No other banking company in England can be eſtabliſhed by act of parliament, or can conſiſt of more than ſix members. It acts, not only as an ordinary bank, but (as we have already ſeen) as a great engine of ſtate ; receiving and paying the greater part of the annuities which are due to the creditors of the public ; circulating exchequer bills ; and advancing to government the annual amount of the land and malt taxes, which are frequently not paid up till ſome years thereafter. It likewiſe has, upon ſeveral different occaſions, ſupported the credit of the principal houſes, not only of England, but of Hamburgh and Holland. Upon one occaſion it is ſaid to have advanced for this purpoſe, in one week, about L. 1,600,000, a great part of it in bullion.

Scotch banks, public and private.

In Scotland there are two public banks, both at Edinburgh. The one, called *The Bank of Scotland,* was eſtabliſhed by act of parliament in 1695 ; the other, called *The Royal Bank,* by royal charter in 1727.

Within theſe 30 years there have alſo been erected private banking companies in almoſt every conſiderable town, and even in ſome villages. Hence the buſineſs of the country is almoſt entirely carried on by paper-currency, *i. e.* by the notes of thoſe different banking companies ; with which purchaſes and payments of all kinds are commonly made. Silver very ſeldom appears, except in the change of a twenty-ſhilling bank-note, and gold ſtill ſeldomer. But though the conduct of all thoſe different companies has not been unexceptionable, and has accordingly required an act of parliament to regulate it ; the country, notwithſtanding, has evidently derived great benefit from their trade. It has been aſſerted, that the trade of the city of Glaſgow doubled in about 15 years after the firſt erection of the banks there ; and that the trade of Scotland has more than quadrupled ſince the firſt erection of the two public banks at Edinburgh. Whether the trade, either of Scotland in general, or of the city of Glaſgow in particular, has really increaſed in ſo great a proportion, during ſo ſhort a period, we do not pretend to know. If either of them has increaſed in this proportion, it ſeems to be an effect too great to be accounted for by the ſole operation of this cauſe. That the trade and induſtry of Scotland, however, have increaſed very conſiderably during this period, and that the banks have contributed a good deal to this increaſe, cannot be doubted.

Smith's Wealth of Nations, Book II. chap. ii.

The value of the ſilver money which circulated in Scotland before the Union in 1707, and which immediately after it was brought into the bank of Scotland in order to be recoined, amounted to L.411,117 : 10 : 9 Sterling. No account has been got of the gold coin; but it appears from the ancient accounts of the mint of Scotland, that the value of the gold annually coined ſomewhat exceeded that of the ſilver. There were a good many people too upon this occaſion, who, from a diffidence of repayment, did not bring their ſilver into the bank of Scotland; and there was, beſides, ſome Engliſh coin, which was not called in. The whole value of the gold and ſilver, therefore, which circulated in Scotland before the Union, cannot be eſtimated at leſs than a million Sterling. It ſeems to have conſtituted almoſt the whole circulation of that country; for though the circulation of the bank of Scotland, which had then no rival, was conſiderable, it ſeems to have made but a very ſmall part of the whole. In the preſent times the whole circulation of Scotland cannot be eſtimated at leſs than two millions, of which that part which conſiſts in gold and ſilver moſt probably does not amount to half a million. But though the circulating gold and ſilver of Scotland have ſuffered ſo great a diminution during this period, its real riches and proſperity do not appear to have ſuffered any. Its agriculture, manufactures, and trade, on the contrary, the annual produce of its land and labour, have evidently been augmented.

Diſcounting of bills.

It is chiefly by diſcounting bills of exchange, that is, by advancing money upon them before they are due, that the greater part of banks and bankers iſſue their promiſſory notes. They deduct always, upon whatever ſum they advance, the legal intereſt till the bill ſhall become due. The payment of the bill, when it becomes due, replaces to the bank the value of what had been advanced, together with a clear profit of the intereſt. The banker, who advances to the merchant whoſe bill he diſcounts, not gold and ſilver, but his own promiſſory notes, has the advantage of being able to diſcount to a greater amount, by the whole value of his promiſſory notes, which he finds by experience are commonly in circulation. He is thereby enabled to make his clear gain of intereſt on ſo much a larger ſum.

Caſh-accounts.

The commerce of Scotland, which at preſent is not very great, was ſtill more inconſiderable when the two firſt banking companies were eſtabliſhed; and thoſe companies would have had but little trade, had they confined their buſineſs to the diſcounting of bills of exchange. They invented, therefore, another method of iſſuing their promiſſory notes, by granting what they called *caſh accounts*; that is, by giving credit to the extent of a certain ſum (L. 2000 or L. 3000 for example), to any individual who could procure two perſons of undoubted credit and good landed eſtate to become ſurety for him, that whatever money ſhould be advanced to him within the ſum for which the credit had been given ſhould be repaid upon demand, together with the legal intereſt. Credits of this kind are commonly granted by banks and bankers in all different parts of the world. But the eaſy terms on which the Scots banking companies accept of repayment are peculiar to them, and have perhaps been the principal cauſe, both of the great trade of thoſe companies and of the benefit which the country has received from it.

Advantages from theſe;

Whoever has a credit of this kind with one of thoſe companies, and borrows L. 1000 upon it for example, may repay this ſum piece-meal, by L. 20 and L. 30 at a time, the company diſcounting a proportionable part of the intereſt of the great ſum from the day on which each of thoſe ſmall ſums is paid in, till the whole be in this manner repaid. All merchants therefore, and almoſt all men of buſineſs, find it convenient to keep ſuch caſh-accounts with them; and are thereby intereſted to promote the trade of thoſe companies, by readily receiving their notes in all payments, and by encouraging all thoſe with whom they have any influence to do the ſame. The banks, when their cuſtomers apply to them for money, generally advance it to them in their own promiſſory notes. Theſe the merchants pay away to the manufacturers for goods, the manufacturers to the farmers for materials and proviſions, the farmers to their landlords for rent, the landlords repay them to the merchants for the conveniences and luxuries with which they ſupply them, and the merchants again return them to the banks in order to balance their caſh accounts, or to replace what they may have borrowed of them; and thus almoſt the whole money-buſineſs of the country is tranſacted by means of them. Hence the great trade of thoſe companies.

to the banks, and

to the country.

By means of thoſe caſh accounts, every merchant can, without imprudence, carry on a greater trade than he otherwiſe could do. If there are two merchants, one in London and the other in Edinburgh, who employ equal ſtocks in the ſame branch of trade, the Edinburgh merchant can, without imprudence, carry on a greater trade, and give employment to a greater number of people, than the London merchant. The London merchant muſt always keep by him a conſiderable ſum of money, either in his own coffers, or in thoſe of his banker (who gives him no intereſt for it), in order to anſwer the demands continually coming upon him for payment of the goods which he purchaſes upon credit. Let the ordinary amount of this ſum be ſuppoſed L. 500. The value of the goods in his warehouſe muſt always be leſs by L. 500 than it would have been, had he not been obliged to keep ſuch a ſum unemployed. Let us ſuppoſe that he generally diſpoſes of his whole ſtock upon hand, or of goods to the value of his whole ſtock upon hand, once in the year. By being obliged to keep ſuch a great ſum unemployed, he muſt ſell in a year L. 500 worth leſs goods than he might otherwiſe have done. His annual profits muſt be leſs by all that he could have made by the ſale of L. 500 worth more goods; and the number of people employed in preparing his goods for the market, muſt be leſs by all thoſe that L. 500 more ſtock could have employed. The merchant in Edinburgh, on the other hand, keeps no money unemployed for anſwering ſuch occaſional demands. When they actually come upon him, he ſatisfies them from his caſh-account with the bank, and gradually replaces the ſum borrowed with the money or paper which comes in from the occaſional ſale of his goods. With the ſame ſtock, therefore, he can, without imprudence, have at all times in his warehouſe a larger quantity of goods than the London merchant; and can thereby both make a greater profit himſelf, and give conſtant employment to a greater number of induſtrious people who prepare thoſe goods for the market. Hence the great benefit which the country has derived from this trade.

The late multiplication, of banking companies in both parts of the united kingdom, an event by which many people have been much alarmed, inſtead of diminiſhing increaſes the ſecurity of the public. It obliges all of them to be more circumſpect in their conduct, and by not extending their currency beyond its due proportion to their caſh, to guard themſelves againſt thoſe malicious runs which the rivalſhip of ſo many competitors is always ready to bring upon them. It reſtrains the circulation of each particular company within a narrower circle, and reduces their circulating notes to a ſmaller number. By dividing the whole circulation into a greater number of parts, the failure of any one company, an accident which, in the courſe of things, muſt ſometimes happen, becomes of leſs conſequence to the public. This free competition too obliges all bankers to be more liberal in their dealings with their cuſtomers, leſt their rivals ſhould carry them away. In general, if any branch of trade, or any diviſion of labour, be advantageous to the public, the freer and more general the competition, it will always be the more ſo. See further, the article *Paper-Money*.

II. Banks of depoſit.

2. The other kind of banks conſiſts of ſuch as are inſtituted wholly on the public account, and are called *Banks of Depoſit*; the nature of which not being generally underſtood, the following particular explanation may not be unacceptable.

Smith's Wealth of Nations. Book IV. chap. iii.

The currency of a great ſtate, ſuch as Britain, generally conſiſts almoſt entirely of its own coin. Should this currency, therefore, be at any time worn, clipt, or otherwiſe degraded below its ſtandard value the ſtate by a reformation of its coin can effectually re-eſtabliſh its currency. But the currency of a ſmall ſtate, ſuch as Genoa or Hamburgh, can ſeldom conſiſt altogether in its own coin, but muſt be made up in a great meaſure, of the coins of all the neighbouring ſtates with which its inhabitants have a continual intercourſe. Such a ſtate, therefore, by reforming its coin, will not always be able to reform its currency. If foreign bills of exchange are paid in this currency, the uncertain value of any ſum, of what is in its own nature ſo uncertain, muſt render the exchange always very much againſt ſuch a ſtate, its currency being, in all foreign ſtates neceſſarily valued even below what it is worth. In order to remedy the inconvenience to which this diſadvantageous exchange muſt have ſubjected their merchants, ſuch ſmall ſtates, when they began to attend to the intereſt of trade, have frequently enacted, that foreign bills of exchange of a certain value ſhould be paid, not in common currency, but by an order upon, or by a transfer in the books of, a certain bank, eſtabliſhed upon the credit and under the protection of the ſtate; this bank being always obliged to pay, in good and true money, exactly according to the ſtandard of the ſtate. The banks of Venice, Genoa, Amſterdam, Hamburgh, and Nuremberg, ſeem to have been originally eſtabliſhed with this view, though ſome of them may have afterwards been made ſubſervient to other purpoſes. The money of ſuch banks, being better than the common currency of the country, neceſſarily bore an agio, which was greater or ſmaller, according as the currency was ſuppoſed to be more or leſs degraded below the ſtandard of the ſtate. The agio of the bank of Hamburgh, for example, which is ſaid to be commonly about 14 *per cent.* is the ſuppoſed difference between the good ſtandard money of the ſtate, and the clipt, worn, and diminiſhed currency poured into it from all the neighbouring ſtates.

Before 1609, the great quantity of clipt and worn foreign coin, which the extenſive trade of Amſterdam brought from all parts of Europe, reduced the value of its currency about 9 *per cent.* below that of good money freſh from the mint. Such money no ſooner appeared, than it was melted down or carried away, as it always is in ſuch circumſtances. The merchants, with plenty of currency, could not always find a ſufficient quantity of good money to pay their bills of exchange; and the value of thoſe bills, in ſpite of ſeveral regulations which were made to prevent it, became in a great meaſure uncertain. In order to remedy theſe inconveniences, a bank was eſtabliſhed in 1609 under the guarantee of the city. The bank received both foreign coin, and the light and worn coin of the country, at its real and intrinſic value in the good ſtandard money of the country, deducting only ſo much as was neceſſary for defraying the expence of coinage, and the other neceſſary expence of management. For the value which remained after this ſmall deduction was made, it gave a credit in its books. This credit was called *bank-money*; which, as it repreſented money exactly according to the ſtandard of the mint, was always of the ſame real value, and intrinſically worth more than current money. It was at the ſame time enacted, that all bills drawn upon or negociated at Amſterdam of the value of 600 gilders and upwards ſhould be paid in bank-money, which at once took away all uncertainty in the value of thoſe bills. Every merchant, in conſequence of this regulation, was obliged to keep an account with the bank in order to pay his foreign bills of exchange, which neceſſarily occaſioned a certain demand for bank-money.

Bank of Amſterdam, one of the moſt famous. Its inſtitution, regulation, utility, &c.

Bank-money, over and above both its intrinſic ſuperiority to currency, and the additional value which this demand neceſſarily gives it, has likewiſe ſome other advantages. It is ſecure from fire, robbery, and other accidents; the city of Amſterdam is bound for it; it can be paid away by a ſimple transfer, without the trouble of counting, or the riſk of tranſporting it from one place to another. In conſequence of thoſe different advantages, it ſeems from the beginning to have borne an agio; and it is generally believed that all the money originally depoſited in the bank was allowed to remain there, nobody caring to demand payment of a debt which he could ſell for a premium in the market. Beſides, this money could not be brought from thoſe coffers, as it will appear by and by, without previouſly paying for the keeping.

Thoſe depoſits of coin, or which the bank was bound to reſtore in coin, conſtituted the original capital of the bank, or the whole value of what was repreſented by what is called *Bank-money*. At preſent they are ſuppoſed to conſtitute but a very ſmall part of it. In order to facilitate the trade in bullion, the bank has been for theſe many years in the practice of giving credit in its books upon depoſits of gold and ſilver bullion. This credit is generally about 5 *per cent.* below the mint price of ſuch bullion. The bank grants at the ſame time what is called a *recipice* or receipt, intitling the perſon who makes the depoſit, or the bearer, to take out the bullion again at any time within ſix months, upon re-transferring to the bank a quantity of bank-money equal to that for which credit had been given in its books when the depoſit was made, and upon paying ¼ *per cent.* for the keeping if the depoſit was in ſilver, and ½ *per cent.* if it was in gold; but at the ſame time declaring, that in default of ſuch payment, and upon the expiration of this term, the depoſit ſhould belong to the bank at the price at which it had been received, or for which credit had been given in the transfer books. What is thus paid for the keeping of the depoſit may be conſidered as a ſort of warehouſe rent; and why this warehouſe rent ſhould be ſo much dearer for gold than for ſilver, ſeveral different reaſons have been aſſigned. The fineneſs of gold, it has been ſaid, is more difficult to be aſcertained than that of ſilver. Frauds are more eaſily practiſed, and occaſion a greater loſs in the more precious metal. Silver, beſides, being the ſtandard metal, the ſtate, it has been ſaid, wiſhes to encourage more the making of depoſits of ſilver than of thoſe of gold.

Depoſits of bullion are moſt commonly made when the price is ſomewhat lower than ordinary; and they are taken out again when it happens to riſe. In Holland the market price of bullion is generally above the mint price, for the ſame reaſon that it was ſo in England before the late reformation of the gold coin. The difference is ſaid to be commonly from about ſix to ſixteen ſtivers upon the mark, or eight ounces of ſilver of eleven parts fine and one part alloy. The bank-price, or the credit which the bank gives for depoſits of ſuch ſilver (when made in foreign coin, of which the fineneſs is well known and aſcertained, ſuch as Mexico dollars), is 22 gilders the mark; the mint price is about 23 gilders; and the market-price is from 23 gilders ſix to 23 gilders ſixteen ſtivers, or from 2 to 3 *per cent.* above the mint-price. The proportions between the bank-price, the mint-price, and the market-price, of gold bullion are nearly the ſame. A perſon can generally ſell his receipt for the difference between the mint-price of bullion and the market-price. A receipt for bullion is almoſt always worth ſomething; and it very ſeldom happens, therefore, that any body ſuffers his receipt to expire, or allows his bullion to fall to the bank at the price at which it had been received, either by not taking it out before the end of the ſix months, or by neglecting to pay the ¼ or ½ *per cent.* in order to obtain a new receipt for another ſix months. This, however, though it ſeldom happens, is ſaid to happen ſometimes, and more frequently with regard to gold than with regard to ſilver, on account of the higher warehouſe-rent which is paid for the keeping of the more precious metal.

The perſon who by making a depoſit of bullion obtains both a bank-credit and a receipt, pays his bills of exchange as they become due with his bank-credit; and either ſells or keeps his receipt, according as he judges that the price of bullion is likely to riſe or to fall. The receipt and the bank-credit ſeldom keep long together, and there is no occaſion that they ſhould. The perſon who has a receipt, and who wants to take out bullion, finds always plenty of bank-credits, or bank money to buy at the ordinary price; and the perſon who has bank-money, and wants to take out bullion, finds receipts always in equal abundance.

The owners of bank-credits and the holders of receipts conſtitute two different ſorts of creditors againſt the bank. The holder of a receipt cannot draw out the bullion for which it is granted, without re-aſſigning to the bank a ſum of bank-money equal to the price at which the bullion has been received. If he has no bank-money of his own, he muſt purchaſe it of thoſe who have it. The owner of bank-money cannot draw out bullion without producing to the bank receipts for the quantity which he wants. If he has none of his own, he muſt buy them of thoſe who have them. The holder of a receipt, when he purchaſes bank-money, purchaſes the power of taking out a quantity of bullion, of which the mint-price is 5 *per cent.* above the bank-price. The agio of 5 *per cent.* therefore, which he commonly pays for it, is paid, not for an imaginary, but for a real value. The owner of bank-money, when he purchaſes a receipt, purchaſes the power of taking out a quantity of bullion, of which the market-price is commonly from 2 to 3 *per cent.* above the mint-price. The price which he pays for it, therefore, is paid likwiſe for a real value. The price of the receipt, and the price of the bank-money, compound or make up between them the full value or price of the bullion.

Upon depoſits of the coin current in the country, the bank grants receipts likewiſe as well as bank-credits; but thoſe receipts are frequently of no value, and will bring no price in the market. Upon ducatoons, for example, which in the currency paſs for three gilders three ſtivers each, the bank gives a credit of three gilders only, or 5 *per cent.* below their current value. It grants a receipt likewiſe intitling the bearer to take out the number of ducatoons depoſited at any time within ſix months, upon paying ¼ *per cent.* for the keeping. This receipt will frequently bring no price in the market. Three gilders bank-money generally ſell in the market for three gilders three ſtivers, the full value of the ducatoons if they were taken out of the bank; and before they can be taken out, ¼ *per cent.* muſt be paid for the keeping, which would be mere loſs to the holder of the receipt. If the agio of the bank, however, ſhould at any time fall to 3 *per cent.* ſuch receipts might bring ſome price in the market, and might ſell for 1¾ *per cent.* But the agio of the bank being now generally about 5 *per cent.* ſuch receipts are frequently allowed to expire, or, as they expreſs it, to fall to the bank. The 5 *per cent.* which the bank gains, when depoſits either of coin or bullion are allowed to fall to it, may be conſidered as the warehouſe rent for the perpetual keeping of ſuch depoſits.

The ſum of bank money for which the receipts are expired muſt be very conſiderable. It muſt comprehend the whole original capital of the bank, which, it is generally ſuppoſed, has been allowed to remain there from the time it was firſt depoſited, nobody caring either to renew his receipt or to take out his depoſit, as, for the reaſons already aſſigned, neither the one nor the other could be done without loſs. But whatever may be the amount of this ſum, the proportion which it bears to the whole maſs of bank-mony is ſuppoſed to be very ſmall. The bank of Amſterdam has for theſe many years paſt been the great warehouſe of Europe for bullion, for which the receipts are very ſeldom allowed to expire, or, as they expreſs it, to fall to the bank. The far greater part of the bank-money, or of the credits upon the books of the bank, is ſuppoſed to have been created, for theſe many years paſt, by ſuch depoſits which the dealers in bullion are continually both making and withdrawing.

No demand can be made upon the bank but by means of a recipice or receipt. The ſmaller maſs of bank-money, for which the receipts are expired, is mixed and confounded with the much greater maſs for which they are ſtill in force; ſo that, though there may be a conſiderable ſum of bank-money for which there are no receipts, there is no ſpecific ſum or portion of it which may not at any time be demanded by one. The bank cannot be debtor to two perſons for the ſame thing; and the owner of bank-money who has no receipt cannot demand payment of the bank till he buys one. In ordinary and quiet times, he can find no difficulty in getting one to buy at the market price, which generally correſponds with the price at which he can ſell the coin or bullion it intitles him to take out of the bank.

It might be otherwiſe during a public calamity; an invaſion, for example, ſuch as that of the French in 1672. The owners of bank-money being then all eager to draw it out of the bank, in order to have it in their own keeping, the demand for receipts might raiſe their price to an exorbitant height. The holders of them might form extravagant expectations, and, inſtead of 2 or 5 *per cent.* demand half the bank-money for which credit had been given upon the depoſits that the receipts had reſpectively been granted for. The enemy, informed of the conſtitution of the bank, might even buy them up in order to prevent the carrying away of the treaſure. In ſuch emergencies, the bank, it is ſuppoſed, would break through its ordinary rule of making payment only to the holders of receipts. The holders of receipts, who had no bank-money, muſt have received within 2 or 3 *per cent.* of the value of the depoſit for which their reſpective receipts had been granted. The bank, therefore, it is ſaid, would in this caſe make no ſcruple of paying, either with money or bullion, the full value of what the owners of bank-money who could get no receipts were credited for in its books; paying at the ſame time 2 or 3 *per cent.* to ſuch holders of receipts as had no bank-money, that being the whole value which in this ſtate of things could juſtly be ſuppoſed due to them.

Even in ordinary and quiet times it is the intereſt of the holders of receipts to depreſs the agio, in order either to buy bank-money (and conſequently the bullion which their receipts would then enable them to take out of the bank) ſo much cheaper, or to ſell their receipts to thoſe who have bank-money, and who want to take out bullion, ſo much dearer; the price of a receipt being generally equal to the difference between the market-price of bank-money and that of the coin or bullion for which the receipt had been granted. It is the inetreſt of the owners of bank-money on the contrary, to raiſe the agio, in order either to ſell their bank-money ſo much dearer, or to buy a receipt ſo much cheaper. To prevent the ſtock-jobbing tricks which thoſe oppoſite intereſts might ſometimes occaſion, the bank has of late years come to a reſolution to ſell at all times bank-money for currency, at 5 *per cent.* agio, and to buy it again at 4 *per cent.* agio. In conſequence of this reſolution, the agio can never either riſe above 5 or ſink below 4 *per cent.* and the proportion between the market-price of the bank and that of current money is kept at all times very near to the proportion between their intrinſic values. Before this reſolution was taken, the market-price of money uſed ſometimes to riſe ſo high as 9 *per cent.* agio, and ſometimes to ſink ſo low as par, according as oppoſite intereſts happened to influence the market.

The bank of Amſterdam profeſſes to lend out no part of what is depoſited with it, but, for every gilder for which it gives credit in its books, to keep in its repoſitories the value of a gilder either in money or bullion. That it keeps in its repoſitories all the money or bullion for which there are receipts in force, for which it is at all times liable to be called upon, and which, in reality, is continually going from it and returning to it again, cannot well be doubted. But whether it does ſo likewiſe with regard to that part of its capital for which the receipts are long ago expired, for which in ordinary and quiet times it cannot be called upon, and which in reality is very likely to remain with it for ever, or as long as the States of the United Provinces ſubſiſt, may perhaps appear more uncertain. At Amſterdam, however, no part of faith is better eſtabliſhed, than that for every gilder circulated as bank-money there is a correſpondent gilder in gold and ſilver to be found in the treaſure of the bank. The city is guarantee that it ſhould be ſo. The bank is under the direction of the four reigning burgomaſters, who are changed every year. Each new ſet of burgomaſters viſits the treaſure, compares it with the books, receives it upon oath, and delivers it over, with the ſame awful ſolemnity, to the ſet which ſucceeds it; and in that ſober and religious country oaths are not yet diſregarded. A rotation of this kind ſeems alone a ſufficient ſecurity againſt any practices which cannot be avowed. Amidſt all the revolutions which faction has ever occaſioned in the government of Amſterdam, the prevailing party has at no time accuſed their predeceſſors of infidelity in the adminiſtration of the bank. No accuſation could have affected more deeply the reputation and fortune of the diſgraced party; and if ſuch an accuſation could have been ſupported, we may be aſſured that it would have been brought. In 1672, when the French king was at Utrecht, the bank of Amſterdam paid ſo readily as left no doubt of the fidelity with which it had obſerved its engagements. Some of the pieces which were then brought from its repoſitories appeared to have been ſcorched with the fire which happened in the town-houſe ſoon after the bank was eſtabliſhed. Thoſe pieces, therefore, muſt have lain there from that time.

What may be the amount of the treaſure in the bank is a queſtion which has long employed the ſpeculations of the curious. Nothing but conjecture can be offered concerning it. It is generally reckoned, that there are about 2000 people who keep accounts with the bank; and allowing them to have, one with another, the value of 1500l. lying upon their reſpective accounts, (a very large allowance), the whole quantity of bank-money, and conſequently of treaſure in the bank, will amount to 3,000,000l. or, at 21 gilders the pound Sterling, 33,000,000 of gilders; a great ſum, and ſufficient to carry on a very extenſive circulation, but vaſtly below the extravagant ideas which ſome people have formed of this treaſure.

The city of Amſterdam derives a conſiderable revenue from the bank. Beſides what may be called the *warehouſe-rent* above mentioned, each perſon, upon firſt opening an account with the bank, pays a fee of 10 gilders; and for every new account, 3 gilders 3 ſtivers; for every transfer, 2 ſtivers; and if the transfer is for leſs than 300 gilders, 6 ſtivers, in order to diſcourage the multiplicity of ſmall tranſactions. The perſon who neglects to balance his accounts twice in the year forfeits 25 gilders. The perſon who orders a transfer for more than is upon his account, is obliged to pay 3 *per cent.* for the ſum overdrawn, and his order is ſet aſide into the bargain. The bank is ſuppoſed too to make a conſiderable profit by the ſale of the foreign coin or bullion which ſometimes falls to it by the expiring of receipts, and which is always kept till it can be ſold with advantage. It makes a profit likewiſe by ſelling bank-money at 5 *per cent.* agio, and buying it at 4. Theſe different emoluments amount to a good deal more than what is neceſſary for paying the ſalaries of officers, and defraying the expence of management. What is paid for the keeping of bullion upon receipts, is alone ſuppoſed to amount to a neat annual revenue of between 150,000 and 200,000 gilders. Public utility, however, and not revenue, was the original object of this inſtitution. Its object was to relieve the merchants from the inconvenience of a diſadvantageous exchange. The revenue which has ariſen from it was unforeſeen and may be conſidered as accidental.

Bank, in ſea-affairs denotes an elevation of the ground or bottom of the ſea, ſo as ſometimes to ſurmount the ſurface of the water, or at leaſt to leave the water ſo ſhallow as uſually not to allow a veſſel to remain a-flote over it.—In this ſenſe, *bank* amounts to much the ſame as flat, ſhoal, &c. There are banks of ſand, and others of ſtone, called alſo *ſhelves*, or *rocks*. In the north ſea they alſo ſpeak of banks of ice, which are large pieces of that matter floating.

BANKER, a perſon who traffics and negociates in money; who receives and remits money from place to place by commiſſion from correſpondents, or by means of bills or letters of exchange, &c.

The ancient bankers were called *argentarii*, and *nummularii*; by the Greeks, τραπεζιται, κολλυβιϛαι, and αργυραμοιβοι. Their chief buſineſs was to put out the money of private perſons to intereſt: they had their boards and benches, for this purpoſe, in all the markets and public places, where they took in the money from ſome, to lend it to others.

BANKING, the making of banks to oppoſe the force of the ſea, rivers, or the like, and ſecure the land from being overflowed thereby. With reſpect to the water which is to be kept out, this is called *banking*; with reſpect to the land, which is hereby to be defended, *imbanking*.

Banking is alſo applied to the keeping a bank, or the employment of a banker. Banking, in this ſenſe, ſignifies the trading in money, or remitting it from place to place, by means of bills of exchange. This anſwers to what the French call *faire le banque*. In France, every body is allowed to bank, whether merchant or not; even foreigners are indulged in this kind of traffic. In Italy, banking does not derogate from nobility, eſpecially in the republic ſtates; whence it is, that moſt of the younger ſons of great families engage in it. In reality, it was the nobility of Venice and Genoa, that, for a long time, were the chief bankers in the other countries of Europe.

BANKISH, a province of the Mogul's dominions, in the north part of the Hither India, lying ſouth-weſt of the province of Caſſimere.

BANKRUPT, (*bancus ruptus*), is ſo called, becauſe, when the bank or ſtock is broken or exhauſted, the owner is ſaid to be a *bankrupt*. And this word *bankrupt* is derived from the French *banqueroute*, which ſignifies a breaking or failing in the world: *banque* in French is as much as *menſa* in Latin, and *route* is the ſame as *veſtigium*; and this term is ſaid to be taken originally from the Roman *menſarii*, which were ſet in public places; and when a tradeſman ſlipped away, with an intention to deceive his creditors, he left only ſome *veſtigia* or ſigns of his table or ſhop behind him. But a bankrupt with us, from the ſeveral deſcriptions given of him in our ſtatute-law, may be defined "a trader, who ſecretes himſelf, or does certain other acts tending to defraud his creditors." For the better underſtanding of this article, it will be proper to conſider, 1. *Who* may become a bankrupt: 2. What *acts* make a bankrupt: 3. The *proceedings* on a commiſſion of bankruptcy: and, 4. In what manner an eſtate in goods and chattels may be *transferred* by bankruptcy.—But of theſe, the two laſt being treated under the article Commission *of Bankruptcy*, the two firſt only belong to this place.

1. A bankrupt was formerly conſidered merely in the light of a criminal or offender; and in this ſpirit we are told by Sir Edward Coke, that we have fetched as well the name, as the wickedneſs, of bankrupts from foreign nations. But at preſent the laws of bankruptcy are conſidered as laws calculated for the benefit of trade, and founded on the principles of humanity as well as juſtice; and to that end they confer ſome privileges, not only on the creditors, but alſo on the bankrupt or debtor himſelf. On the creditors; by compelling the bankrupt to give up all his effects to their uſe, without any fraudulent concealment: on the debtor; by exempting him from the rigor of the general law, whereby his perſon might be confined at the diſcretion of his creditor, though in reality he has nothing to ſatisfy the debt; whereas the law of bankrupts, taking into conſideration the ſudden and unavoidable accidents to which men in trade are liable, has given them the liberty of their perſons, and ſome pecuniary emoluments, upon condition they ſurrender up their whole eſtate to be divided among their creditors.

Blackſt. Comm. II. 472, &c.

In this reſpect the legiſlature ſeems to have attended to the example of the Roman law. We mean not the terrible law of the twelve tables; whereby the creditors might cut the debtor's body into pieces, and each of them take his proportionable ſhare: if indeed that law, *de debitore in partes ſecando*, is to be underſtood in ſo very butcherly a light: which many learned men have with reaſon doubted. Nor do we mean thoſe leſs inhuman laws (if they may be called ſo, as *their* meaning is indiſputably certain), of impriſoning the debtor's perſon in chains; ſubjecting him to ſtripes and hard labour, at the mercy of his rigid creditor; and ſometimes ſelling him, his wife and children, to perpetual foreign ſlavery *trans Tiberim* (A): an oppreſſion, which produced ſo many popular inſurrections, and ſeceſſions to the *mons ſacer*. But we mean the law of ceſſion, introduced by the Chriſtian emperors; whereby, if a debtor *ceded* or yielded up all his fortune to his creditors, he was ſecured from being dragged to a gaol, "*omni quoque corporali cruciatu ſemoto*." For, as the emperor juſtly obſerves, "*inhumanum erat ſpoliatum fortunis ſuis in ſolidum damnari*." Thus far was juſt and reaſonable: but as the departing from one extreme is apt to produce its oppoſite, we find it afterwards enacted, that if the debtor by any unforeſeen accident was reduced to low circumſtances, and would ſwear that he had not ſufficient left to pay his debts, he ſhould not be compelled to cede or give up even that which he had in his poſſeſſion; a law which, under a falſe notion of humanity, ſeems to be fertile of perjury, injuſtice, and abſurdity.

The laws of England, more wiſely, have ſteered in the middle between both extremes: providing at once againſt the inhumanity of the creditor, who is not ſuffered to confine an honeſt bankrupt after his effects are delivered up, and at the ſame time taking care that all his juſt debts ſhall be paid, ſo far as the effects will extend. But ſtill they are cautious of encouraging prodigality and extravagance by this indulgence to debtors: and therefore they allow the benefit of the laws of bankruptcy to none but actual traders; ſince that ſet of men are, generally ſpeaking, the only perſons liable to accidental loſſes, and to an inability of paying their debts, without any fault of their own. If perſons in other ſituations of life run in debt without the power of payment, they muſt take the conſequences of their own indiſcretion, even though they meet with ſudden accidents that may reduce their fortunes: for the law holds it to be an unjuſtifiable practice, for any perſon but a trader to encumber himſelf with debts of any conſiderable value. If a gentleman, or one in a liberal profeſſion, at the time of contracting his debts, has a ſufficient fund to pay them, the delay of payment is a ſpecies of diſhoneſty, and a temporary injuſtice to his creditor: and if, at ſuch time, he has not ſufficient fund, the diſhoneſty and injuſtice is the greater. He cannot therefore murmur, if he ſuffers the puniſhment which he has voluntarily drawn upon himſelf. But in mercantile tranſactions the caſe is far otherwiſe. Trade cannot be carried on without mutual credit on both ſides: the contracting of debts is therefore here not only juſtifiable but neceſſary. And if by accidental calamities, as by the loſs of a ſhip in a tempeſt, the failure of brother traders, or by the non-payment of perſons out of trade, a merchant or trader becomes incapable of diſcharging his own debts, it is his misfortune and not his fault. To the misfortunes therefore of debtors, the law has given a compaſſionate remedy, but denied it to their faults: ſince, at the ſame time that it provides for the ſecurity of commerce, by enacting that every conſiderable trader may be declared a bankrupt, for the benefit of his creditors as well as himſelf, it has alſo, to diſcourage extravagance, declared that no one ſhall be capable of being made a bankrupt, but only a trader; nor capable of receiving the full benefit of the ſtatutes, but only an induſtrious trader.

In the interpretation of the ſeveral ſtatutes made concerning Engliſh bankrupts, *, it hath been held, that buying only, or ſelling only, will not qualify a man to be a bankrupt; but it muſt be both buying and ſelling, and alſo getting a livelihood by it: as, by exerciſing the calling of a merchant, a grocer, a mercer, or, in one general word, a *chapman*, who is one that buys and ſells any thing. But no handicraft occupation (where nothing is bought or ſold, and therefore an extenſive credit, for the ſtock in trade, is not neceſſary to be had) will make a man a regular bankrupt; as that of a huſbandman, a gardener, and the like, who are paid for their work and labour. Alſo an inn-keeper cannot, as ſuch be a bankrupt: for his gain or livelihood does not ariſe from buying and ſelling in the way of merchandize, but greatly from the uſe of his rooms and furniture, his attendance, and the like: and though he may buy corn and victuals, to ſell again at a profit, yet that no more makes him a trader, than a ſchoolmaſter or other perſon is, that keeps a boarding-houſe, and makes conſiderable gains by buying and ſelling what he ſpends in the houſe, and ſuch a one is clearly not within the ſtatutes. But where perſons buy goods, and make them up into ſaleable commodities, as ſhoemakers, ſmiths, and the like; here, though part of the gain is by bodily labour, and not by buying and ſelling, yet they are within the ſtatutes of bankrupts; for the labour is only in melioration of the commodity, and rendering it more fit for ſale.

* 34 Hen. VIII. c. 4. 13 Eliz. c. 7. 21 Jac. I. c. 19. 5 Geo. II. c. 30.

2. To learn what the *acts* of bankruptcy are which render a man a bankrupt, we muſt conſult the ſeveral ſtatutes, and the reſolutions formed by the courts thereon. Among theſe may therefore be reckoned, 1. Departing from the realm, whereby a man withdraws himſelf from the juriſdiction and coercion of the law, with an intent to defraud his creditors. 2. Departing from his own houſe, with intent to ſecrete himſelf and avoid his creditors. 3. Keeping in his own houſe, privately, (except for juſt and neceſſary cauſe), ſo as not to be ſeen or ſpoken with by his creditors; which is likewiſe conſtrued to be an intention to defraud his creditors, by avoiding the proceſs of the law. 4. Procuring or ſuffering himſelf willingly to be arreſted, or outlawed, or impriſoned, without juſt and lawful cauſe; which is likewiſe deemed an attempt to defraud his creditors. 5. Procuring his money, goods, chattels, and effects, to be attached or ſequeſtrated by any legal proceſs; which is another plain and direct endeavour to diſappoint his creditors of their ſecurity. 6. Making any fraudulent conveyance to a friend, or

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(A) In Pegu, and the adjacent countries in Eaſt India, the creditor is entitled to diſpoſe of the debtor himſelf, and likewiſe of his wife and children: inſomuch that he may even violate with impunity, the chaſtity of the debtor's wife; but then, by ſo doing, the debt is underſtood to be diſcharged.

ſecret truſtee, of his lands, tenements, goods, or chattels; which is an act of the ſame ſuſpicious nature with the laſt. 7. Procuring any protection, not being himſelf privileged by parliament, in order to ſcreen his perſon from arreſts; which alſo is an endeavour to elude the juſtice of the law. 8. Endeavouring, or deſiring, by any petition to the king, or bill exhibited in any of the king's courts againſt any creditors, to compel them to take leſs than their juſt debts; or to procraſtinate the time of payment, originally contracted for; which are an acknowledgment of either his poverty or his knavery. 9. Lying in priſon for two months, or more, upon an arreſt or other detention for debt, without finding bail, in order to obtain his liberty. For the inability to procure bail argues a ſtrong deficiency in credit, owing either to his ſuſpected poverty, or his ill character; and his neglect to do it, if able, can ariſe only from a fraudulent intention: in either of which caſes, it is high time for his creditors to look to themſelves, and compel a diſtribution of his effects. 10. Eſcaping from priſon after an arreſt for a juſt debt of L.100, or upwards. For no man would break priſon, that was able and deſirous to procure bail; which brings it within the reaſon of the laſt caſe. 11. Neglecting to make ſatisfaction for any juſt debt to the amount of L.100, within two months after ſervice of legal proceſs, for ſuch a debt, upon any trader having privilege of parliament.

Theſe are the ſeveral acts of bankruptcy expreſsly defined by the ſtatutes relating to this article; which being ſo numerous, and the whole law of bankrupts being an innovation on the common law, our courts of juſtice have been tender of extending or multiplying acts of bankruptcy by any conſtruction or implication. And therefore Sir John Holt held, that a man's removing his goods privately to prevent their being ſeized in execution, was no act of bankruptcy. For the ſtatutes mention only fraudulent gifts to third perſons, and procuring them to be ſeized by ſham proceſs, in order to defraud creditors; but this, though a palpable fraud, yet, falling within neither of thoſe caſes, cannot be adjudged an act of bankruptcy. So alſo it has been determined expreſsly, that a banker's ſtopping or refuſing payment is no act of bankruptcy: for it is not within the deſcription of any of the ſtatutes; and there may be good reaſons for his ſo doing, as ſuſpicion of forgery and the like: and if, in conſequence of ſuch a refuſal, he is arreſted, and puts in bail, ſtill it is no act of bankruptcy; but if he goes to priſon, and lies there two months, then, and not before, is he become a bankrupt.

As to the conſequences reſulting from the unhappy ſituation of a bankrupt, ſee the article *COMMSSSION of Bankruptcy*.

BANKS (John), a dramatic writer, was bred to the law, and belonged to the ſociety of Gray's Inn; but this profeſſion not ſuiting his natural diſpoſition, he quitted it for the ſervice of the muſes. Here, however, he found his rewards by no means adequate to his deſerts. His emoluments at the beſt were precarious, and the various ſucceſſes of his pieces too feelingly convinced him of the error in his choice. This, however, did not prevent him from purſuing with cheerfulneſs the path he had taken; his thirſt of fame, and warmth of poetic enthuſiaſm, alleviating to his imagination many diſagreeable circumſtances into which indigence, the too frequent attendant on poetical purſuits, frequently threw him. His turn was entirely to tragedy, his merit in which is of a peculiar kind. For at the ſame time that his language muſt be confeſſed to be extremely unpoetical, and his numbers uncouth and unharmonious; nay, even his characters very far from being ſtrongly marked or diſtinguiſhed, and his epiſodes extremely irregular: yet it is impoſſible to avoid being deeply affected at the repreſentation, and even at the reading of his tragic pieces. This is owing in the general to an happy choice of his ſubjects; which are all borrowed from hiſtory, either real or romantic; and indeed the moſt of them from circumſtances in the annals of our own country, which, not only from their being familiar to our continual recollection, but even from their having ſome degree of relation to ourſelves, we are are apt to receive with a kind of partial prepoſſeſſion, and a predetermination to be pleaſed. He has conſtantly choſen as the baſis of his plays ſuch tales as were in themſelves and their well-known cataſtrophes moſt truly adapted to the purpoſes of the drama. He has indeed but little varied from the ſtrictneſs of hiſtorical facts; yet he ſeems to have made it his conſtant rule to keep the ſcene perpetually alive, and never ſuffer the characters to droop. His verſe is not poetry, but proſe run mad. Yet will the falſe gem ſometimes approach ſo near in glitter to the true one, at leaſt in the eyes of all but the real connoiſſeurs (and how ſmall a part of an audience are to be ranked in this claſs will need no ghoſt to inform us), that bombaſt will frequently paſs for the true ſublime; and where it is rendered the vehicle of incidents in themſelves affecting, and in which the heart is apt to intereſt itſelf, it will perhaps be found to have a ſtronger power on the human paſſions than even that property to which it is in reality no more than a bare ſuccedaneum. And from theſe principles it is that we muſt account for Mr Banks's writings having in the general drawn more tears from, and excited more terror in, even judicious audiences, than thoſe of much more correct and more truly poetical authors. The tragedies he has left behind are, 1. *Albion Queens.* 2. *Cyrus the Great.* 3. *Deſtruction of Troy.* 4. *Innocent Uſurper.* 5. *Iſland Queens.* This is only the Albion Queens altered. 6. *Rival Kings.* 7. *Virtue betrayed.* 8. *Unhappy Favourite.* The Albion Queens was rejected by the managers in 1604; but was acted by Queen Anne's command in 1706, with great applauſe, and has been ſeveral times revived. The Unhappy favourite continued till very lately a ſtock tragedy at the theatres: but gives way at preſent to the latter tragedies from the ſame ſtory, by Jones and Brooke.—Neither the time of the birth nor that of the death of this author, are aſcertained. His remains, however, lie interred in the church of St James's, Weſtminſter.

BANKS's ISLAND, a ſmall iſland in the South Sea diſcovered by Captain Cook in 1770, in S. Lat. 53. 32. W. Long. 186. 30. It is of a circular figure; and about 24 leagues in compaſs: it is ſufficiently high to be ſeen at the diſtance of 21 or 15 leagues; and the land has a broken irregular ſurface, with the appearance of barrenneſs rather than fertility. It is, however, inhabited, as ſome ſtraggling ſavages were obſerved upon it.

BANKSIA, in botany; a genus of the monogynia order, belonging to the tetrandia claſs of plants. The amentum is ſcaly, the corolla conſiſts of four petals; the antheræ are in the cavity of the folds, and foſſile; the capſule is bivalvular; and the ſeed is ſolitary, and bipartic. There are four ſpecies, the ſerrata, integrifolia, ericæ folia, and dentata, all natives of New Holland.

BANN, or BAN (from the Brit. *ban*, i. e. clamour), is a proclamation or public notice; any public ſummons or edict, whereby a thing is commanded or forbidden. It is a word ordinary among the feudiſts; and there is both *banus* and *banum*, which ſignify two ſeveral things.—The word *banns* is particularly uſed in England in publiſhing matrimonial contracts; which is done in the church before marriage, to the end that if any perſons can ſpeak againſt the intention of the parties, either in reſpect of kindred, precontract, or for other juſt cauſe, they may take their exception in time, before marriage is conſummated; and in the canon law, Bannæ *ſunt proclamationes ſponſi et ſponæ in eccleſiis fieri ſolitæ*. But there may be a faculty or licence for the marriage, and then this ceremony is omitted; and miniſters are not to celebrate matrimony between any perſons without a licence, except the banns have been firſt publiſhed three ſeveral times, upon pain of ſuſpenſion, &c. Can. 62.

The uſe of matrimonial banns is ſaid to have been firſt introduced in the Gallican church, though ſomething like it obtained even in the primitive times; and it is this that Tertullian is ſuppoſed to mean by *trinundina promulgatio*. The council of Lateran firſt extended, and made the uſage general. By the ordinance of Blois, no perſon could validly contract marriage, without a preceding proclamation of three banns; nor could any perſon whatever be diſpenſed with, except for the two laſt. But the French themſelves have abated much of this ſeverity; and only minors are now under an abſolute neceſſity of ſubmitting to the formality of banns. For majors, or thoſe of age, after publication of the firſt banns, the two latter are eaſily bought off.

BANN, is alſo uſed to denote proſcription or baniſhment for a crime proved; becauſe anciently publiſhed by ſound of trumpet; or, as Voſſius thinks, becauſe thoſe who did not appear at the abovementioned ſummons, were puniſhed by proſcription. Hence, *to put a prince under the bann of the empire*, is to declare him diveſted of all his dignities. The ſentence only denotes an interdict of all intercourſe, and offices of humanity, with the offender; the form of which ſeems taken from that of the Romans, who baniſhed perſons by forbidding them the uſe of fire and water. Sometimes alſo cities are put under the imperial bann; that is, ſtripped of their rights and privileges.

BANN alſo denotes a pecuniary mulct, or penalty, laid on a delinquent for offending againſt a bann.

BANN, or BANNUS, a title anciently given to the governor or viceroy of Croatia, Dalmatia, and Sclavonia.

Epiſcopal BANN, (*Bannus Epiſcopalis*), a mulct paid to the biſhop by thoſe guilty of ſacrilege and other crimes.

BANN, is alſo uſed for a ſolemn anathema, or excommunication, attended with curſes, &c. In this ſenſe we read of *papal banns*, &c.

BANN, in military affairs, a proclamation made in the army by beat of drum, ſound of trumpet, &c. requiring the ſtrict obſervance of diſcipline, either for the declaring a new officer, or puniſhing an offender.

BANNER denotes either a ſquare flag, or the principal ſtandard belonging to a prince.

We find a multiplicity of opinions concerning the etymology of the word *banner*; ſome deriving it from the Latin *bandum*, "a band or flag;" others from the word *bann*, "to ſummon the vaſſals to appear in arms;" others again from the German *ban*, "a field or tenement," becauſe landed men alone were allowed a banner; and, finally, there are ſome who think it is a corruption of *panniere*, from *pannus*, "cloth," becauſe banners were originally made of cloth.

The BANNER *of France*, was the largeſt and richeſt of all the flags borne by the ancient kings in their great military expeditions. St Martin's cap was in uſe 600 years as the banner of France; it was made of taffety, painted with the image of that ſaint, and laid one or two days on his tomb to prepare it for uſe. About the year 1100 came in a more pompous apparatus. The banner royal was faſtened to the top of a maſt, or ſome tall tree, planted on a ſcaffold, borne on a carriage drawn by oxen, covered with velvet houſings, decorated with devices or cyphers of the prince reigning. At the foot of the tree was a prieſt who ſaid maſs early every morning. Ten knights mounted guard on the ſcaffold night and day, and as many trumpets at the foot of the tree never ceaſed flouriſhing, to animate the troops. This cumberſome machine, the mode of which was brought from Italy, continued in uſe about 130 years. Its poſt was in the centre of the army. And here it was that the chief feats were performed, to carry off and defend the royal banner; for there was no victory without it, nor was any army reputed vanquiſhed till they had loſt their banner.

BANNERETS, an ancient order of knights or feudal lords; who poſſeſſing ſeveral large fees, led their vaſſals to battle under their own flag or banner, when ſummoned thereto by the king. The word ſeems formed from *banner*, "a ſquare flag;" or from *band*, which anciently denoted a flag.—Bannerets are alſo called in ancient writers *milites vexilliferi*, and *vexillarii bannerarii*, *bannarii*, *banderiſii*, &c.

Anciently there were two kinds of knights, *great* and *little*; the firſt whereof were called *bannerets*, the ſecond *bachelors*; the firſt compoſed the upper, the ſecond the middle, nobility.

The banneret was a dignitary allowed to march under his own flag, whereas the *bachelarius eques* followed that of another. To be qualified for a banneret, one muſt be a gentleman of family, and muſt have a power to raiſe a certain number of armed men, with eſtate enough to ſubſiſt at leaſt 28 or 30 men. This muſt have been very conſiderable in thoſe days; becauſe each man, beſides his ſervant, had two horſemen to wait on him armed, the one with a croſs-bow, the other with a bow and hatchet. As he was not allowed to be a baron who had not above 13 knights fees, ſo he was not admitted to be a banneret if he had leſs than 10.

Banneret, according to Spelman, was a middle order between a baron and a ſimple knight; called ſometimes alſo *vexillarius minor*, to diſtinguiſh him from the greater, that is, from the baron, to whom alone properly belonged the *jus vexilli*, or privilege of the ſquare flag. Hence the banneret was alſo called *bannerettus, quaſi baro minor;* a word frequently uſed by Engliſh writers in the ſame ſenſe as banneret was by the French, though neither of them occur before the time of Edward II.

Some will have bannerets to have originally been perſons who had ſome portion of a barony aſſigned them; and enjoyed it under the title of *baro proximus*, and that with the ſame prerogatives as the baron himſelf. Some, again, find the origin of bannerets in France, others in Brittany, others in England. Theſe laſt attribute the inſtitution of bannerets to Conan, lieutenant of Maximus, who commanded the Roman legions in England under the empire of Gratian in 383. This general, ſay they, revolting, divided England into 40 cantons, and in theſe cantons diſtributed 40 knights; to whom he gave a power of aſſembling, on occaſion, under their ſeveral banners, as many of the effective men as were found in their reſpective diſticts: whence they are called *bannerets*. However this be, it appears from Froiſſart, &c. that anciently ſuch of the military men as were rich enough to raiſe and ſubſiſt a company of armed men, and had a right to do ſo, were called *bannerets*. Not, however, that theſe qualifications rendered them knights, but only bannerets; the appellation of *knight* being only added thereto, becauſe they were ſimple knights before.

Bannerets were ſecond to none but knights of the garter. They were reputed the next degree below the nobility; and were allowed to bear arms with ſupporters, which none elſe may under the degree of a baron. In France, it is ſaid, the dignity was hereditary; but in England it died with the perſon that gained it. The order dwindled on the inſtitution of baronets by King James I. and at length became extinct. The laſt perſon created banneret was Sir John Smith, made ſo after Edghill-fight, for reſcuing the ſtandard of King Charles I.

The form of the banneret's creation was this. On a day of battle, the candidate preſented his flag to the king or general; who, cutting off the train or ſkirt thereof, and making it a ſquare, returned it again, the proper banner of bannerets; who are hence ſometimes called *knights of the ſquare flag*. There ſeems to have been bannerets created either in a different manner, or by others than the ſovereign; ſince King James, in the patent of baronets, gives them precedence to all knights bannerets, except ſuch as are created by the king himſelf in the field; which implies, either that there are ſome of this order created out of the field, or by inferior perſons.

Banneret is alſo the name of an officer or magiſtrate of Rome towards the cloſe of the 14th century.—The people of that city, and throughout the territory of the church, during the diſputes of the antipopes, had formed a kind of republican government; where the whole power was lodged in the hands of a magiſtrate called *ſenator*, and twelve heads of quarters called *bannerets*, by reaſon of the banners which each raiſed in his diſtrict.

BANNOCK, a kind of oat-cake, baked in the embers, or on a ſtone placed before the fire. It is common in the northern parts of Scotland.

BANNUM, in law, ſignifies the utmoſt bounds of a manor or town.

BANQUET, a feaſt or entertainment where people regale themſelves with pleaſant foods or fruits.

Banquet, in the menage, that ſmall part of the branch of a bridle that is under the eye; which being rounded like a ſmall rod, gathers and joins the extremities of the bit to the branch in ſuch a manner that the banquet is not ſeen, but covered by the cope, or that part of the bit that is next the branch.

Banquet-Line, an imaginary line drawn, in making a bit, along the banquet, and prolonged up or down, to adjuſt the deſigned force or weakneſs of the branch, in order to make it ſtiff or eaſy.

Banquet, or *Banquette*, in fortification, a little foot-bank, or elevation of earth, forming a path which runs along the inſide of a parapet, upon which the muſketeers get up, in order to diſcover the counterſcarp, or to fire on the enemy, in the moat or in the covert-way.

BANQUETING room or house. See Saloon. The ancient Romans ſupped in the atrium, or veſtibule, of their houſes; but, in after-times, magnificent ſaloons, or banqueting-rooms, were built, for the more commodious and ſplendid entertainment of their gueſts. Lucullus had ſeveral of theſe, each diſtinguiſhed by the name of ſome god; and there was a particular rate of expence appropriated to each. Plutarch relates with what magnificence he entertained Cicero and Pompey, who went with deſign to ſurpriſe him, by telling only a ſlave who waited, that the cloth ſhould be laid in the Apollo. The emperor Claudius, among others, had a ſplendid banqueting-room named *Mercury*. But every thing of this kind was outdone by the luſtre of that celebrated banqueting-houſe of Nero, called *domus aurea;* which, by the circular motion of its partitions and ceilings, imitated the revolution of the heavens, and repreſented the different ſeaſons of the year, which changed at every ſervice, and ſhowered down flowers, eſſences, and perfumes, on the gueſts.

BANSTICKLE, in ichthyology. See Gasterosteus.

BANTAM, a large town of the iſland of Java, in the Eaſt Indies, ſituated in E. Long. 105. 16. S. Lat. 6. 20. It is the capital of a kingdom of the ſame name, with a good harbour and fortified caſtle. It is divided into two towns ſeparated by a river, and one of them inhabited by the Chineſe. For its hiſtory, &c. ſee Java.

Bantam-work, a kind of painted or carved work, reſembling that of Japan, only more gaudy.

There are two ſorts of Bantam, as well as of Japan work. As, in the latter, ſome are flat, lying even with the black, and others high and emboſſed; ſo, in Bantam-work, ſome are flat, and others in-cut, or carved into the wood, as we find in many large ſcreens: with this difference, that the Japan artiſts work chiefly in gold and other metals; and thoſe of Bantam generally in colours, with a ſmall ſprinkling of gold here and there: for the flat Bantam-work is done in colours, mixed with gum-water, proper for the thing deſigned to be imitated. For the carved, or in-cut kind, the method of performing it is thus deſcribed by an ingenious artiſt: 1. The wood is to be primed with whiting and ſize, ſo often, till the primer lie near a quarter of an inch thick; then it is to be water-plained, *i. e.* rubbed with a fine wet cloth, and, ſome time after, rubbed very ſmooth, the blacks laid on, varniſhed up with a good body, and poliſhed well, though with a gentle hand. This done, the deſign is to be traced out with vermilion and gum-water, exactly in the manner wherein it is intended to be cut; the figures, trees, buildings, &c. in their due proportion: then the graver is applied, with other tools of proper ſhapes, differing according to the workman's fancy: with theſe he cuts deep or ſhallow, as is found convenient, but never deeper than the whiting lies, the wood being never to feel the edge of the inſtrument. Lines, or parts of the black, are ſtill to be left for the draperies, and other out-lines, and for the diſtinction of one thing from another; the rule being to cut where the white is, and leave the black untouched. The carving being finiſhed, then take to the pencil, with which the colours are laid into the cut-work: after this, the gold is to be lain in thoſe places which the deſign requires; for which purpoſe, a ſtrong thick gum-arabic water is taken and laid with a pencil on the work; and, while this remains wet, leaf-gold is cut with a ſharp ſmooth edged knife, in little pieces, ſhaped to the bigneſs and figure of the places where they are to be laid. Theſe being taken up with a little cotton, they daub them with the ſame cloſe to the gum-water, which affords a rich luſtre. The work thus finiſhed, they clear up the black with oil, taking care not to touch the colours. The European workmen ordinarily uſe braſs-duſt, which is leſs bright and beautiful.

BANTRY, a town of Ireland, in the county of Cork, and province of Munſter. It is ſeated on a bay of the ſame name, in W. Long. 9. 15. N. Lat. 51. 30.

BAOBAB, the name given by Proſper Alpinus to the African calabaſh-tree, ſince called ADANSONIA. See that article.

BAPTISM, in matters of religion, the ceremony of waſhing; or a ſacrament, by which a perſon is initiated into the Chriſtian church.—The word is formed from the Greek *βαπτιζω*, of *βαπτω to dip*, or *waſh*. Baptiſm is known, in eccleſiaſtical writers, by divers other names and titles. Sometimes it is called *palingeneſia*, or *laver of regeneration*; ſometimes *ſalus*, or *life and ſalvation*; ſometimes σφραγις, *ſignaculum Domini*, and *ſignaculum fidei*, or *the ſeal of faith*; ſometimes abſolutely *myſterium*, and *ſacramentum*; ſometimes *the ſacrament of faith*; ſometimes *viaticum*, from its being adminiſtered to departing perſons; ſometimes *ſacerdotium laici*, or *the lay prieſthood*, becauſe allowed, in caſes of neceſſity, to be conferred by laymen: ſometimes it is called the *great circumciſion*, becauſe it was imagined to ſucceed in the room of circumciſion, and to be a ſeal of the Chriſtian covenant, as that was the ſeal of the covenant made with Abraham: ſo, in regard that baptiſm had Chriſt for its author, and not man, it was anciently known by the name of Δωρον and χαρισμα Κυριȣ, *the gift of the Lord*: ſometimes it was ſimply called δωρον, without any other addition, by way of eminence, becauſe it was both a gratuitous and ſingular gift of Chriſt: in reference to the making men complete members of Chriſt's body, the church, it had the name of Τελειωσις, and Τελειν, the *conſecration* and *conſummation*; becauſe it gave men the perfection of Chriſtians, and a right to partake of the Το Τελειον, which was *the Lord's Supper*: it had alſo the name of μυησις and μυϛαγωγια, the *initiation*, becauſe it was the admittance of men to all the ſacred rites and myſteries of the Chriſtian religion.

Various names given to baptiſm.

Bingham's Orig. Eccleſ.

Its origin, &c.

Baptiſm has been ſuppoſed by many learned authors to have had its origin from the Jewiſh church, in which, as they maintain, it was the practice long before Chriſt's time, to baptize proſelytes or converts to their faith, as part of the ceremony of their admiſſion; a practice which, according to ſome, obtains among them to this day; a perſon turning Jew, is firſt circumciſed, and, when healed, is bathed, or baptized in water, in preſence of their rabbins; after which he is reputed a good Jew. Others, however, inſiſt that the Jewiſh proſelyte baptiſm is not by far ſo ancient, and that John the Baptiſt was the firſt adminiſtrator of baptiſm among the Jews. Of this opinion were Deylingius, J. G. Carpzovius, Boernerus, Wernſdorfius, Zeltnerus, Owen, Knatchbull, Jennings, Gill, and others.

Grotius is of opinion, that the rite of baptiſm had its original from the time of the deluge; immediately after which, he thinks, it was inſtituted in memory of the world having been purged by water. Some learned men think it was added to circumciſion, ſoon after the Samaritan ſchiſm, as a mark of diſtinction to the orthodox Jews. Spencer, who is fond of deriving the rites of the Jewiſh religion from the ceremonies of the Pagans, lays it down as a probable ſuppoſition, that the Jews received the baptiſm of proſelytes from the neighbouring nations, who were wont to prepare candidates for the more ſacred functions of their religion, by a ſolemn ablution; that, by this affinity of ſacred rites, they might draw the Gentiles to embrace their religion, and that the proſelytes (in gaining of whom they were extremely diligent) might the more eaſily comply with the tranſition from Gentiliſm to Judaiſm. In confirmation of this opinion, he obſerves, firſt, that there is no divine precept for the baptiſm of proſelytes, God having enjoined only the rite of circumciſion for the admiſſion of ſtrangers into the Jewiſh religion. Secondly, that, among foreign nations, the Egyptians, Perſians, Greeks, Romans, and others, it was cuſtomary that thoſe who were to be initiated into their myſteries, or ſacred rites, ſhould be firſt purified by dipping their whole body in water. That learned writer adds, as a farther confirmation of his opinion, that the cup of bleſſing likewiſe, added to the paſchal ſupper, ſeems plainly to have been derived from a pagan original: for the Greeks, at their feaſts, had one cup called ποτηριον αγαθȣ δαιμονος, *the cup of the good dæmon or god*, which they drank at the concluſion of their entertainment, when the table was removed. Since, then, a rite of Gentile origin was added to one of the Jewiſh ſacraments, viz. the paſſover, there can be no abſurdity in ſuppoſing, that baptiſm, which was added to the other ſacrament, namely circumciſion, might be derived from the ſame ſource. In the laſt place, he obſerves, that Chriſt, in the inſtitution of his ſacraments, paid a peculiar regard to thoſe rites which were borrowed from the Gentiles: for, rejecting circumciſion and the paſchal ſupper, he adopted into his religion baptiſm and the ſacred cup; thus preparing the way for the converſion and reception of the Gentiles into his church.

The deſign of the Jewiſh baptiſm, if baptiſm be practiſed by them, is ſuppoſed to be, to import a regeneration, whereby the proſelyte is rendered a new man, and of a ſlave becomes free. The effect of it is, to cancel all former relations; ſo that thoſe who were before akin to the perſon, after the ceremony ceaſed to be ſo. It is to this ceremony Chriſt is ſuppoſed to have alluded, in his expreſſion to Nicodemus, that it was neceſſary he ſhould be born again, in order to become his diſciple.—The neceſſity of baptiſm to ſalvation, is grounded on thoſe two ſayings of our Saviour: *He that believeth, and is baptized, ſhall be ſaved;* and, *Except a man be born of water and of the Spirit, he cannot enter into the kingdom of God.*—

Opinions concerning the neceſſity of baptiſm to ſalvation.

The ancients did not generally think the mere want of baptiſm, where the procuring it was impracticable, excluded men abſolutely from the hopes of eternal ſalvation. Some few of them, indeed, are pretty ſevere upon infants dying without baptiſm; and ſome others ſeem alſo, in general terms, to deny eternal life to adult perſons dying without it: but when they interpret themſelves, and ſpeak more diſtinctly, they make ſome allowances, and except ſeveral caſes, in which the want of baptiſm may be ſupplied by other means. Such are martyrdom, which commonly goes by the name of *ſecond baptiſm in mens own blood,* in the writings of the ancients; becauſe of the power and efficacy it was thought to have, to ſave men by the inviſible baptiſm of the Spirit, without the external element of water. Faith, and repentance, were alſo eſteemed a ſupplement to the want of baptiſm, in ſuch catechumens as died while they were piouſly preparing themſelves for baptiſm. Conſtantly communicating with the church, was thought to ſupply the want of baptiſm, in perſons who had been admitted to communion, on a preſumption of their being duly baptized, though the contrary afterwards appeared. For infants dying without baptiſm, the caſe was thought more dangerous; as here, no perſonal faith, repentance, or the like, could be pleaded, to ſupply the defect, and waſh away original ſin: on this account, they who ſpoke moſt favourably of them, as Greg. Nazianzen, and Severus biſhop of Antioch, only aſſigned them a middle ſtate, neither in heaven nor hell. But the Latins, as St Auguſtin, Fulgentius, Marius Mercator, &c. who never received the opinion of a middle ſtate, concluded, as they could not be received into heaven, they muſt go to hell. Pelagius, and his followers, who denied original ſin, aſſerted, that they might be admitted to eternal life and ſalvation, though not to the kingdom of heaven; between which they diſtinguiſhed. Where the fault was not on the ſide of the child, nor his parents, but of the miniſter, or where any unavoidable accident rendered baptiſm abſolutely impoſſible, Hincmar, and others, make an exception, in holding the child ſaved without baptiſm.

Of the time place, and ſubjects of baptiſm.

The receiving baptiſm is not limited to any time, or age of life. Some contended for its being adminiſtered like circumciſion, preciſely on the eighth day, as Greg. Nazianzen; and others would have it deferred till the child is three years of age, and able to hear the myſtic words, and make anſwer thereto, though they do not underſtand them. In the canon law we find divers injunctions againſt deferring the baptiſm of infants beyond the 37th day, 30th day, and the 9th day; ſome of them under pecuniary forfeitures. Salmaſius, and Suicerus from him, deliver it as authentic hiſtory, that for the two firſt ages, no one received baptiſm, who was not firſt inſtructed in the faith and doctrine of Chriſt, ſo as to be able to anſwer for himſelf, that he believed; becauſe of thoſe words, *He that believeth, and is baptized:* which, in effect, is to ſay, that no infant, for the firſt two ages, was ever admitted to Chriſtian baptiſm. But, afterwards, they own, that pædo-baptiſm came in, upon the opinion that baptiſm was neceſſary to ſalvation. But Voſſius, Dr Forbes, Dr Hammond, Mr Walker, and eſpecially Mr Wall, who has exactly conſidered the teſtimony and authority of almoſt every ancient writer that has ſaid any thing upon this ſubject, endeavour to evince, that infants were baptiſed even in the apoſtolical age. It is certain, Tertullian pleads ſtrongly againſt giving baptiſm to infants; which ſhows, at leaſt, that there was ſome ſuch practice in his age, though he diſapproved of it. It is certain, the ordinary ſubjects of this ſacrament in the firſt ages were converts from Judaiſm and Gentiliſm, who, before they could be admitted to baptiſm, were obliged to ſpend ſome time in the ſtate of catechumens, to qualify them to make their profeſſions of faith, and a Chriſtian life, in their own perſons: for, without ſuch perſonal profeſſions, there were ordinarily no admiſſion of them to the privilege of baptiſm.—Thoſe baptiſed in their ſick-beds were called *clinici;* and were held in ſome reproach, as not being reputed true Chriſtians. Hence ſeveral cenſures, in councils and eccleſiaſtical writers, of clinic baptiſm. This clinic baptiſm was not ſufficient to qualify the perſon, in caſe of recovery, for ordination. Some had their baptiſm put off by way of puniſhment, when they fell into groſs and ſcandalous crimes, which were to be expiated by a longer courſe of diſcipline and repentance. This was ſometimes 5, 10, 20 years, or more; even all their lives, to the hour of death, when their crimes were very flagrant.

In the earlieſt ages of the church, there was no ſtated time or place for the reception of baptiſm. Afterwards, Eaſter, Whitſuntide, and Epiphany, became ſolemn ſeaſons, out of which baptiſm was not adminiſtered, except in caſes of neceſſity. The catechumens, who were to receive it at theſe times, were called *competentes:* and to theſe it is that St Cyril addreſſes his catecheſes. In the apoſtolical age, and ſome time after, before churches and baptiſteries were generally erected, they baptized in any place where they had convenience; as John baptized in Jordan, and Philip baptized the eunuch in the wilderneſs, and Paul the jailor in his own houſe. But in after ages, baptiſteries were built adjoining to the church; and then rules were made, that baptiſm ſhould ordinarily be adminiſtered no where but in theſe buildings. Juſtinian, in one of his novels, refers to ancient laws, appointing that none of the ſacred myſteries of the church ſhould be celebrated in private houſes. Men might have private oratories for prayer in their own houſes; but they were not to adminiſter baptiſm or the euchariſt in them, unleſs by a particular licence from the biſhop of the place. Such baptiſms are frequently condemned in the ancient councils, under the name παραβαπτισματα, *baptiſms in private conventicles.*

Ancient ceremonies.

As to the attendant ceremonies and manner of baptiſm in the ancient church: The perſon to be baptiſed, if

Baptiſm.

if an adult, was firſt examined by the biſhop or officiating prieſt, who put ſome queſtions to him; as, firſt, Whether he abjured the devil and all his works; ſecondly, Whether he gave a firm aſſent to all the articles of the Chriſtian faith: to both which he anſwered in the affirmative. If the perſon to be baptized was an infant, theſe interrogatories were anſwered by his *ſponſores*, or godfathers. Whether the uſe of ſponſors was as old as the apoſtles days, is uncertain: perhaps it was not, ſince Juſtin Martyr, ſpeaking of the method and form of baptiſm, ſays not a word of them.—After the queſtions and anſwers, followed exorciſm; the manner and end of which was this; The miniſter laid his hands on the perſon's head, and breathed in his face, implying thereby the driving away or expelling of the devil from him, and preparing him for baptiſm, by which the good and holy ſpirit was to be conferred upon him.—After exorciſm, followed baptiſm itſelf: and firſt the miniſter, by prayer, conſecrated the water for that uſe. Tertullian ſays, "any waters may be applied to that uſe; but then God muſt be firſt invocated; and then the Holy Ghoſt preſently comes down from heaven, and moves upon them, and ſanctifies them." The water being conſecrated, the perſon was baptized "in the name of the Father, and of the Son, and of the Holy Ghoſt;" by which, "dedication of him to the bleſſed Trinity, the perſon (ſays Clemens Alexandrinus) is delivered from the corrupt trinity, the devil, the world, and the fleſh." In performing the ceremony of baptiſm, the uſual cuſtom (except in clinical caſes, or where there was ſcarcity of water), was to immerſe and dip the whole body. Thus St Barnabas deſcribing a baptized perſon, ſays, "We go down into the water full of ſin and filth, but we aſcend bearing fruit in our hearts." And this practiſe of immerſing the whole body was ſo general, that we find no exceptions made in reſpect either to the tenderneſs of infants, or the baſhfulneſs of the other ſex, unleſs in caſe of ſickneſs or other diſability. But to prevent any indecency, men and women were baptized apart. To which end, either the baptiſteries were divided into two apartments, one for the men, the other for the women, as Bingham has obſerved; or the men were baptized at one time, and the women at another, as is ſhown by Voſſius, from the *Ordo Romanus*, Gregory's *Sacramentarium*, &c. Add, that there was anciently an order of deaconeſſes, one part of whoſe buſineſs was to aſſiſt at the baptiſm of women. Theſe precautions, however, rather indicate a ſcrupulous attention to delicacy, than imply any indecency in the circumſtance of immerſion itſelf. From the candidates being immerſed, there is at leaſt no reaſon to infer that they were naked: The preſent Baptiſts never baptiſe naked, though they always immerſe. After immerſion, followed the unction; by which (ſays St Cyril) was ſignified, that they were now cut off from the wild olive, and were ingrafted into Chriſt, the true olive tree; or elſe to ſhow, that they were now to be champions for the goſpel, and were anointed thereto, as the old athletæ were againſt their ſolemn games. With this anointing was joined the ſign of the croſs, made upon the forehead of the perſon baptized; which being done, he had a white garment given him, to denote his being waſhed from the defilements of ſin, or in alluſion to that of the apoſtle, "as many as are baptized into Chriſt have put on Chriſt." From this cuſtom the feaſt of Pentecoſt, which was one of the annual ſeaſons of baptiſm, came to be called *Whitſunday*, i. e. *White-ſunday*. This garment was afterwards laid up in the church, that it might be an evidence againſt ſuch perſons as violated or denied that faith which they had owned in baptiſm.—When the baptiſm was performed, the perſon baptized, according to Juſtin Martyr, "was received into the number of the faithful, who then ſent up their public prayers to God, for all men, for themſelves, and for thoſe who had been baptized."

The ordinary miniſters, who had the right of adminiſtering this ſacrament, that is, of applying the water to the body, and pronouncing the formula, were preſbyters or biſhops; though on extraordinary occaſions, laymen were admitted to perform the ſame.

Modern Forms.
In the Church of Rome.

As to the preſent form of adminiſtering baptiſm, the church of Rome uſes the following. When a child is to be baptiſed, the perſons who bring it wait for the prieſt at the door of the church, who comes thither in his ſurplice and purple ſtole, attended by his clerks. He begins with queſtioning the godfathers, whither they promiſe, in the child's name, to live and die in the true catholic and apoſtolic faith, and what name they would give the child. Then follows an exhortation to the ſponſors; after which the prieſt, calling the child by its name, aſks it as follows: *What doſt thou demand of the church?* The godfather anſwers, *Eternal life.* The prieſt goes on: *If you are deſirous of obtaining eternal life, keep God's commandments, thou ſhalt love the Lord thy God*, &c. After which he breathes three times into the child's face, ſaying, *Come out of this child, thou evil ſpirit, and make room for the Holy Ghoſt.* This ſaid he makes the ſign of the croſs on the child's forehead and breaſt, ſaying, *Receive the ſign of the croſs on thy forehead, and in thy heart.* Then taking off his cap, he repeats a ſhort prayer; and laying his hand gently on the child's head, repeats a ſecond prayer: which ended, he bleſſes ſome ſalt; and putting a little of it into the child's mouth, pronounces theſe words, *Receive the ſalt of wiſdom.* All this is performed at the church-door. The prieſt, with the godfathers and godmothers, coming into the church, and advancing towards the font, repeat the apoſtle's creed and the Lord's-prayer. Being come to the font, the prieſt exorciſes the evil ſpirit again; and taking a little of his own ſpittle, with the thumb of his right-hand, rubs it on the childs ears and noſtrils, repeating, as he touches the right ear, the ſame word (*Ephatha, be thou opened*) which our Saviour made uſe of to the man born deaf and dumb. Laſtly, they pull off its ſwaddling-cloaths, or ſtrip it below the ſhoulders, during which the prieſt prepares the oils, &c. The ſponſors then hold the child directly over the font, obſerving to turn it due eaſt and weſt; whereupon the prieſt aſks the child, *Whether he renounces the devil and all his works*; and the godfather having anſwered in the affirmative, the prieſt anoints the child between the ſhoulders in the form of a croſs. Then taking ſome of the conſecrated water, he pours part of it thrice on the child's head, at each perfuſion calling on one of the Perſons of the Holy Trinity. The prieſt concludes the ceremony of baptiſm with an exhortation.—The Romiſh church allows midwives, in caſes of danger to baptize a child before it is come entirely out of its mother's womb: where it is to be obſerved, that ſome part of the body of the child muſt appear before it can be baptized, and that it is baptized on the part which firſt appears: if it be the head, it is not neceſſary to rebaptize the child; but if only a foot or hand appears, it is neceſſary to repeat baptiſm. A ſtill-born child, thus baptized, may be buried in conſecrated ground.

In the Greek church.

The Greek church differs from the Romiſh, as to the rite of baptiſm, chiefly, in performing it by immerſion, or plunging the infant all over in the water.

Engliſh form in the liturgy of K. Edward.

The forms of adminiſtrating baptiſm among us being too well known to require a particular deſcription, we ſhall only mention one or two of the more material differences between the form, as it ſtood in the firſt liturgy of King Edward, and that in the Engliſh Common-Prayer book at preſent. Firſt, the form of conſecrating the water did not make a part of the office, in King Edward's liturgy, as it does in the preſent, becauſe the water in the font was changed, and conſecrated, but once a month. The form likewiſe itſelf was ſomething different from that now uſed; and was introduced with a ſhort prayer, that *Jeſus Chriſt, upon whom (when he was baptized) the Holy Ghoſt came down in the likeneſs of a dove, would ſend down the ſame Holy Spirit, to ſanctify the fountain of baptiſm;* which prayer was afterwards left out, at the ſecond review.—By King Edward's firſt book, the miniſter is to dip the child in the water thrice; firſt, dipping the right-ſide; ſecondly, the left; the third time dipping the face toward the font. This trine immerſion was a very ancient practice in the Chriſtian church, and uſed in honour of the Holy Trinity; though ſome later writers ſay, it was done to repreſent the death, burial, and reſurrection, of Chriſt, together with his three days continuance in the grave. Afterwards, the Arians making an ill uſe of it, by perſuading the people that it was uſed to denote, that the three Perſons in the Trinity were three diſtinct ſubſtances, the orthodox left it off, and uſed one ſingle immerſion.

By the firſt common-prayer of King Edward, after the child was baptized, the godfathers and godmothers were to lay their hands upon it, and the miniſter was to put on him the white veſtment commonly called the *chryſome*, and to ſay, "Take this white veſture, as a token of the innocency, which, by God's grace, in this holy ſacrament of baptiſm, is given unto thee; and for a ſign, whereby thou art admoniſhed, ſo long as thou liveſt, to give thyſelf to innocence of living, that after this tranſitory life thou mayeſt be partaker of the life everlaſting. Amen." As ſoon as he had pronounced theſe words, he was to anoint the infant on the head, ſaying, "Almighty God, the Father of our Lord Jeſus Chriſt, who hath regenerated thee by water and the Holy Ghoſt, and hath given unto thee remiſſion of all thy ſins; may he vouchſafe to anoint thee with the unction of his Holy Spirit, and bring thee to the inheritance of everlaſting life. Amen." This was manifeſtly done in imitation of the practice of the primitive church.'

The cuſtom of ſprinkling children, inſtead of dipping them in the font, which at firſt was allowed in caſe of the weakneſs or ſickneſs of the infant, has ſo far prevailed, that immerſion is at length quite excluded. What principally tended to confirm the practice of affuſion or ſprinkling, was, that ſeveral of our Proteſtant divines, flying into Germany and Switzerland during the bloody reign of queen Mary, and returning home when queen Elizabeth came to the crown, brought back with them a great zeal for the Proteſtant churches beyond ſea, where they had been ſheltered and received; and having obſerved, that at Geneva and ſome other places, baptiſm was adminiſtered by ſprinkling, they thought they could not do the church of England a greater piece of ſervice than by introducing a practice dictated by ſo great an oracle as Calvin. This, together with the coldneſs of our northern climate, was what contributed to baniſh entirely the practice of dipping infants in the font.

Notions concerning the effects of baptiſm.

Many different notions have been entertained concerning the effects of baptiſm, which it would be endleſs to enumerate.—The Remonſtrants and Socinians reduce baptiſm to a mere ſign of divine grace. The Romaniſts, on the contrary, exalt its power; holding that all ſin is entirely taken away by it; that it abſolutely confers the grace of juſtification, and conſequently grace *ex opere operato*. Some alſo ſpeak of an indelible character impreſſed on the ſoul by it, called *character dominicas* and *character regius*: but this is held, by others, a mere chimera; for that the ſpiritual character, conferred in regeneration, may eaſily be effaced by mortal ſins. Dodwell maintained, that it is by baptiſm the ſoul is made immortal; ſo that thoſe who die without it will not riſe again. It muſt be added, he reſtrains this effect to epiſcopal baptiſm alone. From the effects ordinarily aſcribed to baptiſm, even by ancient writers, it ſhould ſeem, that the ceremony is as much of heathen as of Jewiſh origin; ſince Chriſtians do not reſtrain the uſe of it, like the Jews, to the admiſſion of new members into the church, but hold, with the heathens, a virtue in it for the remitting and waſhing away ſins. The Bramins are ſtill ſaid to baptize with this latter view, at certain ſeaſons, in the river Ganges; to the waters whereof they have annexed a cleanſing or ſanctifying quality; and hence it is that they flock from all parts, even of Tartary, driven by the expectation of their being eaſed of their load of ſins. But, in this point, many Chriſtians ſeem to have gone beyond the folly of the heathens. It was only the ſmaller ſins of infirmity which theſe latter held to be expiable by waſhing; for crimes of a blacker dye, they allowed no water could efface them, no purgation could diſcharge them. The Chriſtian doctrine of a total remiſſion of ſins by baptiſm could not fail, therefore, to ſcandalize many among the heathens, and furniſhed Julian an occaſion of ſatiriſing Chriſtianity itſelf: "Whoever (ſays he) is guilty of rapes, murder, ſacrilege, or any abominable crime, let him be waſhed with water, and he will become pure and holy."

In the ancient church, baptiſm was frequently conferred on Jews by violence; but the church itſelf never ſeems to have allowed of force on this occaſion. By a canon of the fourth council of Toledo, it is expreſsly forbid to baptize any againſt their wills. That which looks moſt like force in this caſe, allowed by law, were two orders of Juſtinian; one of which appoints the heathens, and the other Samaritans to be baptized, with their wives and children and ſervants, under pain of confiſcation. By the ancient laws, baptiſm was not to be conferred on image-makers, ſtage-players, gladiators, *aurigæ* or public drivers, magicians,

cians, or even ſtrolling beggars, till they quitted ſuch profeſſions. Slaves were not allowed the privilege of baptiſm without the teſtimony and conſent of their maſters; excepting the ſlaves of Jews, Heathens, and heretics, who were not only admitted to baptiſm, but, in conſequence thereof had their freedom. Voſſius has a learned and elaborate work *De Baptiſmo*, wherein he accurately diſcuſſes all the queſtions concerning baptiſm according to the doctrines of the ancients.

Bingham Orig. Eccl. l. 11. c. 5. §. 4. l. 8. c. 11. §. 17.

Baptism by Fire, ſpoken of by St John the Baptiſt, has occaſioned much conjecture. The generality of the fathers held, that believers, before they enter paradiſe, are to paſs through a certain fire, which is to purify them from all pollutions remaining on them unexpiated. Others, with St Baſil, underſtand it of the fire of hell; others, of that of tribulation and temptation. Others, with St Chryſoſtom, will have it denote an abundance of graces. Others ſuppoſe it to mean the deſcent of the Holy Ghoſt on the apoſtles, in form of fiery tongues. Laſtly, others maintain, that the word *fire* here is an interpolation: and that we are only to read the text, *He that ſhall come after me will baptize you with the Holy Ghoſt*. In reality it is not found in divers manuſcript copies of St. Matthew.

The ancient Seleucians and Hermians, underſtanding the paſſage literally, maintained, that material fire was neceſſary in the adminiſtration of baptiſm. But we do not find how, or to what part of the body they applied it, or whether they were ſatisfied with obliging the perſon baptized to paſs through the fire. Valentinus rebaptized all who had received water-baptiſm, and conferred on them the baptiſm of fire.

> *Bis docuit tingi, traductoque corpore flamma.*
> Tertull. Carm. contr. Marc. l. 1.

Heracleon, cited by Clemens Alexandrinus, ſays, that ſome applied a red-hot iron to the ears of the perſon baptized, as if to impreſs ſome mark upon him.

Baptism of the Dead, a cuſtom which anciently prevailed among ſome people in Africa, of giving baptiſm to the dead. The third council of Carthage ſpeaks of it as a thing that ignorant Chriſtians were fond of. Gregory Nazianzen alſo takes notice of the ſame ſuperſtitious opinion prevailing among ſome who delayed to be baptized. In his addreſs to this kind of men, he aſks, whether they ſtaid to be baptized after death? Philaſtrius alſo notes it as the general error of the Montaniſts or Cataphrygians, that they baptized men after death. The practice ſeems to be grounded on a vain opinion, that, when men had neglected to receive baptiſm in their life-time, ſome compenſation might be made for this default by receiving it after death.

Baptiſm of the Dead, was alſo a ſort of vicarious baptiſm, formely in uſe, where a perſon dying without baptiſm, another was baptized in his ſtead.

St Chryſoſtom tells us, this was practiſed among the Marcionites with a great deal of ridiculous ceremony; which he thus deſcribes: After any catechumen was dead, they hid a living man under the bed of the deceaſed; then coming to the dead man, they aſked him, whether he would receive baptiſm? and he making no anſwer, the other anſwered for him, and ſaid, he would be baptized in his ſtead: and ſo they baptized the living for the dead.

Epiphanius aſſures us, the like was alſo practiſed among the Corinthians. This practice they pretended to found on the Apoſtle's authority; alledging that text of St. Paul for it, *If the dead riſe not at all, what ſhall they do who are baptized for the dead?* A text which has given occaſion to a great variety of different ſyſtems and explications. Boſius enumerates no leſs than nine different opinions among learned divines concerning the ſenſe of the phraſe *being baptized for the dead.*

St Ambroſe and Walafred Strabo ſeem clearly of opinion, that the apoſtle had reſpect to ſuch a cuſtom then in being; and ſeveral moderns have given into the ſame opinion, as Baronius, Joſ. Scaliger, Juſtellus, and Grotius.

Several among the Roman-catholics, as Bellarmin, Salmeron Menochius, and a number of ſchoolmen, underſtand it of the baptiſm of tears, and penance, and prayers, which the living undergo for the dead; and thus alledge it as a proof of the belief of purgatory in St Paul's days.

Hypothetical Baptism, that formerly adminiſtered in certain doubtful caſes, with this formula: *If thou art baptized, I do not rebaptize; if thou art not, I baptize thee in the name of the Father*, &c. This ſort of baptiſm, enjoined by ſome ancient conſtitutions of the Engliſh church, is now fallen into diſuſe.

Solemn Baptism, that conferred at ſtated ſeaſons; ſuch, in the ancient church, were the *Paſchal baptiſm*, and that at Whitſuntide. This is ſometimes alſo called *general baptiſm*.

Lay-Baptism, we find to have been permitted by both the Common-prayer Books of King Edward and that of Queen Elizabeth, when an infant is in immediate danger of death, and a lawful miniſter cannot be had. This was founded upon the miſtaken notion of the impoſſibility of ſalvation without the ſacrament of baptiſm: but afterwards, when they came to have clearer notions of the ſacraments, it was unanimouſly reſolved in a convocation, held in the year 1575, that even private baptiſm, in a caſe of neceſſity was only to be adminiſtered by a lawful miniſter.

Baptism is alſo applied, abuſively, to certain ceremonies uſed in giving names to things inanimate.

The ancients knew nothing of the cuſtom of giving baptiſm to inanimate things, as bells, ſhips, and the like, by a ſuperſtitious conſecration of them. The firſt notice we have of this is in the Capitulars of Charles the Great, where it is only mentioned to be cenſured; but, afterwards, it crept into the Roman offices by degrees. Baronius carries its antiquity no higher than the year 968, when the greateſt bell of the church of Lateran was chriſtened by Pope John III. At laſt it grew to that ſuperſtitious height, as to be thought proper to be complained of in the *Centum Gravamina* of the German nation, drawn up in the public diet of the empire held at Nuremberg *anno* 1581; where (after having deſcribed the ceremony of baptizing a bell, with godfathers, who make reſponſes as in baptiſm, and give it a name, and clothe it with a new garment as Chriſtians were uſed to be clothed, and all this to make it capable of driving away tempeſts and devils), they conclude againſt it, not only a ſuperſtitious practice, but contrary to the Chriſtian religion, and a mere ſeduction of the ſimple people.

Baptism, in the ſea language, a ceremony in long voyages on board merchant ſhips, practiſed both on perſons and veſſels who paſs the tropic or line for the firſt time. The baptizing the veſſel is ſimple, and conſiſts only in waſhing them throughout with ſea-water; that of the paſſengers is more myſterious The oldeſt of the crew, that has paſt the tropic or line, comes with his face blacked, a groteſque cap on his head, and ſome ſea-book in his hand, followed by the reſt of the ſeamen dreſſed like himſelf, each having ſome kitchen utenſil in his hand, with drums beating; he places himſelf on a ſeat on the deck, at the foot of the main maſt. At the tribunal of this mock magiſtrate, each paſſenger not yet initiated, ſwears he will take care the ſame ceremony be obſerved, whenever he is in the like circumſtances: Then, by giving a little money by way of gratification, he is diſcharged with a little ſprinkling of water; otherwiſe he is heartily drenched with ſtreams of water poured upon him; and the ſhip-boys are incloſed in a cage, and ducked at diſcretion.—The ſeamen, on the baptizing a ſhip, pretend to a right of cutting off the beak-head, unleſs redeemed by the captain.

BAPTISMAL, ſomething belonging to baptiſm; thus we ſay baptiſmal vow, preſents, &c.

Baptismal Vow or *Covenant*, a profeſſion of obedience to the laws of Chriſt, which perſons in the ancient church made before baptiſm. It was an indiſpenſable part of the obligation on catechumens, before they were admitted to the ceremony of regeneration. It was made by turning to the Eaſt; for what myſtical reaſons, is not well agreed on.

Baptismal Preſents are in uſe in Germany, made by the ſponſors to the infant, conſiſting of money, plate, or even ſometimes fiefs of lands; which by the laws of the country are to be kept for the child till of age, the parents having only the truſt, not the right, of diſpoſing of them. An anonymous author has publiſhed a diſcourſe expreſs on this occaſion, intitled *De pecunia luſtrica.*

BAPTIST (John), Monnoyer, a painter of flowers and fruit, was born at Liſle in 1635, and educated at Antwerp, where he perfected himſelf in the knowledge of his art, and in his firſt years was intended for a painter of hiſtory: but having ſoon obſerved that his genius more ſtrongly inclined him to the painting of flowers, he applied his talents to thoſe ſubjects, and in that ſtyle became one of the greateſt maſters. His pictures are not ſo exquiſitely finiſhed as thoſe of Van Huyſum, but his compoſition and colouring are in a bolder ſtyle. His flowers have generally a remarkable freedom and looſeneſs, as well in the diſpoſition as in penciling; together with a tone of colouring that is lively, admirable, and nature itſelf. The diſpoſition of his objects is ſurpriſingly elegant and beautiful; and in that reſpect his compoſitions are eaſily known, and as eaſily diſtinguiſhed from the performances of others. He died in 1699.—He left a ſon, Anthony, who painted flowers in the ſame ſtyle and manner, and had great merit.

BAPTISTS, in eccleſiaſtical hiſtory, (from βαπτιζω, *I baptize*); a denomination of Chriſtians, diſtinguiſhed from other Chriſtians by their particular opinions reſpecting the mode and the ſubjects of baptiſm.

Inſtead of adminiſtering the ordinance by ſprinkling or pouring water, they maintain that it ought to be adminiſtered only by immerſion. Such, they inſiſt, is the meaning of the word βαπτιζω; ſo that a command to baptize is a command to immerſe. Thus it was underſtood by thoſe who firſt adminiſtered it. John the Baptiſt, and the apoſtles of Chriſt, adminiſtered it in Jordan and other rivers, and places where there was much water. Both the adminiſtrators and the ſubjects are deſcribed as going down into, and coming up again out of, the water; and the baptized are ſaid to be buried in baptiſm, and to be raiſed again: which language could not, they ſay, be properly adopted on ſuppoſition of the ordinance being adminiſtered in any other manner than by immerſion. Thus alſo they affirm it was in general adminiſtered in the primitive church. Thus it is now adminiſtered in the Ruſſian and Greek church: and thus it is, at this day, directed to be adminiſtered in the church of England, to all who are thought capable of ſubmitting to it in this manner. With regard to the ſubjects of baptiſm, the Baptiſts ſay, that this ordinance ought not to be adminiſtered to children or infants at all, nor to grown up perſons in general, but to adults only of a certain character and deſcription. Our Saviour's commiſſion to his apoſtles, by which Chriſtian baptiſm was inſtituted, is to go and teach all nations, baptizing them; that is, ſay they, not to baptize all they meet with; but firſt inſtruct them—to teach all nations, or to preach the goſpel to every creature—and whoever receives it, him to baptize in the name of the Father, and of the Son, and of the Holy Ghoſt. To ſuch perſons, and to ſuch only, baptiſm appears to have been adminiſtered by the apoſtles, and the immediate diſciples of Chriſt. They are deſcribed as repenting of their ſins, as believing in Chriſt, and as having gladly received the word. Without theſe qualifications, Peter acquaints thoſe who were converted by his ſermon, that he could not have admitted them to baptiſm. Philip holds the ſame language in his diſcourſe with the eunuch; and Paul treats Lydia, the jailor, and others, in the ſame manner. Without theſe qualifications, Chriſtians in general think it wrong to admit perſons to the Lord's ſupper; and, for the ſame reaſons, without theſe qualifications, at leaſt a profeſſion of them, the Baptiſts think it wrong to admit any to baptiſm. Wherefore they with-hold it, not only from the impenitently vicious and profane, and from infidels who have no faith; but alſo from infants and children, who have no knowledge, and are incapable of every action civil and religious. They further inſiſt, that all poſitive inſtitutions depend entirely upon the will and declaration of the inſtitutor; and therefore, that reaſoning by analogy from abrogated Jewiſh rites is to be rejected, and the expreſs commands of Chriſt reſpecting the mode and ſubjects of baptiſm ought to be our only rule.

The Baptiſts in England form one of the denominations of Proteſtant diſſenters. They ſeparate from the eſtabliſhment for the ſame reaſons as their brethren of the other denominations do; and from additional motives derived from their particular tenets reſpecting baptiſm. The conſtitution of their churches, and their modes of worſhip, are congregational or independent: in the exerciſe of which they are protected, in common with other diſſenters, by the act of toleration. Before this act, they were liable to pains and penalties as nonconformiſts, and often for their peculiar ſentiments as Baptiſts. A proclamation was iſſued out againſt them, and ſome of them were burnt in Smithfield in 1538. They bore a conſiderable ſhare in the perſecutions of the laſt and of the preceding centuries; and, as it ſhould ſeem, in thoſe of ſome centuries before; for there were ſeveral among the Lollards and the followers of Wickliff, who diſapproved of infant-baptiſm. There were many of this perſuaſion among the Proteſtants and reformers abroad. In Holland, Germany, and the North, they went by the names of ANABAPTISTS and MENNONITES: and, in Piedmont and the ſouth, they were found among the ALBIGENSES and WALDENSES. See the hiſtories of the Reformation, and the above articles in this Dictionary.

The *Baptiſts* ſubſiſt under two denominations, viz. the *Particular* or Calviniſtical, and the *General* or Arminian. The former is by far the moſt numerous. Some of both denominations allow of *mixed communion*, viz. of perſons who have been ſprinkled in their infancy, and therefore unbaptized in the view of the Baptiſts; others diſallow it: and ſome of them obſerve the ſeventh day of the week as the ſabbath, apprehending the law that enjoined it, not to have been repealed by Chriſt or his apoſtles. But a difference of opinion reſpecting theſe and other matters, is not peculiar to the Baptiſts: it is common to all Chriſtians, and to all bodies of men who think and judge for themſelves.

BAPTISTERY, in eccleſiaſtical writers, a place in which the ceremony of baptiſm is performed.

In the ancient church it was one of the exedræ or buildings diſtinct from the church itſelf: and conſiſted of a porch or anti-room where the perſons to be baptized made their confeſſion of faith, and an inner room where the ceremony of baptiſm was performed. Thus it continued till the ſixth century, when the baptiſteries began to be taken into the church-porch, and afterwards into the church itſelf.

The ancient baptiſteries were commonly called φωτιστηρια, *photiſteria*, q. d. places of illumination; an appellation ſometimes given to baptiſm. Or they might have the name for another reaſon, becauſe they were the places of an illumination, or inſtruction, preceding baptiſm: for here the catechumens ſeem to have been trained up, and inſtructed in the firſt rudiments of the Chriſtian faith.

Thoſe baptiſteries were anciently very capacious; becauſe, as Dr Cave obſerves, the ſtated times of baptiſm returning but ſeldom, there were uſually great multitudes to be baptized at the ſame time: and then the manner of baptizing, by immerſion, or dipping under water, made it neceſſary to have a large font likewiſe. In *Venantius Fortunatus*, it is called *aula baptiſmatis*, the large hall of baptiſm; which was indeed ſo capacious, that we ſometimes read of councils meeting and ſitting therein. This hall, or chapel, was always kept ſhut during Lent, and the door ſealed up with the biſhop's ſeal, not to be opened till Maunday-Thurſday.

The baptiſtery was always reputed a ſacred place. In the Roman order, we find the ceremonies uſed in the conſecration of the baptiſteries: they were to be built of a round figure, and diſtinguiſhed with the image of St John the Baptiſt; over the baſon or font was a figure of a dove in gold or ſilver; to repreſent the Holy Ghoſt.

The name *baptiſtery* is ſometimes alſo given to a kind of chapel in a large church, which ſerved for the ſame office. It is an obſervation of ſome learned men, that anciently there was but one baptiſtery in a city, and that at the biſhop's church; and that afterwards they were ſet up in pariſh churches, with the ſpecial allowance however of the biſhop.

BAR, in a general ſenſe, denotes a ſlender piece of wood or iron, for keeping things cloſe together.

BAR, in courts of juſtice, an incloſure made with a ſtrong partition of timber, where the council are placed to plead cauſes. It is alſo applied to the benches where the lawyers or advocates are ſeated, becauſe anciently there was a bar to ſeparate the pleaders from the attorneys and others. Hence lawyers who are called to the bar, or licenſed to plead, are termed *barriſters*, an appellation equivalent to *licentiate* in other countries.

BAR, or *Barr*, (Latin *barra*, and in French *barre*), in a legal ſenſe, is a plea or peremptory exception of a defendant, ſufficient to deſtroy the plaintiff's action. And it is divided into bar to common intendment, and bar ſpecial; bar temporary, and perpetual. Bar to a common intendment is an ordinary or general bar, which uſually diſableth the declaration of the plaintiff; bar ſpecial is that which is more than ordinary, and falls out upon ſome ſpecial circumſtance of the fact as to the caſe in hand. Bar temporary is ſuch a bar as is good for the preſent, but may afterwards fail; and bar perpetual is that which overthrows the action of the plaintiff for ever.

BAR, in heraldry, an ordinary in form of the feſs, but much leſs. See HERALDRY.

BAR, in the menage, the higheſt part of that place of a horſe's mouth ſituated between the grinders and tuſhes, ſo that the part of the mouth which lies under and at the ſide of the bars retains the name of the gum. A horſe with ſenſible bars has a fine light mouth, with an even and firm appui. See APPUI.

To BAR *a Vein*, in farriery, is an operation performed upon the veins of the legs of a horſe and other parts, with intent to ſtop the malignant humours. It is done by opening the ſkin above it, diſengaging it, and tying it both above and below, and ſtriking between the two ligatures.

BAR, in muſic, a ſtroke drawn perpendicularly acroſs the lines of a piece of muſic, including between each two a certain quantity or meaſure of time, which is various as the time of the muſic is either triple or common. In common time, between each two bars is included the meaſure of four crotchets; in triple, three. The principal uſe of bars is to regulate the beating of time in a concert. The uſe of bars is not to be traced higher than the time when the Engliſh tranſlation of Adrian le Roy's book on the Tablature was publiſhed, *viz.* the year 1574; and it was ſometime after that before the uſe of bars became general. To come nearer to the point, Barnard's cathedral muſic, printed in 1641, is without bars: but bars are to be found throughout in the *Ayres and Dialogues* of Henry Lawes publiſhed in 1653; from whence it may be conjectured that we owe to Lawes this improvement.

Bar, in hydrography, denotes a bank of ſand, or other matter, whereby the mouth of a river is in a manner choaked up.

The term *bar* is alſo uſed for a ſtrong beam wherewith the entrance of a harbour is ſecured: This is more commonly called *boom*.

Bar of a tavern or coffee-houſe, the place where the waiters attend to anſwer the calls of the cuſtomers.

Bar, among printers, denotes a piece of iron with a wooden handle, whereby the ſcrew of the preſs is turned in printing. See Printing.

Bars of Iron, are made of the metal of the ſows and pigs as they come from the furnace. Theſe paſs thro' two forges called the *finery* and the *chauſery*; where, undergoing five ſeveral heats, they are formed into bars.

Bar, a very ſtrong city of Podolia in Poland, upon the river Kiow. E. Long. 28. 30. N. Lat. 50. 6.

Bar, a duchy of France, bounded on the eaſt by Lorrain, on the north by Luxembourg, on the weſt by Champagne, on the ſouth by part of the ſame country and by Franche Compte. It is croſſed by the river Meuſe from north to ſouth, and watered by ſeveral other rivers, which render it very fertile. It is divided into four balliages, *viz.* Baſſilyni, Bar, St Michael, and Clermont. The chief towns are Bar-le-duc, Clermont, St Michael, Longuey, Pont a Mouſſon, and Stenay. In 1736, it was given to Staniſlaus then king of Poland.

Bar-le-Duc, the capital of the duchy of Bar, ſeated on the declivity of a hill. It is divided into the higher and lower town: the lower is watered by the rivulet Orney, which abounds with excellent trouts. The wines are excellent, and not inferior to thoſe of Champagne. E. Long. 5. 30. N. Lat. 48. 35.

Bar-le-Mont, a town of the French Netherlands, in Hainault, ſituated on the river Sombre. E. Long. 3. 40. N. Lat. 50. 10.

Bar ſur Auche, an ancient town of France, ſeated at the foot of a mountain. E. Long. 4. 50. N. Lat. 48. 14.

Bar ſur Seine, a town of France, in the duchy of Burgundy, ſeated between a mountain which covers it on the weſt, and the river Seine which runs on the eaſt. E. Long. 4. 30. N. Lat. 48. 5.

Bar-Maſter, among miners, the perſon who keeps the gage, or diſh, for meaſuring the ore.

BARA (anc. geog.), a ſmall iſland in the Adriatic, oppoſite to Brunduſium: the *Pharos* of Mela. Alſo a frith, or arm of the ſea of Britannia Secunda (Ptolemy); ſuppoſed to be the Murray-frith.

Bara, one of the Hebrides or Weſtern Iſlands of Scotland. It is a ſmall rock, only a quarter of a mile in circumference, being part of a chain called the *Long Iſland*, the whole cluſter appearing at low water as one iſland. Bara is altogether barren; but abounds with great numbers of ſea-fowl, ſuch as ſolon geeſe, guillamotes, puffins, &c.

Bara, the name of a feſtival celebrated with much magnificence at Meſſina, and repreſenting the aſſumption of the Virgin. The *bara*, though uſed as the general denomination of this feſtival, ſignifies more particularly a vaſt machine 50 feet high, at the top of which a young girl of 14, repreſenting the Virgin, ſtands upon the hand of an image of Jeſus Chriſt. Round him turn vertically, in a circle, 12 little children which repreſent the ſeraphims; below them, in another circle, which turns horizontally, are 12 more repreſenting the cherubims: below theſe a ſun turns vertically, with a child at the extremity of each of the four principal *radii* of his circle, who aſcend and deſcend with his rotation, yet ſtill ſtand upright. Below the ſun is the loweſt circle, about ſeven feet from the ground, in which 12 boys turn horizontally without interruption: theſe are intended for the twelve apoſtles, who are ſuppoſed to ſurround the tomb of the Virgin at the moment when ſhe aſcends into heaven. This complication of ſuperſtitious whirligigs may have already nearly turned the ſtomachs of ſome of our readers, or at leaſt rendered them ſqueamiſh. But think of the poor little cherubims, ſeraphims, and apoſtles, who are twirled about in this proceſſion! for, ſays Mr Houel, "ſome of them fall aſleep, many of them vomit, and ſeveral do ſtill worſe:" but theſe unſeemly effuſions are no drawback upon the edification of the people; and nothing is more common than to ſee fathers and mothers ſoliciting with ardour for their boys and girls the pious diſtinction of puking at the bara. This machine is not drawn by aſſes or mules, but by a multitude of robuſt monks.

Houel's Deſcriptive Travels thro' Sicily, &c.

BARABINZIANS, a tribe of Tartars, living on both ſides the river Iris. They ſeem to derive their name from the *Barabaian* deſart, whoſe lakes ſupply them abundantly with fiſh, on which and their cattle they chiefly ſubſiſt. They have plenty of game and wild-fowl of every kind, particularly ducks and puffins. Moſt of them are heathens, but Mahometaniſm daily gains ground among them. Some of them pay tribute to the Empreſs of Ruſſia, and others to the Khan Taiſha.

BARACOA, a town in the north eaſt part of the iſland of Cuba. W. Long. 76. 10. N. Lat. 21. 5.

BARALIPTON, among logicians, a term denoting the firſt indirect mode of the firſt figure of ſyllogiſm. A ſyllogiſm in baralipton, is when the two firſt propoſitions are general, and the third particular, the middle term being the ſubject in the firſt propoſition, and the predicate in the ſecond. The following is of this kind:

BA. Every evil ought to be feared;
RA. Every violent paſſion is an evil;
LIP. Therefore ſomething that ought to be feared is a violent paſſion.

BARALLOTS, in church-hiſtory, a ſect of heretics at Bologna in Italy, who had all things in common, even their wives and children.—Their facility in complying with all manner of debauchery made them get the name *obedientes*, "compliers."

BARANCA DE MALAMBO, a town of Terra Firma in America, with a biſhop's ſee and a good haven. It is a place of great trade, and is ſeated on the river Magdaleine. W. Long. 75. 30. N. Lat. 11. 10.

BARANGI, officers among the Greeks of the lower empire. Cujas calls them Latin *protectores*, and others give them the name of *ſecurigeri*. It was their buſineſs to keep the keys of the city gates, where the emperor reſided.

BARANWAHR, a town of Lower Hungary, in a county of the ſame name, taken by the emperor of Germany from the Turks in 1684. It is ſeated between Buda and Belgrade, in E. Long. 20. 5. N. Lat. 46. 0.

BARATHRUM, in antiquity, a deep dark pit at Athens, into which condemned perſons were caſt headlong. It had ſharp ſpikes at the top, that no man might eſcape out; and others at the bottom, to pierce and torment ſuch as were caſt in.—Its depth and capaciouſneſs made it to be applied proverbially to a covetous perſon: to a glutton, called *Barathro* by the Romans (Lucretius, Horace), and *Barathrum* in the ſame ſenſe (Horace); and for a common proſtitute (Platus).

BARATIERE (Philip), a moſt extraordinary inſtance of the early and rapid exertion of mental faculties. This ſurpriſing genius was the ſon of Francis Baratiere, miniſter of the French church at Schwobach near Nuremberg, where he was born Jan. 10th 1721. The French was his mother-tongue, together with ſome words of High Dutch; but by means of his father inſenſibly talking Latin to him, it became as familiar to him as the reſt: ſo that, without knowing the rules of grammar, he at four years of age talked French to his mother, Latin to his father, High Dutch to the maid or neighbouring children; and all this without mixing or confounding the reſpective languages. About the middle of his fifth year he acquired Greek in like manner; ſo that in 15 months he perfectly underſtood all the Greek books in the Old and New Teſtament, which he readily tranſlated into Latin. When he was five years and eight months old, he entered upon Hebrew; and in three years time was ſo expert in the Hebrew text, that from a bible without points, he could give the ſenſe of the original in Latin or French; or tranſlate extempore the Latin or French verſions into Hebrew, almoſt word for word; and had all the Hebrew pſalms by heart. He compoſed at this time a dictionary of rare and difficult Hebrew words, with critical remarks and philological obſervations, in about 400 pages in 4to; and, about his tenth year, amuſed himſelf for twelve months with the Rabinical writers. With theſe he intermixed a knowledge of the Chaldaic, Syriac, and Arabic; and acquired a taſte for divinity and ecceſraſtical antiquity, by ſtudying the Greek fathers, and councils of the firſt four ages of the church. In the midſt of theſe occupations, a pair of globes coming into his poſſeſſion, he could in 8 or 10 days time reſolve all the problems on them; and in about three months, in Jan. 1735, deviſed his project for the diſcovery of the longitude, which he communicated to the Royal Society at London and the Royal Academy of Sciences at Berlin. In June 1731, he was matriculated in the univerſity of Altorf; and at the cloſe of the year 1732, he was preſented by his father at the meeting of the reformed churches of the circle of Franconia; who, aſtoniſhed at his wonderful talents, admitted him to aſſiſt in the deliberations of the ſynod; and to preſerve the memory of ſo ſingular an event, it was ordered to be regiſtered in their acts. In 1734, the Margrave of Brandenburgh Anſpach granted this young ſcholar the uſe of whatever books he wanted from the Anſpach library, together with a penſion of 50 florins, which he enjoyed three years; and his father receiving a call to the French church at Stetin in Pomerania, young Baratiere was, on the journey, admitted maſter of arts, with univerſal applauſe, at the univerſity of Hall: at Berlin he was honoured with ſeveral converſations with the king of Pruſſia, and was received into the royal academy. Towards the cloſe of his life he acquired a taſte for medals, inſcriptions, and antiquities; metaphyſical inquiries, and experimental philoſophy, intervening occaſionally between theſe ſtudies. He wrote ſeveral eſſays and diſſertations; made aſtronomical remarks, and laborious calculations; took great pains towards a hiſtory of the hereſies of the anti-trinitarians, and of the 30 years war in Germany: his laſt publication, which appeared in 1740, was on the ſucceſſion of the biſhops of Rome. The final work he engaged in, and for which he had gathered large materials, was *Inquiries concerning the Egyptian Antiquities*. But the ſubſtance of this blazing meteor was now almoſt exhauſted: he was always weak and ſickly; and died October 5. 1740, aged 19. years 8 months and 16 days. He publiſhed 11 different pieces, and left 26 manuſcripts on various ſubjects, the contents of which may be ſeen in his life written by M. Formey profeſſor of philoſophy at Berlin.

BARATZ (Turkiſh), letters-patent granted by the Turkiſh emperors to the Greek patriarch, biſhops, &c. for the exerciſe of their eccleſiaſtical functions. This *Baratz* gives the biſhops full power and authority to eſtabliſh and depoſe the inferior clergy, and all other religious perſons; to grant licences for marriages, and iſſue out divorces; to collect the revenues belonging to the churches; to receive the pious legacies bequeathed to them; in ſhort, to enjoy all the privileges and advantages belonging to their high ſtation: and all this (as it is expreſſed in the baratz itſelf), "according to the vain and idle ceremonies of the Chriſtians."

BARB, or BARBE, a horſe brought from Barbary. See EQUUS.

BARBA, in botany, a ſpecies of *pubes*, or down, with which the ſurface of ſome plants is covered. The term was invented by Linnæus; and by its application in the *Species Plantarum*, ſeems to ſignify a tuft or bunch of ſtrong hairs terminating the leaves. *Meſembryanthemum barbatum*, furniſhes an example.

The word is alſo often uſed in compoſition with ſome other, to form the trival names of ſeveral plants, as *barba jovis*, *barba capræ*, &c.

BARBACAN, or BARBICAN, an outer defence or fortification to a city or caſtle, uſed eſpecially as a fence to the city or walls; alſo, an aperture made in the wall of a fortreſs, to fire through upon the enemy. See CASTLE.

BARBACAN is alſo uſed to denote a fort at the entrance of a bridge, or the outlet of a city, having a double wall with towers.

BARBADOES, the moſt eaſterly of all the Caribbee Iſlands, ſubject to Great Britain, and, according to the beſt geographers, lying between 59. 50. and 60. 2. of weſt longitude, and between 12. 56. and 13. 16. of north latitude. Its extent is not certainly known: the moſt general opinion is, that it is 25 miles from north to ſouth, and 15 from eaſt to weſt; but theſe menſurations are ſubject to ſo many difficulties and uncertainties, that it will perhaps convey a more adequate idea of this iſland to tell the reader than in reality it does not contain above 107,000 acres. The climate is hot, but not unwholeſome, the heat being qualified by ſea-breezes; and a temperate regimen renders this iſland as ſafe to live in as any climate ſouth of Great Britain; and, according to the opinion of many, as even Great Britain itſelf. This iſland has on its eaſt ſide two ſtreams that are called *rivers*, and in the middle is ſaid to have a bituminous ſpring which ſends forth a liquor like tar, and ſerves for the ſame uſes as pitch or lamp-oil. The iſland abounds in wells of good water, and has ſeveral reſervoirs for rain-water. Some parts of the ſoil are ſaid to be hollowed into caves, ſome of them capable of containing 300 people. Theſe are imagined to have been the lurking-places of runaway negroes, but may as probably be natural excavations. The woods that formerly grew upon the iſland have been all cut down, and the ground converted into ſugar plantations. When thoſe plantations were firſt formed, the ſoil was prodigiouſly fertile, but has ſince been worn out, inſomuch, that about the year 1730, the planters were obliged to raiſe cattle for the ſake of their dung, by which means the profit of their plantations was reduced to leſs than a tenth of its uſual value. Notwithſtanding the ſmallneſs of Barbadoes, its ſoil is different; being in ſome places ſandy and light, in others rich, and in others ſpongy; but all of it is cultivated according to its proper nature, ſo that the iſland preſents to the eye the moſt beautiful appearance that can be imigined. Oranges and lemons grow in Barbadoes in great plenty, and in their utmoſt perfection. The lemon juice here has a peculiar fragrancy. The citrons of Barbadoes afford the beſt drams and ſweetmeats of any in the world, the Barbadoes ladies excelling in the art of preſerving the rhind of the citron fruit. The juice of the limes, or dwarf lemons, is the moſt agreeable ſouring we know, and great quantities of it have of late been imported into Britain and Ireland. The pine apple is alſo a native of Barbadoes, and grows there to much greater perfection than it can be made to do in Europe by any artificial means. A vaſt number of different trees peculiar to the climate are alſo found to flouriſh in Barbadoes in great perfection; ſuch as the aloe, mangrove, calabaſh, cedar, cotton, maſtic, &c. Here likewiſe are produced ſome ſenſitive plants, with a good deal of garden ſtuff, which is common in other places. In ſhort, a native of the fineſt, the richeſt, and moſt diverſified country in Europe, can hardly form an idea of the variety of delicious and at the ſame time nutritive vegetable productions with which this iſland abounds.

When Barbadoes was firſt diſcovered by the Engliſh, few or no quadrupeds were found upon it, except hogs, which had been left there by the Portugueſe. For convenience of carriage to the ſea-ſide, ſome of the planters at firſt procured camels; which undoubtedly would in all reſpects have been preferable to horſes for their ſugar and other works; but the nature of the climate diſagreeing with that animal, it was found impoſſible to preſerve the breed. They then applied for horſes to Old and New England: from the former they had thoſe that were fit for ſhew and draughts; from the latter thoſe that were proper for mounting their militia, and for the ſaddle. They had likewiſe ſome of an inferior breed from Curaſſao, and other ſettlements. They are reported to have had their firſt breed of black cattle from Bonaviſta and the iſle of May; they now breed upon the iſland, and often do the work of horſes. Their aſſes are very ſerviceable in carrying burdens to and from the plantations. The hogs of Barbadoes are finer eating than thoſe of Britain, but the few ſheep they have are not near ſo good. They likewiſe have goats, which when young are excellent food. Racoons and monkies are alſo found here in great abundance. A variety of birds are produced on Barbadoes, of which the humming bird is the moſt remarkable. Wild fowl do not often frequent this iſland; but ſometimes teal are found near their ponds. A bird which they call the *man of war*, is ſaid to meet ſhips at 20 leagues from land, and their return is, to the inhabitants, a ſure ſign of the arrival of theſe ſhips. When the wind blows from the ſouth and ſouth-weſt, they have flocks of curlews, plovers, ſnipes, wild pigeons, and wild ducks. The wild pigeons are very fat and plentiful at ſuch ſeaſons, and rather lager than thoſe of England. The tame pigeons, pullets, ducks, and poultry of all kinds, that are bred at Barbadoes, have alſo a fine flavour, and are accounted more delicious than thoſe of Europe. Their rabbits are ſcarce; they have no hares; and if they have deer of any kind, they are kept as curioſities. The inſects of Barbadoes are not venomous, nor do either their ſnakes or ſcorpions ever ſting. The muſketoes are troubleſome, and bite; but are more tolerable in Barbadoes than on the continent. Various other inſects are found on the iſland, ſome of which are troubleſome, but in no greater degree than thoſe that are produced by every warm ſummer in England. Barbadoes is well ſupplied with fiſh; and ſome caught in the ſea ſurrounding it are almoſt peculiar to itſelf; ſuch as the parrot-fiſh, ſnappers, grey cavallos, terbums, and coney-fiſh. The mullets, lobſters, and crabs, caught here are excellent; and the green turtle is perhaps the greateſt delicacy that ancient or modern luxury can boaſt of. At Barbadoes this delicious ſhell-fiſh ſeldom ſells for leſs than a ſhilling a pound, and often for more. There is found in this iſland a kind of land crab which eats herbs wherever it can find them, and ſhelters itſelf in houſes and hollows of trees. According to report, they are a ſhell-fiſh of paſſage; for in March they travel to the ſea in great numbers. See CANCER.

The inhabitants may be reduced to three claſſes, viz. the maſters, the white ſervants, and the blacks. The former are either Engliſh, Scots, or Iriſh: but the great encouragement given by government to the peopling of this and other Weſt Indian iſlands, induced ſome Dutch, French, Portugueſe, and Jews, to ſettle among them with their eſtates; by which, after a certain time, they acquire the rights of naturalization in Great Britain. The white ſervants, whether by covenant or purchaſe, lead more eaſy lives than the day-labourers in England; and when they come to be overſeers, their wages and other allowances are conſiderable. As to the treatment of the negro ſlaves in this and the other iſlands, that falls to be ſpoken of under the articles NEGRO, SLAVE, WEST-INDIES; which ſee. The manners of the white inhabitants, in general, are the ſame as in moſt polite towns and countries in Europe. The capital of the iſland is called *Bridge-Town*; ſee that article.

As the hiſtory of this iſland furniſhes no very remarkable events, the following ſhort hints concerning it may ſuffice.

When the Engliſh, ſome time after the year 1625, firſt landed here, they found it the moſt ſavage and deſtitute place they had hitherto viſited. It had not the leaſt appearance of ever having been peopled even by ſavages. There was no kind of beaſts of paſture or of prey, no fruit, no herb, no root fit for ſupporting the life of man. Yet as the climate was ſo good, and the ſoil appeared fertile, ſome gentlemen of ſmall fortune in England reſolved to become adventurers thither. The trees were ſo large, and of a wood ſo hard and ſtubborn, that it was with great difficulty they could clear as much ground as was neceſſary for their ſubſiſtence. By unremitting perſeverance, however, they brought it to yield them a tolerable ſupport; and they found that cotton and indigo agreed well with the ſoil; and that tobacco, which was beginning to come into repute in England, anſwered tolerably. Theſe proſpects, together with the ſtorm between the king and parliament, which was beginning to break out in England, induced many new adventurers to tranſport themſelves into this iſland. And what is extremely remarkable, ſo great was the increaſe of people in Barbadoes, 25 years after its firſt ſettlement, that in 1650 it contained more than 50,000 whites, and a much greater number of negro and Indian ſlaves. The latter they acquired by means not at all to their honour: for they ſeized upon all thoſe unhappy men, without any pretence, in the neighbouring iſlands, and carried them into ſlavery; a practice which has rendered the Caribbee Indians irreconcilable to them ever ſince. They had begun a little before this to cultivate ſugar, which ſoon rendered them extremely wealthy. The number of ſlaves, therefore, was ſtill augmented; and in 1676 it is ſuppoſed that their number amounted to 100,000, which, together with 50,000 whites, make 150,000 on this ſmall ſpot: a degree of population unknown in Holland, in China, or any other part of the world moſt renowned for numbers. At this time Barbadoes employed 400 ſail of ſhips, one with another, of 150 tons in their trade. Their annual exports in ſugar, indigo, ginger, cotton, and citron-water, were above L.350,000, and their circulating caſh at home was L.200,000. Such was the increaſe of population, trade, and wealth, in the courſe of 50 years. But ſince that time this iſland has been much on the decline; which is to be attributed partly to the growth of the French ſugar-colonies, and partly to the Engliſh eſtabliſhments in the neighbouring iſles. Their numbers at preſent are ſaid to be 20,000 whites, and 100,000 ſlaves. Their commerce conſiſts of the ſame articles as formerly, though they deal in them to leſs extent.

Barbadoes-Tar, a mineral fluid of the nature of the thicker fluid bitumens, of a nauſeous bitteriſh taſte, very ſtrong and diſagreeable ſmell, found in many parts of America trickling down the ſides of the mountains, and ſometimes floating on the ſurface of the waters. It has been greatly recommended in coughs, and other diſorders of the breaſt and lungs.

BARBARA, among logicians, the firſt mode of the firſt figure of ſyllogiſms. A ſyllogiſm in barbara is one whereof all the prepoſitions are univerſal and affirmative; the middle term being the ſubject of the firſt propoſition, and attribute in the ſecond.

Examp. BAR. Every wicked man is miſerable;
BA. All tyrants are wicked men;
RA. Therefore all tyrants are miſerable.

BARBARIAN, a name given by the ancient Greeks and Romans to all who were not of their own country, or were not initated in their language, manners, and cuſtoms.—In this ſenſe, the word ſignified with them no more than foreigner; nor ſignifying, as among us, a wild, rude, or uncivilized perſon.

BARBARISM, in a general ſenſe, a rudeneſs of language or behaviour.

BARBARISM, in grammar, an offence againſt the purity of ſtyle or language; or an ungrammatical way of ſpeaking or writing, contrary to the true idiom of any particular language.

BARBAROSSA (Aruch, and Hayradin), two famous corſairs, the ſons of a potter in the iſle of Leſbos, who, turning pirates, carried on their depredations with ſuch ſucceſs and conduct, that they were ſoon poſſeſſed of 12 galleys beſide ſmaller veſſels. Of this fleet Aruch the elder brother, called *Barbaroſſa* from the redneſs of his beard, was admiral, and Hayradin the ſecond in command: they called themſelves the *friends of the ſea*, and the *enemies of all who ſailed upon it*; and their names became terrible from the ſtraits of Dardanelles to thoſe of Gibraltar. With ſuch a power they wanted an eſtabliſhment; and the opportunity of ſettling themſelves offered in 1516, by the inconſiderate application of Eutemi king of Algiers to them for aſſiſtance againſt the Spaniards. Aurch, leaving his brother to command the fleet, carried 5000 men to Algiers, where he was received as their deliverer; and ſecretly murdering the prince he came to aid, cauſed himſelf to be proclaimed king in his ſtead. To this uſurpation he added the conqueſt of Tremecen; when his exploits and piracies induced the emperor Charles V. to furniſh the Marquis de Gomarez governor of Oran with troops to ſuppreſs him; by whom he was defeated and killed near Tremecen. His brother Hayradin, known alſo by the name of *Barbaroſſa*, aſſumed the ſceptre at Algiers with the ſame abilities, and with better fortune; for the Spaniards, ſufficiently employed in Europe, giving him no diſturbance, he regulated the interior police of his kingdom with great prudence, carried on his naval operations with vigour, and extended his conqueſts on the continent of Africa. He put his dominions under the protection of the Grand Signior, Solyman the Magnificent; and obtained the command of the Turkiſh fleet. With ſo powerful a protector, he acquired the kingdom of Tunis in a manner ſimilar to that by which his brother gained Algiers. Since the time of the Barbaroſſas, Algiers has been underſtood to be dependent on the Porte; but this dependence is now little more than merely nominal.

END OF THE SECOND VOLUME.

DIRECTIONS FOR PLACING THE PLATES OF VOL. II.

PART I.

Plate	Page.
XXXII. to face	26
XXXIII.	28
XXXIV.	34
XXXV.	222
XXXVI.	235
XXXVII.	
XXXVIII.	236
XXXIX.	
XL.	
XLI.	
XLII.	237
XLIII.	
XLIV.	242
XLV.	
XLVI.	243
XLVII.	246
XLVIII.	
XLIX.	
L.	
LI.	
LII.	249
LIII.	250
LIV.	
LV.	260
LVI.	
LVII.	326
LVIII.	378
LIX.	394

PART II.

Plate (li. or)	Page.
LX.	417
LXI.	420
LXII.	428
LXIII.	432
LXIV.	440
LXV.	444
LXVI.	452
LXVII.	456
LXVIII.	460
LXIX.	468
LXX.	472
LXXI.	480
LXXII.	484
LXXIII.	492
LXXIV.	496
LXXV.	504
LXXVI.	508
LXXVII.	516
LXXVIII.	520
LXXIX.	528
LXXX.	532
LXXXI.	544
LXXXII.	552
LXXXIII.	560
LXXXIV.	568
LXXXV.	572
LXXXVI.	576
LXXXVII.	580
LXXXVIII.	584
LXXXIX.	588
XC.	592
XCI.	757

[In all, 60 Plates.]